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C(T)SIL Exhibit 26(*bis*)

"Histories of New Southern Archipelago", *Taiwan Times* (May 1939)

Histories of New Southern Archipelago

新南群島の今昔

台湾時報　Taiwan Times

May 1939

II. Living Records of Prior Occupation by Japan

The New Southern Archipelago consists of coral reefs all surrounded by reefs. Accordingly, while there grow relatively small trees and weeds, and rarely palm trees and other tall trees, such as *Ficus microcarpa*, in terms of agriculture and forestry there is almost nothing worth looking at. However, the islands holds phosphorous guano and phosphate ore, and are rich in ocean products - such as bonito, tuna, flying fish, green sea turtles, and Trochus seashells; it appears that, from time to time, Chinese fisherman have visited the islands in junks of twenty to thirty tons and collected sea cucumbers, seashells, turtles, etc.; in the end, there is no mistake when saying that they are deserted islands. Thus, the islands of the New Southern Archipelago have been recognized as *terra nullius*; while it has been well known to our people that, as a result of the development of the recent Sino-Japanese War, the Seisa [Paracel] Archipelago that lies to the southeast of Hainan Island were occupied by our navy, these islands are also called Hirata Archipelago. They were named after the person who discovered the islands and started business as the master of the island in the same manner that the Tousa [Spratly] Archipelago is called Nishizawa Archipelago.

At the same time as he explored this Hirata Archipelago (Seisa Archipelago, also called Paracel Island [sic]), Mr. Hirata also set foot on the New Southern Archipelago, and raised the national flag of Japan's Southern Advance before returning home. Following this expedition by Mr. Sueharu Hirata, one Japanese after another went on expedition to this archipelago; in particular, after Rasa Phosphate Ore, Ltd. conducted as many as three field studies in an attempt to develop guano and phosphate ore extraction on New Southern Archipelago in and after 1918, it invested a huge amount of capital in the Long Island [Itu Aba] in 1921 and the South Futago Island [Southwest Cay] in 1923, endeavoring to develop permanent facilities on the islands.

Following the exploration by Mr. Sueharu Hirata, in August 1917 Mr. Kinzo Ikeda, Shigenori Komatsu, and others explored this place. Subsequently, the first exploration team of Rasa Phosphate Ore led by Mr. Kokura, a reserve navy commander, explored this island in December 1918. Rasa Phosphate Ore conducted the second survey in April 1920, and started mining guano in this island (that is, Long Island) in June 1921.

They constructed offices, dormitories, jetties, etc. on the land, and about 200 employees were engaged in mining. In the early Showa era (*the Showa era started in 1926), the island became the center for fishing tunas and shellfish based on Kaohsiung City, and the Japanese were active in the area around the island. Long Island and Futago Island (North Danger) became the place for fishing boats to get water.

That is to say, at that time, the place was the advanced base of Kaohsiung fishermen, and thus the fishermen of Kaohsiung felt that it was strange for the government to announce that the place belonged to Japan after all these years.

Rasa Phosphate Ore started mining phosphate ore on Long Island in October 1921, and on the Futago Islands in December 1921. However, following the depressions and the panic of the financial industries after the European war, Rasa Phosphate Ore suspended the mining and withdrew in April 1929.

8. Fertile paradise of everlasting summer—the island was named at that time

Around 1924, Rasa Phosphate Ore thrived and about tens of Japanese employees and coolie laborers lived on Long Island. In addition, three Chinese lived there for fishing sea cucumber and commercial top shell for Chinese cuisine. Since they did not have weapons and had never caused any harm, the Japanese people there let the Chinese live on the island. People lived in the isolated island which was far from their hometown. They had many bizarre topics to talk about to kill time. Long Island, the South and North Futago Islands and Kikko Island were named at that time. Short and tall trees grow thickly, and small birds sing among the trees; this place is literally a paradise, with the bright sunshine in the sky.

Among the big trees, there are so-called big udo (aralia cordata) trees, the thickness of which are such that you could wrap your arms around the trees three or four times. We chased small birds with rifles on the shoulder for the purpose of adding dishes for dinner, and if we recklessly stood on the old decayed big udo trees, our legs would sink just like we were in old ponds; the quality of the wood seemed weak. In addition, REIGO trees, a kind of fabaceae plant, grow there, and their leaves fall and red beautiful floors to "bloom" in January. Further, I heard that Papaya trees which were replanted from Taiwan, and banana and pineapple etc. grow in the seashore, and that pepper, pumpkin and napa [cabbage] grow well all through the years.

特輯・新南群

序

このたび新南群島は永年の懸案を解決して、はつきりと我が領土たることが中外に闡明された。これは同群島において事業を行つてゐる私どもにとり、この上なき喜びであると共に、國民的な喜びであらねばならないであらう。

臺灣の南端鵝鑾鼻を我が領土の最南端と稱した時代があつたが、今や南方生命線の合言葉として「北緯七度」が、嚴然として登場した。なんと誇らかな言葉ではあるまいか。北は千島のはてから、南は「北緯七度」の新南群島のはてまで、我が　天皇陛下の御稜威は輝き布いてゐるのである。それにしても待遠い永の月日であつたが、兎に角も私どもは、今、この上なき喜びにある。

元々この二十幾つの島から成る新南群島とは、大正六年四月始めて調査に赴いて以來の、二十數年來の交渉であるが、實にこの新南群島こそは、我が高雄を基地とする南方漁業の中心漁場をなして居り、その前進根據地として、生命線ともい

島の今昔

ふべき地位にある。私どもがこの島の開發に努力してゐることも、一つには我が南進漁業確立に貢獻したいとの念願に外ならない。

しかし、今、私の口から新南群島の事情につき詳しいことを物語るのは、色々な點からして遠慮すべきだと考へてゐる。いつか私が自ら筆を執つて廣く一般に新南群島を語るときが來ると思つてゐるが、現在はその時機ではない。たゞ大日本帝國の國民として、皆さんと共に新南群島の管轄確定をお喜びしたいのである。

私に代つて記されたこの新南群島の話は、ほゞその正鵠をつたへてゐるやうであるから、之について新南群島の概念を承知していただきたいと思ふ。

開洋興業株式會社にて

（寫眞は各方面から續々舞込む祝辭、祝電を手にして、喜びあふれる平田末治氏）

一、新南群島とは

南溟遙か熱帶の洋上に小石をおいたやうに點々と浮く新南群島、これが我が高雄市に編入されたことは、高雄市民としてのみでなく國民としての喜びだ。

この新南群島は高雄港から南西七百五十浬、香港から西南七百二十浬、比島パラワン南端から西北西二百浬、ボルネオ北端から北西二百五十浬、佛印ツーラン港から南東五百浬、海南島から南東五百五十浬、西澤島（プラタス島）から南六百三十浬、平田群島（パラセル島）から南東四百浬、ほゞ北緯七度乃至十二度東經百十一度乃至百十七度、即ち南支那海佛

領印度支那とヒリッピン群島との中間に當つてゐる。その大部分は航海危險區域として知られ、航洋大汽船は恐れて近寄らないところだ。この區域外の西側には高潮面上四、五ファイート乃至十餘ファイート、面積五千坪乃至十一萬坪の平坦なる小沙島が多數散在してゐるがその主なるものは

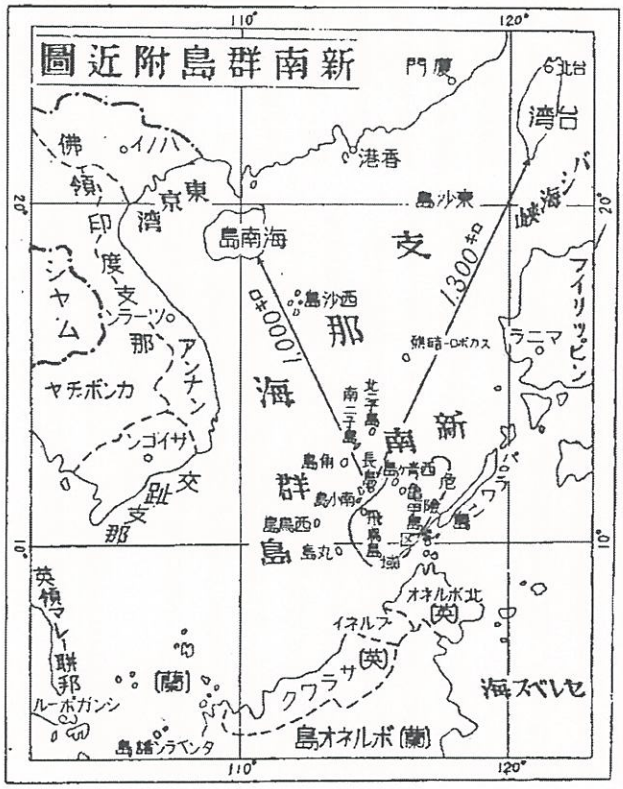
北二子島(キタフタゴシマ)南二子島(ミナミフタゴシマ)西青島(ニシアヲシマ)三角島(サンカクシマ)中小島(ナカコシマ)龜甲島(キッコウシマ)南洋島(ナンヨウシマ)長島(ナガシマ)北子島(キタコシマ)南子島(ミナミコシマ)飛鳥島(アスカシマ)西鳥島(ニシトリシマ)丸島(マルシマ)

と何れも日本名が古くから冠せられてゐる。

二、日本が先占した生ける記錄

新南群島はどれもリーフに圍まれた珊瑚礁から出來てゐる。從つて比較的小さい雜木や雜草が生え稀には椰子その他榕樹のやうな大木も生えてゐるが、農產、林產方面では殆んど見るべきものはない。然し島には、燐酸質グアノおよび燐礦石があり、また鰹、鮪、飛魚、青海龜、高瀨貝等の海產に富み、時に支那人漁夫が二、三十噸のジャンク船に乘つて來島し、各島嶼で海鼠、貝、龜甲龜などを採取したことがあるやうで、畢竟するに無人島であることに誤りはない。

かうして新南群島は無主の島と認められてゐたが、今次日支事



變の展開によつて、海南島の南東に横たる西沙群島が我が海軍の手に占據されたことは背く國民に知られてゐるが、この島の別名を平田群島と呼んでゐる。あたかも東沙群島（プラタス島）を西澤群島と呼ぶが如く、發見者であり島の主として事業を開始したその人の名をとつたものである。

この平田群島（西沙群島、別名パラセル島）の探險と同時に平田氏は新南群島にも足跡を印し、南進日本の國旗を樹てゝ還つた。時に大正六年六月の事であつた。此の平田末治氏の踏査についで日本人のこの群島を調査するもの相つぎ、特に大正七年以來ラサ燐礦株式會社では、新南群島のグアノおよび、燐礦採取其の他の資源を開發せんものと、三回にわたり詳細なる現地調査を行つたうへ、大正十年から長島において、又同十二年からは南二子島において巨額の資本を投下し、永久的な設施設をおいて島の開發に從事したのであつた。

三、椰子や灌木繁茂・南國の情趣深し

高雄の南島漁船隊は、つい隣の家にでも行くやうな心易さで新南群島附近の漁場に出かけてゆく。漁船の船長達にきくと、高雄を出港して五日目には新南群島につく。臺灣本島とヒリッピン呂宋島の間のバシー海峽を過ぎると、發動機の漁船も航海は極めて平穩、七日目には新南群島の最北端である二子島（ノース・デンジャー）が見える。一つの環礁の中に二つの島がぽつかりと浮いてゐるのでこの名がある。

東の島には椰子等が繁り南國の情趣は深く、西の島は白い裸島だ。漁船はこの二子島が唯一の目標で、島影の見えぬ七日の航海に、この島の椰子の繁みは漁師を勇氣百倍させるのである。

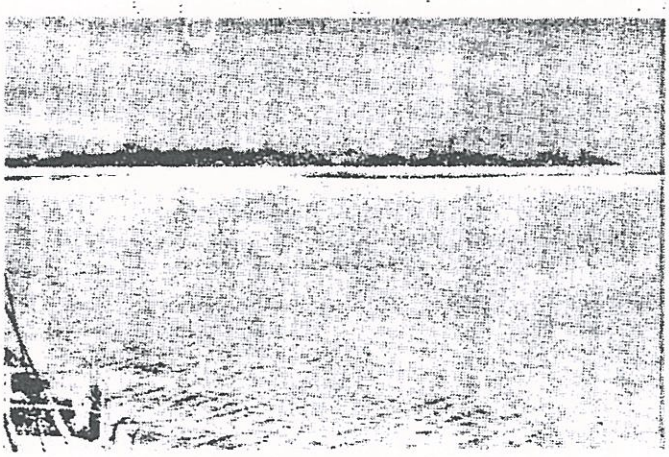
こゝから長島に向ふと、こゝは新南群島最大の島で、椰子の木や灌木が繁り、パパイアの實がみのつてゐる。

黒い土の底からは燐礦が顔をのぞかせて居り、毒蛇も惡蟲もマラリア蚊もゐない。唯だ大きな名も知らぬ島が翼を擴げて舞つてゐる。新鮮な魚ばかり食べてゐるので、こんなによく肥つてゐるのでもあらうか。

この長島はそのうちでも最も經濟的價値が多いと見られてゐるが、東西一千三百米、南北三百米の楕圓形をなして居り、水面上五メートル乃至六メートル、海岸には二十五メートル乃至五十メートル幅の白砂があつて、これが島をとりまいてゐる。

島内はわづかに低い盆地となつて黒土に掩はれ、ところどころに燐礦が露はれてゐる。

島の外側は灌木が繁茂し、内部には數種の熱帶樹がある。西方の一部開けた樹木の蔭には、現在開洋興業會社出張所があるが、椰子の亭々たる情趣は南國を思はせるに充分だ。



（新南群島長島の遠望）

四、今更日本領とは、不思議がる漁民

長島の附近一帯は磯魚類が豊富で、ことに赤松鯛など臺灣近海や南支那海のものよりは遙かに脂がつよく、とろりとした素晴らしい味だ。磯魚ばかりでなく、底魚や浮魚など小型漁船にはもつて來いの漁業で、常に數十隻の臺灣籍漁船が附近に在る。臺灣拓殖の子會社開洋漁業會社もこゝに前進根據地を設く筈で、非常な期待をかけられてゐるが、春から夏にかけてのスコールは實に氣持よく、平均氣溫二十七度から八度位、華氏では最低六十五度位から最高九十五度位までと云ふから常夏の島と云ふべく、夜は海洋性の氣候で誠に凌ぎよい。

平田末治氏の探險について、同大正六年八月には池田金造氏、小松重利氏等がこゝを探險、大正七年十二月には小倉豫備海軍中佐を隊長とする第一次ラサ燐礦株式會社の探險隊が上陸調査し、同九年四月にはラサ燐礦第二次調査が行はれ、同十年六月には同社ではこの長島においてグアノの採掘に着手した。

陸上には事務所、宿舍、棧橋などを施設し、約二百人からの從業員が採鑛に從事してゐたが、降つて昭和のはじめには、高雄市を根據とする鮪漁業及び採貝漁業の中心地と化し、附近一帶は邦人の活躍する大舞臺となつた。同時にこの長島と二子島（ノース・デンジャー）は漁船の給水地となつてゐた。

三角島をついでに記しておく。これも廣い外礁で圍まれた水面上六メートル乃至七メートルの島で、灌木に掩はれ、この外礁は殆んど一浬も遠いところにあつて、外礁から內側には小舟も入れず美しい珊瑚礁が手にとるやうに見える。

つまり當時から高雄漁業の前進根據地として漁船關係者の間では、いまさら日本領だなどと宣言するのさへ不思議に思つてゐる程だ。

五、先占を裏書きする海國日本の大探險

——ラサ燐礦の報効丸探險成る

今から二十二年前、歐洲大戰の餘波はヒシ〳〵と極東の日本にも押寄せ、燐礦石の缺乏は新資源の發見を餘儀なくした。こゝにラサ島燐礦(現ラサ工業)株式會社では平田末治氏の探險報告を唯一の手蔓りとして、豫備海軍中佐小倉卯之助氏を隊長として監督船長濱田市松、船長佐藤昌雄、農學士近藤三衛、歩兵中尉武藤尚治氏らほか乘組員二十餘を率ゐて、この新南群島探險に向はせ東京月島を出帆した。時に大正七年十一月二十三日午後二時。

この探險船報効丸は、千島探險で有名な郡司大尉の主宰せる報効義會に所屬せる帆船で、僅か八十三噸ばかりの老朽船、その後ラッコ船として千島沖で暴風に遭つて沈沒したが、隨分な冒險ではあつた。途中船員の待遇問題で物議の起るなどあつたが、沖繩中城灣と臺灣の打狗(高雄)に寄港して目的の新南群島に向ひ、十二月二十六日北二子島を發見した。

しかし天候險惡にして近寄れず、押し迫つた暮の三十日漸く上陸したが、一行の喜びは大したもので、記念すべき檜の標柱を島に打建てた。

見渡せば信天翁が悠々大空を飛廻つて、有望らしきグアノ層が發見された。正覺坊や瑠璃淺瀨に甲羅を干し鄙子、パパイヤが繁茂して南海特有の美しさに暫しみとれてゐるうちに、無人島とばかり思はれる島に人影を發見した。驚いて近づいて見ると支那人漁夫三名であつた。

早速捕へて筆談を試みると、彼等は海南島海口から高瀨貝や海鼠の漁獲に來てゐるもので、更に驚くべきことには一箇月前に一人の日本人が來島してゐたと云ふ。

かくて二箇月にわたり五島の調査を行ひ、翌大正八年四月東京に歸つたが、この調査は有力なる調査として、その後の新南群島開發にどれだけ役立つたことであらう。

六、第二次、第三次探險成る

小倉中佐の第一次探險報告に基き、ラサ燐礦株式會社では新南群島における、グアノ採取の有望性を認め、採取着手に先立つ本格的企業調査のため更に大正九年四月に第二次、同十二年九月に第三次の探險隊を同群島に派遣することゝなつた。此の兩調査に際し隊長として活躍したのが海軍中佐鄕島村八氏であ

る。

一行は海國日本の名譽にかけても立派に成功させるのだと大變な意氣込みで出發した。ラサ工業會社から五名、その外船長技師など乘組員二十一名、このときは第一次の小倉中佐一行の調査が大いに役立つて、西島島はじめ都合十一島の調査を完了、それ〴〵の島嶼に長さ四尺、三寸角の木標に日附、帝國領土、恒藤博士の名を記して防腐材を塗り、祕密の箇所に埋めた。この調査で大體事業の收支について目算がついたので、翌大正十年三月歸航した。かくてラサ燐礦株式會社では六月斷然新南群島のグアノを採掘するに決定して各般の準備に着手し、着々そのグアノを內地に輸送したが、その年十二月には南双子島でもグアノを採掘するに至つた。これが新南群島における日本人の本格的事業の第一歩である。

七、孤島の砂濱の上　咲き亂れる朝顏

ラサ燐礦第三次調査隊は副島中佐を首班として、大正十二年七月一日再び帆船兼用の南星丸(二百噸)を南支那海に走らせた。

出帆間際に副島中佐は朝顏の種子を夫人から托されたが、その後この島から歸つた人の話では、島と云ふ島はいづれも朝顏の蔓で掩はれ、毎年四月半頃には全島に美しく咲き亂れてゐると云ふ。おそらく中佐の蒔らした朝顏の種子は、暖かい氣候と海鳥の糞に肥えた土壤に、海風にそよぎながら野性の花のやうに美しく育つてゐるのでもあらう。

八月一日から猛烈な颱風に遭遇しこの颱風圈を拔出づるのに一箇月を費したと云はれる。マストは吹折られる、機關は浸水するといふ有樣で、命からく〳〵にマニラに着いたのが九月一日、恰もこの日關東大震災の當日であり、一行は翌日このニュースを聞き、急いで內地に歸還するに至つたのであつた。

この間ラサ燐礦では既に大正十年十月には長島に、又同年十

(新南群島長島の林相　平田末治氏撮影)

二月には二子島にグアノ採掘を開始してゐたが、昭和四年四月、歐洲戰後襲ひ來つた不況のドン底、財界パニックを經て遂にラサ燐礦では一切の採掘を中止して引揚げるの止むなきに至つた。

八、豐沃常夏の樂園・島名も此時命名

ラサ燐礦華やかなりし大正十三年頃の長島の狀況は、ラサ燐礦の社員、苦力併せて數十名の日本人が住んでゐた。外に支那人が三名、支那料理に用ひる海鼠や高瀨貝を獲るために住んでゐたが、武器を持つてゐるのでもなく、別段危害を加へる事もしないのでそのまゝにして住まはせてゐた。故國を遠く離れて孤島の生活の徒然に、徼奇にみちた話題が相當あるやうだが、長島、南・北二子島、龜甲島などその當時つけられた名である。全島喬木や灌木が一面に密生してゐて樹間に小鳥の囀るさまは、宛然樂園そのまゝで、空には明るい太陽が輝いてゐる。大きな樹木には三抱へも四抱へもある俗にウドの大木と云ふのがある。夕食の膳を賑はさうと銃を肩に小鳥を追ひかけ、うつかりしてこの大木の朽ち倒れたものゝ上に立つと、づぶ〳〵と古沼にはまり込むやうにめり込むさうだ、それだけ木質としては軟弱なものであるらしい。又莖科植物の伶指などといふものがあり、一月ごろに落葉して眞赤な花が開き、とても美觀を呈する。このほか海岸には臺灣から移植したパパイヤをはじめ、バナナ、パインアップル等も生え、胡瓜や南瓜、白菜などの野菜も四季を通してよく出來るさうである。

九、素敵に美味しい海龜の肉を常食

會社の拓いた長島のセットルメントは、一面無味乾燥ではあつたが愉快なことも少くなかつた。たとへば島の動物と云へば、何萬といふ海鳥の群がギヤーギヤーと四六時中啼き騒いで居り、又野鼠も多い。無人島で人間を恐れぬ野鼠たちは、平氣で人間の手足にからみつき、内地から猫を數匹移入したところが、その猫たちは鼠といふ甘い御馳走が豐富なうへに暖熱地と來てゐるので、一年に四回も子を生む多産狀態がつゞき、鼠島から猫島に一變したといふ笑へぬ笑話もある。猛獸はゐないがたゞ蝎がゐた。朝目を覺ましてズボンにでもうつかり足を入れると、ズボンの中に數匹の蝎が鎭座しますといふ贈をつぶすやうなこともあつた。このために沖繩生れの工夫が一人命をとられてゐつた。島の生活で最も愉快なのは海龜一正覺坊を捕へる面白さだ。この海龜といふ奴は、五月から六月にかけてが産卵期で、夜になるとごそ〳〵と海岸へ這ひ上つて來るが、人の氣があると絶對に濱へ近寄らない。おまけに砂濱にはきつと上陸地點以外に僞の足跡を作つて人目を胡魔化さうといふ、なか〳〵抜目

のない動物だ。ちようどピンポンの球に似た卵を六、七十箇も砂の中に產み込むのだが、濱に這上つたところを人間が二人がかりで巧に仰向けにすると、もう龜さん何日經つても動きがとれないといふから面白い。重さは四十貫から七十貫もある大きなものばかりだが、この龜の肉がまたとても素敵な味ですき燒や味噌煮で食べるとその味は一生涯忘れ得ぬ程だと云はれる。暑いといつても七月から九月までの間に九十五、六度位になる位のもので、夜の訪れに南十字星の美しい輝き、椰子の葉蔭の靜ひなどを思へば、もう一度行きたいと當時新南群島にあつた人達は語つてゐる。

十、新南群島を繞る日佛の所屬紛爭

大正七年の第一次調査以來引續く數次の調査と大正十年以來のラサ燐礦株式會社の燐礦採掘事業に、同社が注込んだ投資は百萬圓に近く、建物十九棟そのほか運搬用軌道や棧橋の永久的諸施設をしたが、たまたま昭和四年經濟界の不況によつて、その施設と採掘したグアノを長島に殘し、從業員は一時新南群島を引揚げて了つた。

その間ラサ燐礦が輸送したグアノは約二萬五千九百餘噸、この金額七十二萬七千餘圓であつた。

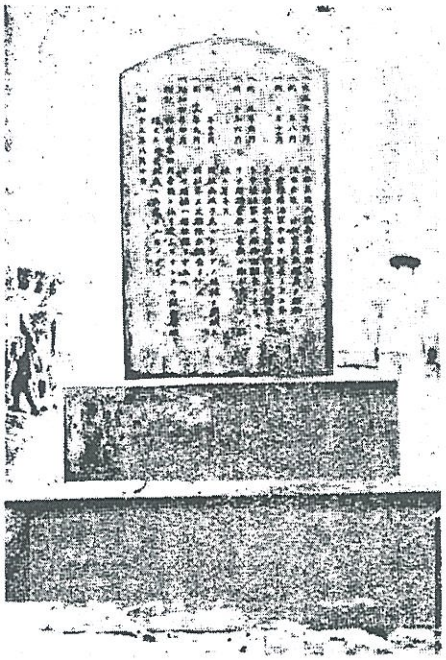
日本と佛蘭西との間に紛爭を生じたのは、昭和八年來のことで、あたかもラサ燐礦が一時採掘を中止し、その後平田末治氏が獨力新南群島の資源開發と漁業者への公益施設に乘出し、その後これは開洋興業株式會社として形式を整へたが、その間隙を窺つた火事泥的行爲であつた。佛國政府は、航路の安全のためと稱し、昭和八年突如一隻の軍艦を新南群島に派遣して、これを佛國主權に歸屬すべき旨を宣言し日本政府に通告し來つたのである。

帝國政府としてはもとよりかゝる現實を無視した行爲を容認しうべき筈もなく、直ちに佛國政府に對して領有宣言撤回方を申入れたのであるが、佛國政府では我が勸告に應じなかつたので、日本側では自來新南群島の佛國側先占はこれを承認せずとの態度を持し、他方において各種の措置を講じて日本側の先占を確保し今日に至つたのである。

因みに、フランスが昭和八年七月二十五日附官報で佛領と宣言したのは

西島島（スプラトリ島）及びその附近の島嶼、丸島（アムボイナ島）及びその附近の島嶼、長島（イツアバ島）及びその附近の島嶼、二子島（ドウジル島）及びその附近の島嶼、中小島（ロアイタ島）及びその附近の島嶼、三角島（チツ礁）及びその附近の島嶼

である。



（新南群島長島にある　大日本帝國碑裏面）

子島沖についた。上陸用意をすると名も知らぬ魚がリーフの間を游いでゐる。色とりどりで内地の水族館では見られないものだ。島の東側に人家が一軒見え、人の氣配があるので護身用として大きなナイフを持ち、まさかの時の用意に強さうな水夫三名をつれて上陸した。海南島から來たといふ支那人二名が擧手の禮を以て出迎へた、八月の烈日はこの砂濱に照りつけ、目がくら〳〵ッとして倒れさうだつた。かれ等の建物のドアを見た私達は思はずアッ！と叫んだ、一見して日本の大工の手になつたものであることが觀取された。

と記してゐる。

調査を了へた一行は南二子島に向つた。無數の鳥が飛んで、水夫が竹竿でたたき落した鳥は五、六羽に達した。船はラサ燐礦が作業した當時の棧橋前に投錨したが、棧橋にしかれたレールも永い休業に腐つて、これに無數の鳥がとまつてゐる。上陸すると五、六種類の鳥が大群をなして砂上にかたまつてをり、その啼聲は耳を聾するばかり、三好氏の打振るステッキに二羽三羽とたゝかれて落る。それのみか足もとには玉子が一尺置きぐらゐに並んでゐて、用心しないと踏みつぶしてしまふ。親鳥が飛立つと、天日ために暗しと云ふ言葉通りで、悪いことには

十一、我が國民の憤激と大毎の探險

この昭和八年の、フランスが軍艦を派遣して、この群島を佛領なりと稱したことは、どんなに我が國民を憤激させたか云ふも愚である。大毎では四十七噸の發動機船第三愛媛丸を仕立てて三好、松尾兩社員を新南群島へ調査に赴かせたが、果せる哉一行はラサ島燐礦株式會社の嚴然たる施設の跡を見とゞけた。その記錄するところ次の通りである。

昭和八年八月十八日高雄を出帆し二十五日正午頃目的地北二

驟雨沛然として降り注ぎ、上衣も帽子もめちや〳〵である。砂濱をはづれたところにラサの事務所があつたのだが、支那人どもに荒されたのと、自然の暴威などによつて倒壊し、コンクリートの礎石のうへに崩れ腐つて重なつてゐた。これが事務所で、これが鑛夫の宿舍だと說明を聞くと、ラサがこゝに作業をつゞけてゐたことは直ちに諒解がついた。それは棟木の組方を見てもわかるし、また燐礦石を積出すばかりにして積上げた山、または日本式の井戸の形を見ては、一點の疑ひも差しはさむ餘地はない。島の中央にラサが埋めたといふ日本帝國領の標柱を發見すべく、あちこちと發掘したが遂に見出せなかつた。島の南端にもラサの殘した建物があり支那人が三名ゐた。

二十七日いよ〳〵主島の長島に向つた。この島はラサが根據地としてゐた島で、二十七町あるといふ周圍には臺灣から苗を持つて來た二百何十本かの椰子が美しい景觀をつくつてゐた。砂濱は正覺坊の足跡が多く、久し振りに上陸してテントを張りゆつくり探險した。この島の事業遂行中生命を失つた沖繩縣人上里賢德氏の墓を訪れた。墓標は腐れかけてゐるが、字は判讀できる。ラサの事務所は他の島と同じく相變らず荒れて倒れてゐた。甚だしきはパパイヤの林に建られたラサ神社社殿さへ何者かによつて踏み壞され、玉垣や純日本式の燈籠も倒壞してゐた。

神社の前には「洗心」と刻んだ手洗ひが幾年月の古さを物語つて、苔が一面にはえてゐた。こゝまで見れば最早われ等は何をかいはんやである。

神社の附近を發掘するとシャベルの先にコツンと當がして

大日本帝國東京ラサ島燐礦株式會社

西曆一千九百十七年八月

と鮮かに書かれたコンクリート板が現れた。

この島の人柱ともなつた殉業鑛夫の墓を見、ラサ神社の狀況、いまこのコンクリート板が嚴然と存在するのを見たからにはわれ等の探險は目的の大部分を終つたことになる。島はまだ七、八つもあるが打切つて歸途についた。

かう綴られてあるが、この記錄も亦貴い記錄の一つであると思ふ。

十二、帝國南海の生命線

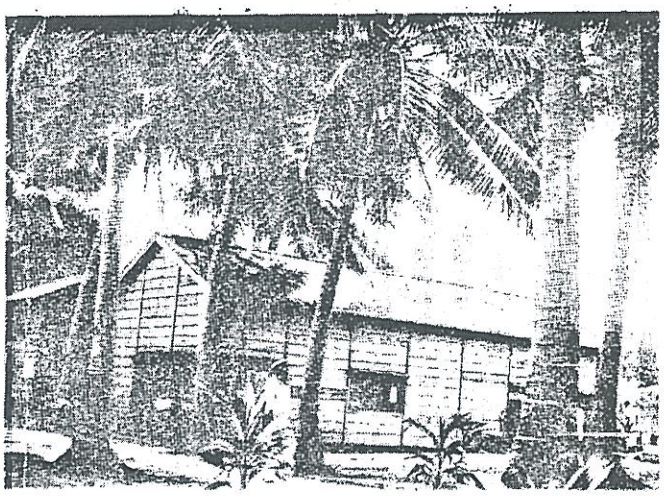
明かにわが領土たる新南群島に對して、佛國政府の先占宣言は斷じて容認さるべき筋合ではなく、直ちにその撤回を求めたが、以來これを承認せずとの態度を持してゐたのであつた。かうした紛爭發生後も、フランスは何等の行動に出なかつたが、支那事變の發生するとゝもに、再び同方面に積極的活動を開始

した。さきには我が海軍によつて占領せる支那領西沙群島に對しても、軍艦を派遣して日本側の活動狀況を調査し、或は商船を派して活動資材を揚陸する等同島の占有を實効的ならしめようとする氣配を示したが、國民的憤激の聲は猛烈にあがつたことと勿論である。

ラサ燐礦のグアノ採掘一時中止の跡をうけて、高雄の平田末治氏は新南群島に乘出したが、同氏の主唱によつて、その後開洋興業株式會社の設立を見た。時に昭和十年の春である。資本金五十萬圓、社長には鹽水港製糖社長である櫻哲氏を、專務取締役に平田末治氏、取締役には森コンツエルンの總師森直和氏と日本鹽業の伊藤文吉氏、同三毛菊次郎氏、監査役には鹽水港製糖の黒田秀博氏と安部幸の安部信治氏が就任した。その事業は第一に公益事業として漁船の救助、氣象の觀測、漁船の通信及び漁場の監視をなし、第二次的に營利事業をなすことになつてゐるのである。

新南群島で日本側が事業を行つてゐることは佛は勿論英も周知のことであつた。日本の手薄を良いことにし昭和十三年佛關西人を頭にして、約三十名の安南人が定住し通信その他を開始したのだ。その長島には以前から開洋興業の社員が事業をしてゐる。ほんの目と鼻の間のところに施設したのである。

しかし島での兩國人は極めて紳士的に別段の紛糾もなく、時に安南人の通信技師等が遊びに來る。彼等はいつもかう云ふさうだ、それはこゝで事業をすることは差支へないが、フランス政府の許可を取つて呉れと、これはこちらが云ひたいことで、君



（新南群島長島開洋興業社宅　平田末治氏撮影）

等は日本政府の許可を取つて來給へとやり返したさうである。又フランス側は難破船のあるたびに日本側の援助をうけてゐた。昭和十二年來事業を開始した開洋興業株式會社が數十名の社員等を常置してゐることも承知してゐるのだ。

十三、水産南進の重要基地

日本と新南群島との關係は、このやうに長年月に亙つてゐるのであり、事實關係からも國際法上の權限からも嚴として動かすことの出來ないものなのだ、從つて群島は、その實際において我が大日本帝國の領土に屬すべきは當然であるが、たゞ、未だ行政上の管轄關係が確立してゐなかつた點においてフランスとの關係に無用の紛爭乃至は摩擦を生じたのである。

だからこの際新南群島の行政管轄を確定し、內外に對してその所屬關係を判然とさせることが最も必要であり、かつ適切であると認められるに至つたので、三月三十日附をもつてこれを臺灣總督府管下に編入し、なほ新南群島の經濟的、交通的關係から高雄市域に編入されることゝなつたのであつた。三月三十一日、高雄神社大前において執行された新南群島市域編入奉告祭は、この意味において實に歷史的行事であつたのだ。高雄市尹宗藤大陸氏は

當然のことが當然に行はれたのだが　陛下の御稜威は南海の孤島にも及ぶ。

と語つたのである。

十四、むすび

群島の高雄市域編入宣言に對しフランスでは、印度支那、フイリツピン、ボルネオよりほゞ等距離の重要位置を占める新南群島は、水上機の根據地たりうる點から見て、佛領印度支那その他に脅威を與へる戰略的要地である、フランス政府は數週間前、右問題を國際仲裁々判に附せんとの提議をなしたが、今囘の日本の宣言は右フランスの提議に對する拒絕の囘答とも見られる、フランス政府は今後も同群島の合法的權利であることを主張するであらうと云ひ、英國は又これに對して

將來の極東大戰の際には日本軍にとり重要な前哨基地とならう

と重視し、アメリカも又ハル長官は新聞記者團に對し

米國は新南群島に對する日本政府今囘の主張に重大關心を有するものである。

と言明した。然し日本としてはその法的根據についてすでに十分に研究し盡くされてゐるので、たとへ第三國から抗議的申入れがあつても、斷乎これを論駁する用意をもつてゐるが、更に同島のフイリツピン諸島に屬するとの所論に對しては、一八九

八年の米西媾和條約第三條に見るも、この度のわが方の範圍とは抵觸しないもので、新南群島の我が領有たることは、まことに當然のことであつたのだ。今この新南群島にある開洋興業株式會社の社員達は

俺たちは水産日本の前進重要地點として、水産日本の第一線にゐるのだ、新南群島は俺たちで護るのだ。

といふ覺悟でしつかり結ばれ、何かと不自由なこの土地で年中元氣一ぱいで働いて居り、その姿はまつたく涙ぐましいものがある。（完）

追記

本稿をしるした直後、新聞紙上につぎのやうなニュースが報じられてゐる。卽ち新南群島附近が高雄南進漁船隊の、絶好の漁場としていよ〳〵その價値を認識せられ、同群島に前進根據地として漁港船溜を持つことが絶對必要なりとし、その實現計畫が樹てられつゝあるといふのである。

これがため總督府高雄築港事務所では、これが調査の目的を以て技術員を同島に派遣するに決したが、これに先立ち高雄漁業界の意見を徵したところ港内は少くとも漁船百二十隻を收容しうるものであること、最大百噸程度の漁船が出入しうること、水深は干潮面最低三メートルを維持したいこと等の希望があつた由である。

やがて本計畫も實現にうつされることであらうがこの新南群島に前進基地をもつことは、臺灣水産界にとつて絶大なる强味を付與することであり、その完成の曉には頻出せる海の犧牲もその跡を絶つべく、大いに期待すべきものがある。

なほ新南群島の記錄について、プラタス島（西澤群島）の命名者である高雄州商工奬勵館長西澤基一氏の父君が、明治四十一年既に新南群島に赴いて調査を遂げられたさうであるが、事業に着手するには至らなかつた。この詳細について西澤氏より話を聞きたいと思つたが、同氏は目下上京中であり、その機を得なかつた。尤も西澤氏が記錄上最も古く同島に赴いた人であつても、平田氏の新南群島に對する功績には何等かはりはない。

（若林修史誌す）

C(T)SIL Exhibit 33(*bis*)

"French Flag over the Unoccupied Islets", *The Illustration* (15 July 1933)

[image]

THE FRENCH FLAG OVER UNOCCUPIED ISLETS

———

Between Indochina and the Philippines stretches a region of coral shallows scattered with reefs which are crowned with sandy islets; the hydrographic survey vessel *Rifleman* visited the western part of this region in 1867, but the marine charts bore a worrying note in the east: 'Dangerous unexplored region'. Many a vessel which tried to navigate the direct route through the sandbanks from Indochina to New Caledonia were shipwrecked.

It was known, however, that some of the reefs were accessible; that several islets had vegetation; that the Japanese had tried with all their might, but without success, to exploit a shallow layer of phosphates; and that Chinese from Hainan managed to survive on the cays (small rocky islands surrounded by coralliferous reefs) from turtle and sea cucumber fishing, as well as a small area planted with coconut and banana trees and potatoes.

[image]
[caption:] One of the five inhabitants of Thitu island.

It was also known, from the map drawn with remarkable precision by the officers of the *Rifleman*, that some reefs as large as ten or so nautical miles surrounded lagoons filled with calm water, which would be excellent potential refuges for seaplanes, submarines and light vessels.

Was this negligence or lack of concern for such a deprived region? None of the continental powers held neighbouring territories: England, the US, France, Holland, and Japan hadn't thought to claim sovereignty, and the private companies that were trying to get the phosphates didn't know who to turn to for their prospecting declarations. Yet it appeared that a foreign power exercising a right of surveillance over the China seas could be dangerous to the security of French maritime communications in a conflict.

The French government decided to act: in 1930, the gunboat *Malicieuse* officially took possession of *Tempête* island; in 1933, the dispatch boats *Astrolabe* and *Alerte* hoisted the French flag on the islets in the north of the archipelago. France's colonial domain had been increased by 100 hectares.

On 6 April 1933, the two dispatch boats and the Indochinese oceanographic research vessel *Lanessan* visited *Tempête* island. The three Chinese that inhabited the island had hoisted the French flag and their little domain seemed prosperous, the coconut trees strong, and the turtles abundant.

On 7 April, the *Astrolabe* took possession of the cay of Amboyne, a coral and sand islet sitting on the sea like a golden weight on a deserted azure sea and licked by the slightest of waves. Thousands of 'mad' white-breasted sea birds covered the islet and chicks covered with a thick white down came to nestle in the hollow of one's hand.

Along the reefs, a marvellous palette where all of the colours of the rainbow, from indigo to light yellow, the ships headed for the north-east, towards Tizard bank, a vast emerald lagoon, and dropped anchor by an islet covered in greenery from which coconut trees sprang: Itu Aba.

The island was deserted, but two occupants had left their mark: cement wells, remains of an iron jetty, rusted rail tracks on the embankment, and a pile of abandoned phosphates bore witness to a Japanese enterprise dating back to 1925; then a hut made out of foliage, a well maintained potato field, a little altar with a votive tea light and stick jars to the Lar gods of the Chinese fishermen. A board hung on a hut, covered with characters which could roughly be translated as 'I, Ti Mung, Chief of the Junk, come here in the full moon of March to bring you food. I found nobody, I left rice in the shelter of the rocks and I left'. The mysterious drama that is solitude!

[image]
[caption:] The new French archipelago.

[image]
[caption:] The board attached to the door of the abandoned hut on the island of Itu Aba.

The dispatch boats hoisted the French flag on the islands in the north: Loaita, Thitu, *Deux-Iles*. They all resembled one another; seated atop the reef, sometimes showing at low tide, covered by white coral where wonderful fish would play in the clear waters – royal blue carp, black and white streaked sunfish, tiger-striped ochre catfish –, the islet stood 3 meters tall, covered with impenetrable mangroves dominated by a few trees.

[image]
[caption:] The mission commander burying the statement recording the French possession of Itu Aba island.

Arriving in a whaleboat up to the edge of the reef, the sailors disembarked and crossed the belt of coral in waist-deep water. At the foot of the flag, under a boundary stone, they buried a statement recording the French possession of the islet; the bugler sounded the 'colours' while two sailors presented arms.

[image]
[caption:] One of the boundary stones under which the statements recording French ownership were buried.

Itu Aba and Loaita were deserted, but in Thitu and *Deux-Iles* there were Chinese, all from Hainan; junks resupplied them every year and took back dried turtle meat and sea cucumbers. They seemed happy with their lot on their little monsoon-battered domain and enjoyed music in their free time, at dusk...

G.M.

[image]
[caption:] Coconut trees and turtle shells on *Tempête* island.

LE PAVILLON FRANÇAIS SUR DES ILOTS INOCCUPÉS

Entre l'Indochine et les Philippines s'étend une région de hauts fonds coralliens, parsemée de récifs sommés d'îlots de sable ; le navire hydrographe *Riffleman* en visita la partie ouest en 1867, mais les cartes marines portent dans l'est l'émouvante mention : « Région dangereuse inexplorée. » Maints navires qui tentèrent de suivre à travers les bancs la route directe d'Indochine en Nouvelle-Calédonie firent naufrage.

L'un des cinq habitants de l'île Thi Tu.

On savait cependant que certains récifs étaient abordables ; que plusieurs îlots portaient de la végétation ; que des Japonais avaient tenté, avec des moyens puissants, mais sans succès, l'exploitation d'une couche superficielle de phosphates ; que des Chinois d'Haïnan vivaient sur les cayes (îlots rocheux entourés de récifs coralligènes) de la pêche à la tortue et aux holothuries ainsi que d'un petit domaine planté de cocotiers, de bananiers et de patates.

On savait aussi, d'après la carte dressée avec une remarquable exactitude par les officiers du *Riffleman*, que certains récifs, larges d'une dizaine de milles, entouraient des lagons d'eau calme, excellents refuges éventuels pour des hydravions, des sous-marins, des navires légers.

Négligence, insouciance pour une région aussi déshéritée ? Aucune des puissances continentales possédant des territoires voisins : Angleterre, Etats-Unis, France, Hollande, Japon, n'avait songé à faire acte de souveraineté, et les compagnies privées que tentaient les phosphates ne savaient à qui s'adresser pour faire leurs déclarations de recherches. Il apparaissait pourtant que l'exercice par une puissance étrangère d'un droit de surveillance sur les mers de Chine pouvait être dangereux dans un conflit pour la sécurité de nos communications maritimes.

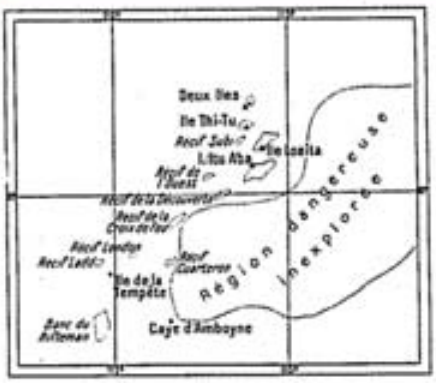
Le gouvernement français décida d'agir : en 1930, la canonnière *Malicieuse* prit officiellement possession de l'île de la Tempête ; en 1933, les avisos *Astrolabe* et *Alerte* hissèrent notre pavillon sur les îlots au nord de l'archipel. Le domaine colonial de la France s'en trouvait accru de... 100 hectares.

Le 6 avril 1933, les deux avisos et le bâtiment océanographe de l'Indochine *Lanessan* visitèrent l'île de la Tempête. Les trois Chinois qui l'habitent avaient hissé le pavillon français, leur petit domaine paraissait prospère, les cocotiers, vigoureux, les tortues, abondantes.

Le 7 avril l'*Astrolabe* prit possession de la caye d'Amboyne, îlot de sable corallien posé sur la mer comme un besant d'or sur un écu d'azur, désert et balayé par les vagues à la moindre houle. Des milliers de « fous », oiseaux de mer au ventre blanc, y couvaient ; des poussins couverts d'un épais duvet blanc venaient se blottir au creux de la main.

Longeant les récifs, palette merveilleuse où s'étalent toutes les couleurs du prisme, de l'indigo au jaune clair, les bâtiments firent route au nord-est, vers le banc Tizzard, vaste lagon d'émeraude, et mouillèrent devant un îlot couvert de verdure d'où surgissaient des cocotiers : Itu-Aba.

L'île était déserte, mais deux occupants avaient laissé des traces : des puits en ciment, les débris d'un appontement en fer, les rails rouillés d'un chemin de fer sur remblai, un tas de phosphates à l'abandon témoignaient d'une entreprise japonaise remontant à 1925 ; puis une hutte de feuillages, un champ de patates bien entretenu, un petit autel avec sa théière votive, ses jarres à bâtonnets, deux



Le nouvel archipel français.

lares de pêcheurs chinois. A la hutte était pendue une planchette couverte de caractères dont la traduction grossière peut s'écrire ainsi : « Moi, Ti Mung, patron de jonque, suis venu ici à la pleine lune de mars pour vous porter des aliments.

La planchette fixée à la porte de la case abandonnée de l'île Itu Aba.

Je n'ai trouvé personne, je laisse le riz à l'abri des pierres et je pars. » Drame mystérieux de la solitude !

Les avisos hissèrent le pavillon français sur les îles du nord : Loaita, Thi Tu, les Deux-Iles. Elles

Le commandant de la mission enterrant le procès-verbal de prise de possession de l'île Itu Aba.

se ressemblent ; sur le socle du récif, affleurant parfois à mer basse, couvert de corail blanc où se jouent dans l'eau claire des poissons admirables — cyprins bleu de roi, lunes striées de noir et de blanc, poissons-chats tigrés d'ocre — l'îlot se dresse haut de 3 mètres, couvert d'impénétrables buissons de mangles, que dominent quelques arbres.

Venus en baleinière jusqu'à la lisière du récif, les marins débarquent et franchissent la ceinture de corail avec de l'eau jusqu'à la ceinture. Au pied du pavillon, on enterre sous une borne un procès-verbal constatant la prise de possession ; le clairon sonne les « couleurs » tandis que deux marins présentent les armes.

L'une des bornes sous lesquelles ont été déposés les procès-verbaux de prise de possession.

Itu Aba, Loaita étaient déserts, mais à Thi Tu, aux Deux-Iles habitaient des Chinois, tous venus d'Haïnan ; des jonques les ravitaillaient tous les ans et emportaient la chair de tortue et les holothuries séchées. Ils paraissaient heureux de leur sort sur leur petit domaine battu par les moussons et charmaient leurs loisirs d'un air de musique, au crépuscule...

G. M.

Cocotiers et entassement de carapaces de tortue dans l'île de la Tempête.

Annex 893

C. Mora et al., "Dredging in the Spratly Islands: Gaining Land but Losing Reefs", *PLOS Biology* (31 Mar. 2016)

PLOS | BIOLOGY

PERSPECTIVE

Dredging in the Spratly Islands: Gaining Land but Losing Reefs

Camilo Mora[1]*, Iain R. Caldwell[2], Charles Birkeland[3], John W. McManus[4]

1 Department of Geography, University of Hawaii at Manoa, Honolulu, Hawaii, United States of America, **2** Hawaii Institute of Marine Biology, University of Hawaii at Manoa, Honolulu, Hawaii, United States of America, **3** Department of Biology, University of Hawaii at Manoa, Honolulu, Hawaii, United States of America, **4** Department of Marine Biology and Ecology, Rosenstiel School, University of Miami, Miami, Florida, United States of America

* cmora@hawaii.edu

Abstract

Coral reefs on remote islands and atolls are less exposed to direct human stressors but are becoming increasingly vulnerable because of their development for geopolitical and military purposes. Here we document dredging and filling activities by countries in the South China Sea, where building new islands and channels on atolls is leading to considerable losses of, and perhaps irreversible damages to, unique coral reef ecosystems. Preventing similar damage across other reefs in the region necessitates the urgent development of cooperative management of disputed territories in the South China Sea. We suggest using the Antarctic Treaty as a positive precedent for such international cooperation.

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Coral reefs constitute one of the most diverse, socioeconomically important, and threatened ecosystems in the world [1–3]. Coral reefs harbor thousands of species [4] and provide food and livelihoods for millions of people while safeguarding coastal populations from extreme weather disturbances [2,3]. Unfortunately, the world's coral reefs are rapidly degrading [1–3], with ~19% of the total coral reef area effectively lost [3] and 60% to 75% under direct human pressures [3,5,6]. Climate change aside, this decline has been attributed to threats emerging from widespread human expansion in coastal areas, which has facilitated exploitation of local resources, assisted colonization by invasive species, and led to the loss and degradation of habitats directly and indirectly through fishing and runoff from agriculture and sewage systems [1–3,5–7]. In efforts to protect the world's coral reefs, remote islands and atolls are often seen as reefs of "hope," as their isolation and uninhabitability provide de facto protection against direct human stressors, and may help impacted reefs through replenishment [5,6]. Such isolated reefs may, however, still be vulnerable because of their geopolitical and military importance (e.g., allowing expansion of exclusive economic zones and providing strategic bases for military operations). Here we document patterns of reclamation (here defined as creating new land by filling submerged areas) of atolls in the South China Sea, which have resulted in considerable loss of coral reefs. We show that conditions are ripe for reclamation of more atolls, highlighting

the need for international cooperation in the protection of these atolls before more unique and ecologically important biological assets are damaged, potentially irreversibly so.

Studies of past reclamations and reef dredging activities have shown that these operations are highly deleterious to coral reefs [8,9]. First, reef dredging affects large parts of the surrounding reef, not just the dredged areas themselves. For example, 440 ha of reef was completely destroyed by dredging on Johnston Island (United States) in the 1960s, but over 2,800 ha of nearby reefs were also affected [10]. Similarly, at Hay Point (Australia) in 2006 there was a loss of coral cover up to 6 km away from dredging operations [11]. Second, recovery from the direct and indirect effects of dredging is slow at best and nonexistent at worst. In 1939, 29% of the reefs in Kaneohe Bay (United States) were removed by dredging, and none of the patch reefs that were dredged had completely recovered 30 years later [12]. In Castle Harbour (Bermuda), reclamation to build an airfield in the early 1940s led to limited coral recolonization and large quantities of resuspended sediments even 32 years after reclamation [13]; several fish species are claimed extinct as a result of this dredging [14,15]. Such examples and others led Hatcher et al. [8] to conclude that dredging and land clearing, as well as the associated sedimentation, are possibly the most permanent of anthropogenic impacts on coral reefs.

The impacts of dredging for the Spratly Islands are of particular concern because the geographical position of these atolls favors connectivity via stepping stones for reefs over the region [16–19] and because their high biodiversity works as insurance for many species. In an extensive review of the sparse and limited data available for the region, Hughes et al. [20] showed that reefs on offshore atolls in the South China Sea were overall in better condition than near-shore reefs. For instance, by 2004 they reported average coral covers of 64% for the Spratly Islands and 68% for the Paracel Islands. By comparison, coral reefs across the Indo-Pacific region in 2004 had average coral covers below 25% [21]. Reefs on isolated atolls can still be prone to extensive bleaching and mortality due to global climate change [22] and, in the particular case of atolls in the South China Sea, the use of explosives and cyanine [20]. However, the potential for recovery of isolated reefs to such stressors is remarkable. Hughes et al. [20] documented, for instance, how coral cover in several offshore reefs in the region declined from above 80% in the early 1990s to below 6% by 1998 to 2001 (due to a mixture of El Niño and damaging fishing methods that make use of cyanine and explosives) but then recovered to 30% on most reefs and up to 78% in some reefs by 2004–2008. Another important attribute of atolls in the South China Sea is the great diversity of species. Over 6,500 marine species are recorded for these atolls [23], including some 571 reef coral species [24] (more than half of the world's known species of reef-building corals). The relatively better health and high diversity of coral reefs in atolls over the South China Sea highlights the uniqueness of such reefs and the important roles they may play for reefs throughout the entire region. Furthermore, these atolls are safe harbor for some of the last viable populations of highly threatened species (e.g., Bumphead Parrotfish [*Bolbometopon muricatum*] and several species of sawfishes [*Pristis*, *Anoxypristis*]), highlighting how dredging in the South China Sea may threaten not only species with extinction but also the commitment by countries in the region to biodiversity conservation goals such as the Convention of Biological Diversity Aichi Targets and the United Nations Sustainable Development Goals.

Recently available remote sensing data (i.e., Landsat 8 Operational Land Imager and Thermal Infrared Sensors Terrain Corrected images) allow quantification of the sharp contrast between the gain of land and the loss of coral reefs resulting from reclamation in the Spratly Islands (Fig 1). For seven atolls recently reclaimed by China in the Spratly Islands (names provided in Fig 1D, Table 1), we extracted one cloud-free image for each 60-day period from February 2014 to May 2015. In these images, only land above sea level is visible in the short-wave infrared band (i.e., Landsat band 6), while land above sea level and natural reef areas (e.g., coral

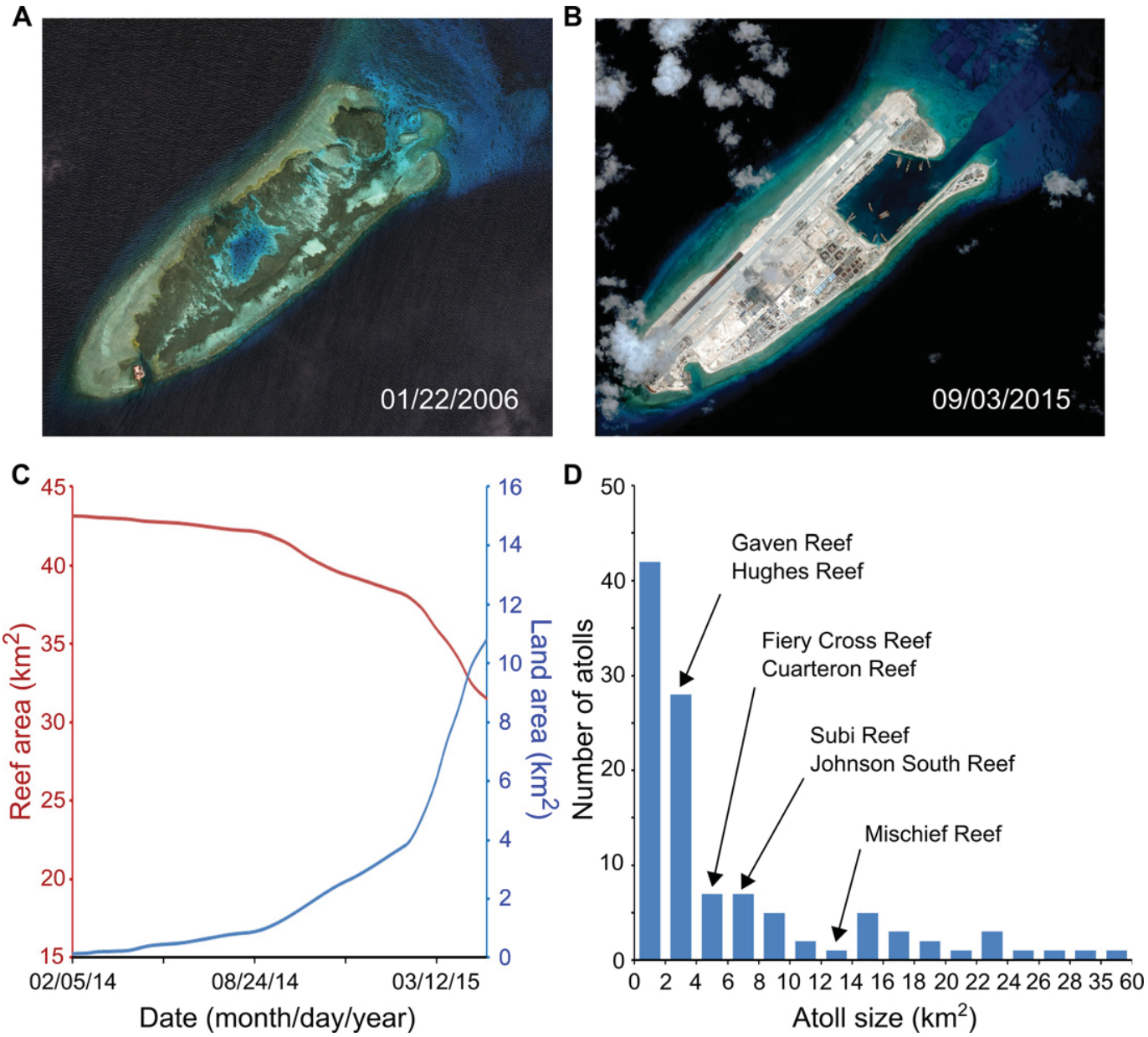

Fig 1. Reclamation leads to gains of land in return for losses of coral reefs: A case example of China's recent reclamation in the Spratly Islands. For display purposes, we show two images of Fiery Cross Reef before (A) and after (B) land reclamation (images courtesy of the Asia Maritime Transparency Initiative from the Center for Strategic and International Studies and Digital Globe). The cumulative reclamation in the seven atolls has resulted in considerable increases in land (blue line, C) but reductions in coral reef area (red line, C). Changes in land and reefs, over time, for the individual atolls are shown in S2 Data. The Spratly Islands, South China Sea, are rich in atolls with similar sizes and characteristics to those already reclaimed (D, China's seven recently reclaimed atolls are highlighted with arrows in their respective size categories). Data for plots C–D are provided in S2–S4 Data. Quantifying similar trends for the reclamation of other atolls by other countries was not possible with available Landsat 8 images because reclamation in many of these atolls had occurred prior to the launching of the Landsat 8 satellite in 2013 and because historically there was land above sea level, which precludes differentiating reclaimed land from natural land.

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reefs and submerged natural sand bars) are both visible in the red optical band (i.e., Landsat band 4). By subtracting the size of visible areas in Landsat band 6 from the size of visible areas in Landsat band 4, we were able to quantify the total size of natural reef areas (see S1 Data for

Table 1. List of reclaimed atolls in the Spratly Islands and the Paracel Islands. Several countries are responsible for the land fillings but are not named to avoid implying ownership.

SPRATLY ISLANDS	Latitude	Longitude
Cuarteron Reef	8°51′39.04″N	112°50′20.52″E
Fiery Cross Reef	9°32′53.33″N	112°53′18.59″E
Gaven Reef	10°12′29.25″N	114°13′22.52″E
Hughes Reef	9°54′51.29″N	114°29′51.57″E
Johnson South Reef	9°43′11.81″N	114°16′56.30″E
Mischief Reef	9°54′8.19″N	115°32′14.22″E
Subi Reef	10°55′31.53″N	114°5′6.03″E
Erica Reef	8°6′27.29″N	114°8′1.88″E
Mariveles Reef	7°58′3.09″N	113°55′13.54″E
Swallow Reef	7°22′28.80″N	113°49′43.79″E
Thitu Island	11°3′13.87″N	114°17′5.89″E
Itu Aba Island	10°22′37.36″N	114°21′56.44″E
Central Reef	8°55′51.13″N	112°21′0.47″E
Namyit Island	10°10′46.13″N	114°21′57.63″E
Pearson Reefs	8°57′28.47″N	113°40′38.21″E
Sand Cay	10°22′28.72″N	114°28′48.63″E
Sin Cowe Island	9°53′7.52″N	114°19′47.29″E
Southwest Cay	11°25′45.36″N	114°19′54.05″E
Spratly Island	8°38′42.03″N	111°55′13.15″E
West Reef	8°51′45.58″N	112°13′29.83″E
PARACEL ISLANDS		
Duncan Island	16°27′6.41″N	111°42′37.06″E
Lincoln Island	16°39′59.93″N	112°43′49.44″E
Money Island	16°26′51.70″N	111°30′25.13″E
Palm Island	16°27′8.01″N	111°42′2.62″E
Pattle Island	16°32′2.76″N	111°36′25.93″E
Rocky Island	16°50′39.71″N	112°20′50.41″E
Triton Island	15°47′6.02″N	111°12′15.13″E
Woody Island	16°50′4.82″N	112°20′15.70″E

doi:10.1371/journal.pbio.1002422.t001

details); the area of reclamation is the size of visible areas in Landsat band 6, as prior to reclamation most of the atolls were submerged, with the exception of small areas occupied by a handful of buildings on piers (note that the amount of land area was near zero at the start of the reclamation; Fig 1C, S1 Data). The seven reclaimed atolls have effectively lost ~11.6 km^2 (26.9%) of their reef area for a gain of ~10.7 km^2 of land (i.e., >75 times increase in land area) from February 2014 to May 2015 (Fig 1C). The area of land gained was smaller than the area of reef lost because reefs were lost not only through land reclamation but also through the deepening of reef lagoons to allow boat access (Fig 1B). Similar quantification of reclamation by other countries in the South China Sea (Table 1) was not possible with available Landsat 8 images because reclamation in many of these atolls has occurred prior to the launching of the Landsat 8 satellite in 2013 and because historically there was land above sea level, which precludes differentiating reclaimed land from natural land.

The impacts of reclamation on coral reefs are likely more severe than simple changes in area, as reclamation is being achieved by means of suction dredging (i.e., cutting and sucking materials from the seafloor and pumping them over land). With this method, reefs are ecologically degraded and denuded of their structural complexity. Dredging and pumping also

disturbs the seafloor and can cause runoff from reclaimed land, which generates large clouds of suspended sediment [11] that can lead to coral mortality by overwhelming the corals' capacity to remove sediments and leave corals susceptible to lesions and diseases [7,9,25]. The highly abrasive coralline sands in flowing water can scour away living tissue on a myriad of species and bury many organisms beyond their recovery limits [26]. Such sedimentation also prevents new coral larvae from settling in and around the dredged areas, which is one of the main reasons why dredged areas show no signs of recovery even decades after the initial dredging operations [9,12,13]. Furthermore, degradation of wave-breaking reef crests, which make reclamation in these areas feasible, will result in a further reduction of coral reefs' ability to (1) self-repair and protect against wave abrasion [27,28] (especially in a region characterized by typhoons) and (2) keep up with rising sea levels over the next several decades [29]. This suggests that the new islands would require periodic dredging and filling, that these reefs may face chronic distress and long-term ecological damage, and that reclamation may prove economically expensive and impractical.

The potential for land reclamation on other atolls in the Spratly Islands is high, which necessitates the urgent development of cooperative management of disputed territories in the South China Sea. First, the Spratly Islands are rich in atolls with similar characteristics to those already reclaimed (Fig 1D); second, there are calls for rapid development of disputed territories to gain access to resources and increase sovereignty and military strength [30]; and third, all countries with claims in the Spratly Islands have performed reclamation in this archipelago (Table 1; at least 20 atolls have been reclaimed in the Spratly Islands, and this does not include reclamation activities in the Paracel Islands). In the Spratly Islands, where no country can gain full access to resources without generating international conflict and where the race for development could cause irreversible damage to unique natural assets, novel multinational approaches to conservation are urgently needed [20]. One such possibility is the generation of a multinational marine protected area [16,17]. Such a marine protected area could safeguard an area of high biodiversity and importance to genetic connectivity in the Pacific, in addition to promoting peace in the region (extended justification provided by McManus [16,17]). A positive precedent for the creation of this protected area is that of Antarctica, which was also subject to numerous overlapping claims and where a recently renewed treaty froze national claims, preventing large-scale ecological damage while providing environmental protection and areas for scientific study. Development of such a legal framework for the management of the Spratly Islands could prevent conflict, promote functional ecosystems, and potentially result in larger gains (through spillover, e.g. [31]) for all countries involved.

Supporting Information

S1 Data. Methods used to quantify the area of reefs dredged and filled in the Spratly Islands using Landsat 8 imagery.
(PDF)

S2 Data. Raw and interpolated data from Landsat 8 imagery (as shown in Fig 1C).
(XLSX)

S3 Data. Sizes of atolls in the Spratly Islands (data shown in Fig 1D).
(XLSX)

S4 Data. Compressed folder containing the shapefiles created from Landsat 8 imagery to calculate changes in land and reef areas over time for seven recently reclaimed atolls in the Spratly Islands.
(ZIP)

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Annex 894

Charles Gide, PRINCIPLES OF POLITICAL ECONOMY (2nd Edition) (1904)

PRINCIPLES OF

POLITICAL ECONOMY

BY

CHARLES GIDE

PROFESSOR AT THE UNIVERSITY OF MONTPELLIER, LECTURER ON ECONOMICS AT THE PARIS LAW SCHOOL

SECOND AMERICAN EDITION

ENTIRELY RE-TRANSLATED FROM THE LATEST FRENCH ORIGINAL AND ADAPTED TO THE USE OF AMERICAN STUDENTS

BY

C. WILLIAM A. VEDITZ, PH.D., LL.B.

SOMETIME FELLOW IN SOCIOLOGY AT THE UNIVERSITY OF PENNSYLVANIA
PROFESSOR OF ECONOMICS AT BATES COLLEGE, LEWISTON, MAINE

BOSTON, U.S.A.
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resistance to any attempt at removal, and since the labor and expense necessary for overcoming this resistance increase in proportion to the distance to be covered, the industry of transportation cannot entirely do away with the inequality of natural conditions.

As for those natural substances that exist in limited quantities, it is possible that man, by discovering the processes of nature which brought them forth, may actually reproduce them. We may some day be able to make diamonds by crystallizing carbon ; or if the supply of coal should ever become exhausted, we may succeed in extracting fuel from the carbonates of lime found in large quantities in the earth's crust. It is also possible that we may find substitutes for those materials that are not obtainable in sufficient quantities. We sometimes succeed in doing this, and should always succeed if our knowledge were wide enough ; for there is such an infinite variety of organic and inorganic substances — many of which possess similar characteristics —that they could to a certain degree take each other's place.

IV. The Law of Diminishing Returns

As land and raw materials are limited in quantity, the production in which they are the necessary factors also must be limited. And such is indeed the fact. Hunting, which played so great a part in primitive societies, has disappeared from the list of productive industries in civilized countries, for the very good reason that, despite the regulations established for its protection, it has ceased to give a satisfactory remuneration. Even in the deserts of Africa, and in the uninhabited territories near the poles, the hunt for elephants, ostriches, beavers, otters, and whales is becoming unprofitable. The scarcity of fish in the seas which border our shores is a subject of lamentation for our sea fishermen, who are now obliged to pursue fish out on the high seas and to equip themselves with larger vessels. The disappearance of

forests, and consequently of wood for carpentry, is an accomplished fact in several European countries, particularly England.

To be sure, there are industries in which a change of processes may avert, for a time, the threatening calamity. Instead of hunting ostriches, we may raise them; instead of catching fish in the seas or rivers, we may hatch them; instead of merely cutting down trees, we may at the same time plant them. This would amount to changing these occupations from simply extractive industries into productive ones, like agriculture, in which we do not merely let nature work, but assist and guide her. There are, however, two important limitations even in agriculture: —

(1) Agricultural production is limited by the supply of *mineral substances* that are indispensable to plant-life. Every plot of land, even the most fertile, contains only a fixed amount of nitrogen, potassium, phosphoric acid, etc. A part of these essential substances is removed with every crop that is raised on the land. It is true that the farmer aims not only to restore to the soil a part of the substances that each harvest has removed, but also to enrich it by adding new substances. But it must be borne in mind that the sources from which the farmer derives these enriching substances are themselves limited. Natural fertilizers restore to the soil only a part of what the animals that pasture on it have consumed, and chemical fertilizers consist of minerals (phosphates, nitrates, guano, etc.), the supply of which is small and easily exhaustible.

(2) Moreover, agricultural production is limited by the *time* and *space* necessary for vegetable and animal life; these conditions are much more rigid, and less subject to modification, than those of industrial production. The farmer is reduced to an almost passive part in production; he must wait patiently for nature to accomplish her part of the work according to laws which he knows but imperfectly and which he cannot change. It takes months to transform the seed

into ears of wheat; and it takes years for the acorn to become an oak. Again, every plant requires room in which to spread its roots and to breathe; this space cannot be restricted. It is different with the industrial worker. The mechanic in his shop generally subjects matter to simple transformations whose physical and chemical laws are much less mysterious than those of organic life. The proof of this lies in the fact that these laws have been tamed, as it were, and obliged to work with mechanical precision at man's command. The industrial worker is not tied down to an inexorable succession of seasons; he can ignore climate and weather, and keep his machinery and furnaces going day and night, summer and winter.[1]

Doubtless, there is not a single piece of land of which the farmer could not, if need be, increase the yield. Only, after a certain stage of cultivation, he cannot do this except *at an increased cost in labor*. There must consequently be a point at which the effort made to increase the crop is incommensurate with the result.

Suppose an acre of land produces 40 bushels of wheat, and that these 40 bushels represent 20 days' labor, or, if we prefer to express the same thing in money, an expense of $20.

[1] We may, nevertheless, ask the question: Since the limitations encountered by farming are due to the fact that it is concerned with living organisms, why should we not try to surmount this obstacle by courageously giving up the assistance rendered us by the mysterious forces of animal and plant life, and seek to manufacture food just as a scientist manufactures chemical substances? All the tissues of living beings, animals or plants, are made up almost exclusively of oxygen, hydrogen, nitrogen, carbon, and mineral salts. All these materials exist in superabundant quantities in the earth's crust and in the atmosphere. The problem, therefore, seems to be theoretically solvable; in fact, some chemists believe that we are on the verge of its practical solution. If chemists should ever succeed in solving it, they will have discovered more than the solution of a chemical problem, or even the problem of Life; they will have found the solution of the social problem, or, at least, they will have revolutionized all the laws of economics. For if food could be manufactured, agriculture would be useless, and man would use the earth merely to walk and build on. Every small piece of land could then feed a population as dense as that of the most populous quarters of our large cities.

To make an acre produce twice as much wheat (*i.e.* 80 bushels), more than 40 days of labor or more than $40 of expenditure would be necessary. To double the product it would be necessary to triple, perhaps to quadruple, the labor and expense. This fact is expressed by the *law of diminishing returns*, according to which the returns are not directly proportionate to the increased expenditure of labor or capital.[1]

This law is certainly borne out by the experience of every day. Ask an intelligent farmer whether his land could not produce more than it does. He will reply: "Certainly, the wheat crop would be larger if I chose to use more manure, to apply more thorough labor, to clear the land of the smallest weeds, to have the earth carefully dug up by manual labor, to use the hoe more thoroughly, and to protect the harvest from insects, birds, and parasitical weeds." Then ask him why he does not do all this, and he will reply that it would not pay; the increase of crops would cost more than it would be worth. There is therefore in the output of any piece of land a point of equilibrium which marks the limit, not beyond which it is impossible to pass, but beyond which no one cares to pass because there is *no advantage* in doing so.[2]

If things were not as they are in this respect, if we could increase the crop of a given piece of land indefinitely, upon the sole condition of proportionately increasing labor and expenditure, the tillers of the soil would not hesitate to do this: instead of increasing the size of their farms, they

[1] It is, of course, true that improved methods of cultivation may for a time put off the point of diminishing returns.

[2] It may appear strange to speak of the limitations of agricultural production at a time when the superabundance of farming products is such that European farmers are complaining, and governments in Europe feel called upon to protect them by customs duties excluding foreign cereals, cattle, etc. But this may be said to be an accident, due to the recent cultivation of large areas in new countries with sparse populations, on which extensive cultivation is easily practised because land is cheap and abundant. This fact explains the postponement of one effect of the law of diminishing returns, and its temporary suspension, but it does not abrogate the law.

would reduce them to the smallest possible area, because the smaller the area the easier it is to manage a farm. But in this event the earth's surface would be entirely different from what it is. The simple fact that things are not as we have just supposed, and that poorer and less favorably situated land is in fact constantly brought under cultivation, demonstrates that in reality we cannot expect a piece of land under given conditions to yield more than a limited crop. (See the section on Rent.)

V. Motive Forces

We have explained that production consists in changing the place or the form of matter. The resistance offered by matter to these changes may sometimes be considerable, and man's muscular energy is not very great. In all times, therefore, and especially since the abolition of slavery has made it impossible to employ the strength of his fellows, man has endeavored to supplement his strength by using the motive forces provided by nature. There are not very many of them, and they have often been overestimated. There are really only four or five which man has been able to utilize in production : the *muscular energy of animals*, the *propelling power of wind and of water*, the *expansive power of vapors* (especially of steam), and recently, although thus far in a small measure, *electricity*. Man makes use of these natural forces by means of *machinery*. Machines are only tools, with the difference that most tools are manipulated by hand, whereas machines are worked by natural forces, such as waterfalls and steam.[1] Now it is a difficult problem to

[1] When the instruments worked by man are complicated, they are sometimes also called machines, *e.g.* sewing-machines ; but this terminology is not correct. Besides, tools and implements can also multiply the power of man. Aided by a hydraulic press, a child can exert a pressure that is theoretically unlimited. With a lever and a place on which to rest it, Archimedes could have moved the world. Yet it has been calculated that had Archimedes found this necessary point of support, and worked several millions of years, he could have raised the world only a few inches ; for a law of mechanics

Annex 895

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CHAPTER III

MAIN ROUTE TO HONGKONG—DESCRIPTION OF ISLANDS, REEFS, AND SHOALS

EASTERN SIDE OF MAIN ROUTE

Caution.—Vessels should not attempt to pass eastward of the banks that are here described, as numerous shoals exist over a very large central area known as "Dangerous ground," which have not been correctly charted.

Currents and tides.—While the surveying vessel *Rifleman* was at anchor on the reefs, during both monsoons, careful observations were taken of the set of the current on the reefs, which, for 16 hours out of the 24, invariably set to windward, generally with the greatest force when the monsoon was strongest; it is not to be supposed that this action occurs at any great distance from the reef, it being an eddy, more or less.

The rise of tide at springs was about 5 feet, and at neaps 1 to 2 feet; one tidal current in the 24 hours.

Banks on eastern side—Vanguard Bank, having 9 fathoms (16.5 m.) least water, and general depths of 20 to 60 fathoms (36.6 to 109.7 m.), is crescent-shaped, about 34 miles in length, and has an average breadth of 6 miles. The position of the 11 fathoms (20.1 m.) on its eastern end is 7° 30′ N., 109° 55′ E., or about 110 miles eastward of Charlotte Bank, the southernmost bank on the western side of the main route.

Grainger Bank, the center of which lies 37 miles 64° from the eastern patch of the Vanguard, is 5½ miles in length by 2 miles in breadth. There are coral heads with 6 to 8 fathoms (11 to 14.6 m.) over them, and depths of 10 to 20 fathoms (18.3 to 36.6 m.) around; the coral bottom is visible over nearly the whole of it.

Prince Consort Bank lies between the Vanguard and the Prince of Wales Bank, and extends about 16 miles north and south by 9 miles east and west. No danger exists on it; the general depths are from 30 to 50 fathoms (54.9 to 91.4 m.), sand and coral, the least water found being on some coral heads near the western edge, with depths of 10 to 13 fathoms (18.3 to 23. 8 m.), with no bottom at 200 fathoms (365.8 m.) at a short distance westward.

Prince of Wales Bank, between 20 to 33 miles east-northeastward of Prince Consort Bank, is 14 miles in extent northeast and southwest, and 7 miles in breadth; it is of coral formation, with irregular depths, there being several heads with depths of 8 to 10 fathoms (14.6 to 18.3 m.), and one of 4 fathoms (7.3 m.) near its northwestern corner, in 8° 08′ N., 110° 27′ E.

Alexandra Bank, about 3½ miles southeastward of Prince of Wales Bank, is 5 miles in length north and south, 3½ miles in breadth, and steep-to. A patch with 3 fathoms (5 5 m.) lies near the eastern edge, and there are others with 6 to 7 fathoms (11 to 12.8 m.); the general depth is about 15 fathoms (27.4 m.), the bottom coral, distinctly visible.

Rifleman Bank is about 30 miles in length in a north and south direction by about 13 miles in breadth. Shallow patches, varying from 1¾ to 9 fathoms (3.2 to 16.5 m.), exist around the edges, within which are depths of 12 to 45 fathoms (21.9 to 82.3 m.), sand and coral; around the banks are depths of about 500 fathoms (914.4 m.).

Bombay Castle Shoal, the shoalest spot, with 1¾ fathoms (3.2 m.), situated at the northern end of Rifleman Bank, in 7° 56′ N., 111° 42′ E., is marked by heavy breakers, except during the finest weather.

Bombay Castle, Orleana Shoal, Johnson Patch, and Kingston Shoals have been found to be patches on the edges of Rifleman Bank, and are named accordingly. It is quite possible that other small shoal patches may exist on the bank.

Owen Shoal, reported (1835) by the ship *David Scott* to be about 2 miles in extent, and to have a depth of 3½ fathoms (6.4 m.), over coral, is charted 22 miles northeastward of Rifleman Bank, in 8° 08′ N., 111° 59′ E. It has not been examined.

Ladd Reef (8° 39′ N., 111° 40′ E.), about 42 miles northward of the Rifleman, is a coral reef 3 miles in length, east and west, and about 1 mile in br adth. In the center of the reef is a lagoon with a bottom of white sand. The surrounding reef uncovers at half tide in many places, and at low water it is almost impossible for boats to cross over into the lagoon.

Spratly (or Storm) Island, situated 14 miles eastward from Ladd Reef, is a bare flat island about 8 feet (2.4 m.) high, 500 yards in length, and 300 yards in breadth, with a margin of bright white sand and broken coral. At a distance of 3 or 4 miles, in the breeding season, the birds standing erect look like small bushes.

The island is on the western end of a coral bank, which is 1⅓ miles in length by 1,400 yards in breadth. Northward of the island at ¾ mile distant, there is a depth of 3½ fathoms (6.4 m.) close to the edge of the bank, decreasing toward the shore. Northeastward

the depth is 7 or 8 fathoms (12.8 or 14.6 m.) not quite ½ mile from the island. Rocky ledges, dry at low water, surround the island, requiring caution when landing, which during the southwest monsoon may be effected on the lee side. The bank is steep-to, the sea breaking heavily upon it, except in very fine weather.

The *Rifleman*, anchored in about 6 fathoms (11 m.) on the northeastern point of the bank, fairly sheltered from the southwest, with the extremities of the island bearing about 221° and 244°, and the extremity of the breakers on the western edge, 264°.

In the months of June and July turtle frequent the island, and they may possibly do so at other seasons. Numbers were taken on the beach, being easily turned over by two or three men. Quantities of their eggs were found on the southwestern side of the island. Sea birds' eggs covered the ground in the months mentioned.

Tides.—Observations at Spratly Island in the summer months showed but one tide during the 24 hours, and in the early part of July it was found to be high water at 9h. a. m., the rise and fall being 5¼ feet. The direction of the current at the northeastern corner of the bank was southwestward during the rising tide, and from southeast to east-northeast during the falling tide.

Amboyna Cay (7° 51′ N., 112° 55′ E.), about 70 miles eastward of Rifleman Bank, and at the southwestern extremity of a small coral bank, is 150 yards in extent, and 8 feet (2.4 m.) high. It is surrounded by coral ledges, partly dry at low water, and steep-to, to the distance of nearly 400 yards in places, upon which the sea breaks heavily with any swell.

A bank, 400 yards wide, extends about 1 mile northeastward of the cay, with a depth of 4 fathoms (7.3 m.) at about 670 yards from it; at the extremity of the bank the water deepens suddenly from 9 to 17 fathoms (16.5 to 31.1 m.) and thence to deep water.

Anchorage on this bank has been found in 5 fathoms (9.1 m.) in the southwest monsoon, fairly sheltered by the cay from the prevailing wind.

A reef, with a depth of 2 to 2½ fathoms (3.7 to 4.6 m.), reported as lying with the center of Amboyna Cay bearing 137°, distant from ½ to 1 mile; it is to near the cay to be shown on the chart, which is on a small scale.

Eastward of Amboyna Cay is the edge of the "dangerous ground" still unsurveyed, and which should be avoided, as before mentioned.

Tides.—By observations at Amboyna Cay 2 days before neaps the maximum rate of the tidal current was 1.4 knots, the flood current setting northward, the ebb westward; flood commencing at 11 p. m., and the ebb at 6 a. m.; rise and fall doubtful.

Remains of huts, which had been made of stones, pieces of coral, planks and bamboos, parts of an old boat, etc., were seen on the cay (1889), all covered with a white coating of guano, denoting that it is a long time since anyone was working guano, or living on Amboyna Cay. The guano on this cay is reported to have no commercial value.

Stags Shoal, northward of Amboyna Cay, was reported in 1802 in 8° 24′ N., 112° 57′ E., as consisting of rocks showing above water.

A sounding of 1,085 fathoms (1,984.2 m.), ooze, has been found in the position assigned to Stags Shoal. Amboyna Cay has been found to be 11 miles farther west than first reported, and it is possible, therefore, that the position of the Stags given may be 11 or 12 miles eastward of its true position. The *Renard*, in 1862, got upon the position ascribed to the Stags Shoal, and steered a few miles east and west, but could not discover it. It is probably the northern end of Lizzie Webber Shoal.

London Reefs.—The London Reefs, four in number, lie about 60 miles northeastward of Rifleman Bank, extend over a distance of about 38 miles in an east and west direction, and are steep-to.

Like most dangers in the China Sea, the London Reefs are surrounded by deep water, thus rendering the lead useless; great caution is therefore necessary when navigating in the vicinity of these reefs, and vessels should not stand toward them with the sun shining ahead, as under these circumstances it becomes almost impossible to distinguish shoal water or breakers.

West (London) Reef (8° 51′ N., 112° 12′ E.) is about 4 miles in extent with several detached coral heads dry at low water around its edge. In the center of the reef there are depths of 6 to 10 fathoms (11 to 18.3 m.), with several coral heads. The only approach to the center is from the southeast side, but so many coral patches exist that the navigation is hazardous. On the eastern side of the reef is a sand cay, 2 feet (0.6 m.) high.

Central Reef is a coral patch awash ½ mile in extent, with a shallow lagoon within the belt of coral, at 8 miles northeastward of West Reef. On the southwestern extremity of the reef is a sandbank, probably covered at high-water springs. It is not always marked by breakers, like those which so readily point out the positions of East and West London Reefs.

East (London) Reef, 16 miles eastward of West Reef, is 7 miles in length, east and west, from 1 to 2 miles in breadth. The coral around its edges inclose a lagoon, having depths of 4 to 8 fathoms (7.3 to 14.6 m.), with many rocky heads; no entrance into the lagoon was discovered. The sea breaks heavily on the reef, and on its western extremity are one or two rocks which seldom cover.

Cuarteron Reef, the easternmost of the London Reefs, at about 9 miles eastward of East Reef, is awash, crescent-shaped, about 3 miles in length, and very steep-to. Although deep water is found close to all of these reefs, there was generally some slope from the edges, on which the surveying vessel could anchor with safety for a short period to enable the position to be fixed, but on Cuarteron Reef no anchorage could be found, it being "steep-to" all around.

The Fiery Cross or Northwest Investigator Reef is a coral reef having several dry patches, upon most of which the sea breaks even in light winds, or with a slight swell. It is 14 miles in length, northeast and southwest, and 4 miles in breadth. The largest dry patch is at its southwestern end in 9° 32′ N., 112° 52′ E.

Dhaulle Shoal, reported in 1826 to exist in 9° 32′ N., 112° 24′ E., is considered to be identical with one of the neighboring reefs. In this locality a depth of 1.060 fathoms (1,938.5 m.) is charted.

Discovery Great Reef, the southern point of which lies 55 miles east-northeastward from Fiery Cross Reef, in 10° 01′ N., 113° 51′ E., is a narrow coral reef, about 7 miles in length, the greater part of which dries at low water, but with several large rocks always showing; in the center is a lagoon, which appeared to be shallow and to have no passage leading into it. No bottom was found at 100 fathoms (182.9 m.) within a short distance of any part of the reef, except off its northern end, where the surveying vessel anchored in 42 fathoms (76.8 m.) nearly ½ mile from the rocks.

The Hainan Island fishermen reported a reef or shoal lying 10 miles northeastward of Discovery Great Reef, but depths of 40 fathoms (73.2 m.), no bottom, have been found in that locality.

Discovery Small Reef, lying about 10 miles eastward from the south point of Discovery Great Reef, is a round coral patch, 670 yards in diameter, dry in places at low water, with very deep water all round.

Western or Flora Temple Reef (10° 15′ N., 113° 37′ E.) is the westernmost reef in this part of the China Sea, and dangerous, having patches of rock just under water at the southwestern part and from 1 to 3 fathoms (1.8 to 5.5 m.) in other places. It is a narrow reef, 1½ miles in length northeast and southwest, with depths of 20 to 70 fathoms (36.6 to 128 m.) close-to, and no bottom at 200 fathoms (365.8 m.) at a short distance.

Tizard Bank, with reefs and islands.—Tizard Bank lies about 16 miles northeastward of Discovery Small Reef. Like most of the large coral banks in the China Sea, it consists of a lagoon bordered by reefs dry at low water, two with islands on them, and a third with a sand cay. The bank is about 30 miles in length in an east and west direction, with an average breadth of about 8 miles. In the

lagoon are several coral heads of 5 to 6 fathoms (9.1 to 11 m.). The tops of the few trees on the islands may possibly be seen from a distance of 8 to 10 miles.

Hainan fishermen, who subsist by collecting trepang and tortoise shell, were found upon most of these islands; some of them remain for years among the reefs. Junks from Hainan (Tonkin Gulf) annually visit the islands and reefs of the China Sea with supplies of rice and other necessaries, for which the fishermen give trepang and other articles in exchange; the junks leave Hainan in December or January and return with the first of the southwest monsoon. The water found in the well on Itu Aba Island was better than elsewhere.

Itu Aba (10° 23′ N., 114° 21′ E.), the larger of the two islands, lies at the northwestern corner of Tizard Bank and is ¾ mile in length. The reef surrounding it extends in some places nearly ½ mile, its limits being generally defined by a line of breakers. The island is covered with small trees and bushes, and there are a few coconut and plantain trees near a well, the tops of which are about 25 feet (7.6 m.) above the sea.

Sand Cay.—About 6 miles eastward of Itu Aba Island is a sand cay, near the center of a reef ¾ mile in diameter. This cay, which was a mere patch of sand when visited by the surveying vessel *Rifleman* in 1869, had bushes on it about 9 feet high; when seen from H. M. S. *Rambler* in 1888, their tops were about 15 feet (4.6 m.) above high water.

The island and cay are connected by a line of shallow patches; nearly midway between is a reef about 1,400 yards in diameter, covered at high tide. Elsewhere on the northern edge of the bank there is a depth of not less than 4 fathoms (7.3 m.), and vessels may safely anchor in 7 to 10 fathoms (12.8 to 18.3 m.) about midway between the sand cay and the reef last described.

Petley Reef, an oval-shaped patch about 1 mile in extent, forms the extremity of a ledge of coral, about 1¼ miles wide, projecting nearly 5 miles in a northerly direction from the northern side of the bank, and with irregular depths; no bottom could be obtained with 100 fathoms (182.9 m.) at a short distance on either side of the ledge.

Eldad Reef forms the eastern extremity of Tizard Bank. It is 4½ miles in length, from 200 yards to nearly 1 mile in breadth, and steep-to on its northern and southern sides; a ridge, about 1 mile in length, extends northeastward of the reef, with depths increasing from 8 to 45 fathoms (14.6 to 82.3 m.), beyond which it drops sharply to 100 fathoms (182.9 m.) and more. A few large rocks on Eldad Reef are always visible, and at low water many smaller ones uncover.

Namyit Island (10° 12′ N., 114° 21′ E.), on the southern side of Tizard Bank, is 600 yards in length by 200 yards in breadth, and surrounded by a reef which projects more than 1 mile to the westward and about 670 yards in other directions. It is about 20 feet (6.1 m.) in height and composed of sand covered with small trees and bushes.

Gaven Reefs, two in number, form the southwestern extremity of Tizard Bank; they are each about 1 mile in extent, covered at high water, and about 2½ miles apart, with coral heads between.

Anchorage—Directions.—The above comprise the whole of the shallow dangers found on Tizard Bank, and with the exception of a 3-fathom (5.5 m.) patch, about 1 mile northeastward of Namyit, nothing less than 4 fathoms (7.3 m.) was discovered on any of the shoal patches surrounding the lagoon. Vessels of moderate draft can, therefore, in cases of necessity and in fine weather, find convenient anchorage, observing always due care and caution in approaching them, so as to guard against possible danger from some shoal spot having escaped detection by the lead.

Loaita Bank extends 21 miles in a northeast and southwest direction and is 7 miles wide near its middle, tapering toward the ends.

Loaita Island (10° 41′ N., 114° 25′ E.) lies 18 miles 10°, from Itu Aba Island on Tizard Bank. It is a sand cay, 300 yards in diameter, covered with bushes, and surrounded by a reef extending in some places nearly ½ mile.

A reef, about 1¼ miles in extent, dry at low water, with a sand cay near the center, lies 5 miles northwestward of Loaita Island. Another reef about 1¾ miles in extent, lies ¾ mile to the southwestward of the one just mentioned. Not less than 4 fathoms (7.3 m.) was found anywhere on the northern edge of Loaita Bank.

Lankiam Cay and adjacent reefs.—A coral patch, ½ mile in extent, partly dry at low water, lies 75° distant 2 miles from Loaita Island; and about 6¾ miles 67°, from the same island, is a reef ¾ mile in diameter, having a sand cay near its center, known to the Hainan fishermen as Lankiam.

At 3 and 4½ miles northeastward from Lankiam are two coral reefs which dry at low water, forming the southeastern extremity of Loaita Bank; no shallow reefs were found northward of these, though they may exist, the least depth being 6 fathoms (11 m.) near the northern end.

Thitu Island and Reefs consist of several dangerous patches upon two coral banks, 12 miles in length, separated by a narrow and deep channel.

Thitu (11° 03′ N., 114° 16′ E.) is a low sand island, about 800 yards in length, situated on the reef which forms the eastern extremity of the western bank. There are a few coconut and plantain trees near a small well.

Banks.—The western bank is 7 miles in length, with a maximum breadth of about 3¼ miles; its northern side is marked by a round coral reef, ¾ mile in diameter, between which and the island reef are depths of 2½ to 6 fathoms (4.6 to 11 m.).

A sand cay lies on the northwestern edge of the bank, on a reef dry at low water and about 1½ miles in extent; between it and the western extremity of the bank are reefs, nearly always marked by breakers. There is a passage into the lagoon between the sand cay reef and the reef eastward of it, with depths of 5 fathoms (9.1 m.).

The southern extremity of the bank is marked by a small reef, situated 2 miles southwestward of the island.

The southern side of the bank is not nearly so dangerous as the northern side, and vessels may anchor upon it, with the sand cay on the northwestern side bearing between 36° and 328°, or to the eastward of the small reef on its southern extremity, where there is not less than 4 fathoms (7.3 m.). In the lagoon the depths are as much as 19 fathoms (34.7 m.).

The eastern bank is a mass of reefs and patches 4½ miles in length, with a breadth of 2 miles; its western extremity is about 1,400 yards eastward of Thitu Island Reef.

Subi Reef (10° 55′ N., 114° 06′ E.), the northern end of which lies southwestward 12½ miles from Thitu Island, is an irregular shaped coral reef, 3½ miles in length by 2 miles in breadth, dry at low water, and has a lagoon, into which there appears to be no passage; it usually breaks and is apparently steep-to.

Discolored water.—In 1923 an area of strongly discolored water, extending about 165 yards northeast and southwest was reported in 11° 11′ N., 113° 58′ E. by the *Munsterland*.

North Danger Reef, of coral formation, is about 8½ miles in length, northeast and southwest, 4½ miles in breadth, and situated from 20 to 28 miles northward of Thitu Islands.

On its northwestern side are two sand cays, each about ½ mile in length; Northeast Cay, the northern one (11° 28′ N., 114° 21′ E.) is 10 feet (3 m.) high, and Southwest Cay 15 feet (4.6 m.). Between the cays is a passage 1 mile wide, with depths of about 5 fathoms (9.1 m.) leading into the lagoon of the reef, where the depth is from 20 to 27 fathoms (36.6 to 49.3 m.).

Shallow water exists all round the edge of North Danger Reef, and there are heavy breakers over the coral, awash at its north-

eastern and southwestern extremities. No bottom could be obtained close to the edge of the reef with upward of 100 fathoms (182.9 m). of line.

Both cays are covered with coarse grass, and on the northeastern of the two is a stunted tree. The cays are frequented by Chinese fishermen from Hainan, who collect bêche-de-mer, turtle shell, etc., and supply themselves with water from a well in the center of Northeastern Cay.

Trident Shoal, lying 16 miles eastward of North Danger, is composed of coral, and is 7½ miles in length by 6 miles in breadth; there are many patches on this shoal with less than 10 fathoms (18.3 m.) water over them, two of which are very shallow. The patches lie around the edge of the shoal, forming a lagoon, the depths in which are 20 to 34 fathoms (36.6 to 62.2 m.); close outside the shoal there is no bottom at 100 fathoms (182.9 m.).

The shallowest patch, situated at the northern extremity of the shoal, is about 2 miles in length, east and west, having near its center (11° 31′ N., 114° 39′ E.) a spot which dries at low water springs; the depths on other parts of the patch vary from 1 to 5 fathoms (1.8 to 9.1 m.). Another shallow patch lies at the eastern extremity, with a least depth of 2¼ fathoms (4.1 m.). A depth of 4 fathoms (7.3 m.) was found on a head about 1 mile southwestward of the northern patch, but not less than 5 fathoms (9.1 m.) on any of the other patches.

Lys Shoal, about 5 miles in length, lies 2 miles southward of Trident Shoal, and like the latter is formed of a number of patches under 10 fathoms (18.3 m.), with a lagoon in the center. A spot of 2¾ fathoms (5 m.) was found near the southwest extremity of the bank. Some 5-fathom (9.1 m.) patches exist near the northeast end of the bank, but nothing under 6 fathoms (11 m.) was discovered elsewhere; the bank is steep-to.

Reported Reef.—A reef on which the steamer *Kasenga*, drawing 16 feet of water, touched, was reported (1910) in 11° 50′ N., 114° 37′ E., about 26½ miles 39° from Northeast Cay, North Danger.

Macclesfield Bank, discovered by the English ship of that name in 1701, lies between 15° 24′ N. and 16° 15′ N., and 113° 40′ E. to 114° 57′ E.

Reports of shallow water on the edge of this bank caused its partial survey by the *Penguin* in 1892 and *Egeria* in 1892–93. A previous partial survey showed that this coral bank rose rapidly out of deep water, was about 75 miles in length in a northeasterly and opposite direction, with an extreme breadth of 33 miles, and that it was a submerged atoll, with a general depth of about 40 fathoms (73.2 m.) over a large part of its area, and with distinct indications of a shal-

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low rim surrounding this area. The general result of the whole examination may be stated to be that on the whole of the 200 miles forming the periphery of the bank there exists a coral rim about 3 miles wide of luxurious growth and at a remarkably even depth below the surface of from 7 to 14 fathoms (12.8 to 25.6 m.); this rim being broken here and there by passages of greater depth, but less than the general depths of from 40 to 50 fathoms (73.2 to 91.4 m.) which prevail over the central portion of the bank.

On one spot only of the rim (near its northeastern end on Pigmy Shoal) was a depth of as little as 6½ fathoms (11.9 m.) found, and on a patch in the center of the lagoon a small spot of 5 fathoms (9.1 m.) (Walker Shoal) was the shoalest water found. Banks under 10 fathoms (18.3 m.) have been given the names of surveying officers chiefly. The western portion has only been partially surveyed.

The depth of the surrounding ocean is about 1,300 fathoms (2,377.4 m.), the bottom globigerina ooze; the south face of the bank is almost perpendicular to 600 fathoms (1,097.3 m.), the west is very steep, but the north face slopes gradually from 60 fathoms (109.7 m.), close to the rim, to 200 fathoms (365.8 m.) at 10 miles northward.

Caution.—The bank may generally be seen from aloft on approaching by the greenish color of the water. In heavy weather the sea on its edge is high and confused. As it is quite possible that shallow coral heads may exist in the unsurveyed portion, and that others may have escaped the lead in the part which has been more fully examined, it is recommended that vessels should pass either eastward or westward of Macclesfield Bank, and not over it.

Helen Shoal (19° 12′ N., 113° 53′ E.), between Macclesfield Bank and Hongkong, is 2 miles in length, east and west, and 1 mile in breadth. The least water found is 6½ fathoms (11.9 m.), the general depths being 8 and 9 fathoms (14.6 and 16.5 m.), with no bottom at 100 fathoms (182.9 m.) close around. The shoal breaks in bad weather.

Current.—Strong tide rips were observed in the vicinity of Helen Shoal, but on examination deep water was found to exist. The current was found to set generally with the wind.

Discolored water.—In 1923 discolored water was reported in 20° 09′ N., 113° 57′ E.

Pratas Reef and Island.—Pratas Island (20° 42′ N., 116° 43′ E.) is situated on the western side, on the middle of the sunken part of Pratas Reef. It is about 1½ miles in length east and west, ½ mile in breadth, and 40 feet (12.2 m.) in height, to the tops of the trees. It is visible from a distance of about 12 miles in clear weather. In the hazy weather, which generally prevails during the northeast monsoon, the island is seldom visible beyond 5 or 6 miles,

and the breakers at the edge of the reef may possibly not be seen until within 1 mile of them.

The island is composed of sand and its shape is that of a horseshoe; the two prongs, extending westward from the main portion, inclose a shallow inlet about 1 mile in length from the bar at its entrance to the settlement at its northeast arm; it affords shelter to the Chinese fishing craft which come here in the early part of the year. Brackish water can be obtained near the settlement by digging a few feet into the sand. Sea birds are numerous in the breeding season.

A coral reef, which dries in parts, extends about ¾ mile southwestward, ½ mile westward, and nearly 2 miles northward of the western part of the island.

White Sand Spit, which breaks with a westerly swell, extends about ¾ mile southward of the western end of the island.

There is a jetty on the south coast of the island and a settlement on the northeast coast. Near the jetty is a flagstaff and near the settlement a mast.

Beacons.—Central Beacon, consisting of a pole with a diamond top mark, and Bay Beacon, a pole with a triangle top mark, are situated on the southern coast of Pratas Island.

Outer and End Beacons are situated on the southern and northern sides, respectively, of the entrance to the inlet.

North Beacon (20° 42′ N., 116° 43′ E.) is situated northwestward of the settlement on the northern coast of the island.

Pratas Reef, the northeastern point of which (20° 46′ 30″ N., 116° 53′ E.) is about 10 miles from the island, is a coral barrier of circular form, inclosing a lagoon with 5 to 10 fathoms (9.1 to 18.3 m.) water, thickly studded with coral knolls round its margin, but comparatively clear near the middle. The reef is about 40 miles in circumference and 1 to 2 miles in breadth. The north, east, and southern sides are just dry at low-water springs and steep-to; the western side forms a sunken barrier, across which are two channels leading into the lagoon, one on each side of Pratas Island. Many coral knolls are believed to exist in the lagoon and in the channels, in addition to those shown on the chart.

Channels.—The North Channel lies between the island and the edge of the breakers, and a depth of 2½ fathoms (4.6 m.), white sand, may be carried near the middle of it at low-water springs, but it is encumbered with patches with as little as 2 feet (0.6 m.) in places. The South Channel is by far the better of the two, being wider and a little deeper, and is less encumbered with coral knolls. This channel is apparently available for vessels of 15 feet draft.

Tides.—It is high water, full and change, at about 6 h. 00 m., with a spring rise of about 5 feet.

Anchorages.—Although Pratas Reef is steep-to in most parts, there are several spots where, in case of necessity, a vessel might find anchorage outside the breakers, particularly on the western side, abreast the middle of the North and South Channels. At each of these spots there is good anchorage in the northeast monsoon, in 20 to 10 fathoms (36.6 to 18.3 m.), but the position abreast the South Channel is considered the better of the two, the sunken reef at this part being deeper and the bottom more even than in the channel north of the island. There is anchorage in about 20 fathoms (36.6 m.), coral and clay, at about 1 mile westward of the western end of the island. A vessel of light draft might even anchor in safety on the reef in the middle of the South Channel entrance, in 3½ fathoms (6.4 m.) at low water, or cross it and take up a berth inside the lagoon in 10 fathoms (18.3 m.), fine sand.

Directions.—During the strength of the monsoons sailing vessels should always endeavor to pass to leeward of Pratas Reef on account of the invariable set of the current to leeward; for there are no soundings to indicate a near approach, and the weather is frequently thick and hazy in this vicinity. The safest quarter to make the reef is from the westward, the island being on its western side, and the currents in the neighborhood invariably running in a northeast or opposite direction, according to the monsoon. Approaching the reef a vessel should be conned from aloft, as with the sun in a favorable position the bottom can be seen in 10 fathoms (18.3 m.).

As previously mentioned, South Channel is recommended and believed to be navigable for vessels of 15 feet and less draft.

Caution.—The Pratas Reef, lying in the route between Manila and Hongkong, is a serious danger, especially in the northeast monsoon, when strong gales and thick clouds are sometimes prevalent for weeks together; and as, in this monsoon, vessels generally approach the reef from the southeastward, the greater number of wrecks have occurred on this side.

Currents—Tide rips.—At distances of 20 to 50 miles northwestward through north to northeastward of Pratas Reef, during the times of various searches being made for reported shoals, the currents in the neighborhood were found to be exceptionally strong and tide rips were frequently observed, which occasionally appeared like breakers.

Vereker Banks, two in number, are situated about 40 miles northwestward of Pratas Reef; both are steep-to, with deep water between and around them.

North Vereker Bank is 11 miles in length, in a northwest and southeast direction, and 7 miles in breadth within a depth of 100

fathoms (182.9 m.); the least depth obtained was 35 fathoms (64 m.), 2 miles southeastward of the center of the bank. No live coral was found. Position of 35-fathom (64 m.) spot: 21° 04′ N., 116° 02′ E.

South Vereker Bank, 8 miles in length, has a least depth of 32 fathoms (58.5 m.), 2 miles westward of the center of the bank. The depths between the banks are from 150 to 180 fathoms (274.3 to 329.2 m.).

Heavy overfalls and tide rips were met with in the vicinity of these banks.

Bank.—A sounding of 32 fathoms (58.5 m.), sand and mud, has been obtained southwestward of Vereker Banks, in (approximately) 20° 40′ N., 115° 18′ E.

Current.—During the examination of Vereker Banks (February) the current ran between west-northwest and south-southwest, from ½ to 1 knot; the prevailing set was between west-northwest and west-southwest. The current at times sets to windward. During calms or light southwest winds the current sets between south-southeast and east-southeast, with a rate of from ¼ to 1 knot.

WESTERN SIDE OF MAIN ROUTE—ISLANDS AND DANGERS

Charlotte Bank, in 7° 08′ N., 107° 35′ E., is the first bank met with on the western side of the main route northward of the Anamba Islands. It has a least depth of 5 fathoms (9.1 m.), with from 32 to 40 fathoms (58.5 to 73.2 m.) around it, and is about 4 miles in length, east and west, by 2 miles in breadth.

Scawfell Shoal, originally reported in 1865 as a patch of 7½ fathoms (13.7 m.), practically in the position since found to be in, has a least depth of 5 fathoms (9.1 m.), coral, near its center; it is ½ mile in length, east and west, by ¼ mile in breadth, within the 10-fathom (18.3 m.) curve, and situated in 7° 19′ N., 106° 51′ E. The shoal at the time of examination by the *Waterwitch* in 1908 was not marked by discolored water nor by overfalls.

Pulo Condore Group, known as Connon by the Cochin Chinese, consists of about a dozen islands, situated about 45 miles from the coast of Cochin China, in the track of vessels proceeding between Singapore and Saigon; their north extremity is distant 97 miles from Cape St. James, at the entrance to that river.

The principal island (8° 41′ N., 106° 36′ E.) is nearly 9 miles in length, northeast and southwest, from 2 to 4 miles in breadth, and is formed of a ridge of mountains, the summit being flat-topped and 1,954 feet (595.6 m.) above high water. The eastern side is divided into two bays by a rocky peninsula, the northern of which is completely opened to the eastward; on the western side is Southwest Bay.

Pulo Condore is encompassed by several smaller islands, which are mostly high and covered with trees, the highest attaining an elevation of 1,076 feet (328 m.). The peak on Little Condore, 800 yards westward of the Gullet, forms an excellent landmark from the southward or westward. See view on Chart 3147.

Settlement—Supplies.—The French have established a fortified post and a penal settlement at the village in Great or East Bay. A small pier fronts the village. The island is but thinly populated, but it furnishes plenty of fruits and abounds with timber. The natives rear a quantity of poultry and pigs. Water is procurable in Southwest Bay, southward of the landing place.

Telegraph.—Pulo Condore is connected with Cape St. James and with Pontianak in Borneo by submarine cable.

Radio.—There is a radio station that handles commercial messages in (approximately) 8° 40′ N., 106° 41′ E. call letters H V O. Wave length 600 meters. This station also sends out radio weather bulletins, radio storm warnings, and radio navigational warnings. (See H. O. Pub. No. 205 Radio Aids to Navigation.)

Communication.—The Messageries Maritimes and Messageries Fluviales steamers call here.

Great or East Bay is formed by the projection from the main body of the island of two high points of land, which are about 4 miles apart. It is only available during the southwest monsoon period.

Islets.—Off the southern point, four islets, fringed with coral, extend nearly 1½ miles, the eastern one having a conspicuous lime kiln on it. Off East Point is Hon Baikan, an island nearly 3 miles in length and 1,076 feet (328 m.) in height, also fringed with coral. Hon Lap, a small islet, lies off its southern side. Hon Kao, about 1 mile in extent and 787 feet (239.9 m.) in height, lies about 2 miles northeastward of Hon Baikan.

Light.—A fixed white light, visible 25 to 30 miles, is shown at an elevation of 696 feet (212.1 m.) from a rectangular white lighthouse with a red roof, 52 feet (15.8 m.) in height, situated on the eastern extremity of Hon Baikan. See Light List.

Dangers.—East Bay, inside a line connecting its northern and southern points, is encumbered with an extensive shore flat and many detached shallow patches, on account of which vessels should not go inside that line except at the southwestern part of the bay, where the least-known depths are 3¼ and 3½ fathoms (5.9 and 6.4 m.).

The southeastern and main entrance to the bay is barred by a flat which extends right across from Hon Gue' (Grue) to Hon Baikan, with depths under 5 fathoms (9.1 m.) and several patches of 2 to 3 fathoms (3.7 to 5.5 m.), as shown on the plan.

In the deep-water anchorage between this bar and the shallows off the head of the bay is a patch of 2¾ fathoms (5 m.), steep-to, with White Rock in line with East Point, bearing 36°, the latter distant 1⅔ miles. Patches of 4 to 5 fathoms (7.3 to 9.1 m.) are charted in the southern part of the deep water, and others may exist, as the bay has not been thoroughly examined.

Landmark.—A whitewashed mark is situated on the shore southeastward of the remarkable rock, and is a useful mark for making the anchorage.

Range lights.—Front light, fixed red, 43 feet (13.1 m.) above water, visible 10 miles, is shown from a triangular pyramidal masonry structure, 1,000 yards westward of the landing pier.

Rear light, fixed white, 75 feet (22.9 m.) above water, visible 10 miles, is shown from a rectangular masonry structure, 956 yards northwestward from the front light.

These lights in range bearing 339° lead into the anchorage on the western side of the bay.

Directions.—Great or East Bay has three entrances. That from the southwestward between the southern point of the bay and Hon Cha is 600 yards wide, and apparently deep, but the water shoals to less than 5 fathoms (9.1 m.) within the island.

The second, or the channel from the southeastward, is between Hon Gue and Hon Baikan, over the bar which connects the two. The best water, about 4¼ to 5 fathoms (7.8 to 9.1 m.), will be found by passing from 200 to 400 yards northeastward of Hon Gue, about midway between it and the bank with 2 fathoms (3.7 m.) water to the eastward.

The passage from the northeastward between East Point and Hon Baikan is 1,340 yards wide and deep, but the soundings are very scant in the approach. When within the entrance, by keeping White Rock twice its breadth open from East Point, a vessel will pass eastward of the 2¾-fathom (5 m.) patch in the fairway; when the remarkable rock situated on the northern slope of the hills on the south side of the bay bears 263°, or the white mark on the shore 255°, the vessel will be southward of the patch, then steer for the southern point of the bay, anchoring as convenient.

If bound to the Inner Anchorage, steer in with the remarkable rock bearing 263° until the white mark bears 230° when bring it ahead, and gradually hauling to the northwestward to avoid the rock on the northern side of the approach.

Anchorages.—A good berth for a large vessel (which must enter by the northern channel) appears to be in 6 to 7 fathoms (11 to 12.8 m.), with the summit of Hon Taileung, bearing about 182° and Hon Lap 95°.

During the strength of the southwest monsoon, in order to avoid the sea, vessels of moderate or light draft should anchor farther westward, where, however, the squalls are heavier, but the holding ground is good, the bottom being gray mud. There appears to be good anchorage with depths of 4½ to 5½ fathoms (8.2 to 10.1 m.), inside the ridge, which has 3¼ and 3½ fathoms (5.9 and 6.4 m.) patches, with the southern point of the bay bearing from 199° to 176°, and Hon Lap from 92° to 98°.

The Inner Anchorage, 190° about 1,600 yards from the landing pier, has a depth of 3½ to 4 fathoms (6.4 to 7.3 m.) as charted.

Tides.—It is high water, full and change, at Pulo Condore at 2h. 30m.; springs rise 6½ feet in East Bay.

Northeast Bay offers convenient shelter in the southwest monsoon for vessels not wishing to enter Great Bay. It appears to be free from danger, but the depths decrease sharply within the 5-fathom (9.1 m.) curve. Vessels should therefore anchor in 7 fathoms (12.8 m.), mud, or directly the water shoals under that depth.

Shoals.—A 2-fathom (3.7 m.) shoal lies ½ mile westward of Hon Vivum off the southern extremity of Little Condore. Another patch of 3¼ fathoms (5.9 m.) lies ¾ mile eastward of the same island.

White Rock lies east-northeastward, distant 3⅓ miles from the northeastern point of the largest island of the Pulo Condore Group. It is apparently high, and there are depths of 17 to 22 fathoms (31.1 to 40.2 m.) at about ½ mile off, but none charted near it.

There is a bank of 8 fathoms (14.6 m.) 13 miles east-northeastward of White Rock.

Southwest Bay is formed between the southwest end of the large island and the adjoining high island, Little Condore or Bae Vioung, 708 feet (215.8 m.) in height, the eastern point of which is separated from the southwestern point of the large island by a narrow channel. The entrance to the bay is about ¾ mile wide, with depths of 7 to 9 fathoms (12.8 to 16.5 m.), gravel and mud, decreasing to 5 fathoms (9.1 m.) near the flat that occupies the head of the harbor, and which is dry at low water for ½ mile. This bay is well sheltered by the surrounding hills, except from the northwestward, but the wind is seldom strong from that quarter; the heavy squalls, however, require precaution, but the holding ground is good.

Some islets lie off the northern point of this bay, northward of which is a high island named Hon Tap, having some rocks above and below water extending from its northwestern side.

Hon Tae, another high island, lies about 1 mile to the northwestward of Hon Tap; off its northeastern extremity is an islet. Hon

Tae Niao is another island lying a little more than 2 miles northeastward of Hon Tae, having a reef and some rocks extending about 200 yards from its northern side.

The Brothers are two islets, about 3 miles apart, northeast and southwest, and situated 22 miles westward of the Pulo Condore Group. The westernmost, Ilot Aride (8° 34′ N., 106° 06′ E.), is a low barren rock, appearing white from the eastward, and has heavy breakers on its eastern side during strong winds. The easternmost Ilot Boise is a round islet, 180 feet (54.9 m.) in height, covered with vegetation to its summit.

Wallace Bank was reported by the master of the *Wallace* (1885) to be about ¾ mile in extent, with a depth of 8 fathoms (14.6 m.) in 9° 32′ N., 107° 40′ E.

Royal Bishop Bank (9° 39′ N., 108° 15′ E.), composed of coral, is 3½ miles in length, and about 1½ miles in breadth, with a depth of 10 fathoms (18.3 m.) over it, and 25 to 30 fathoms (45.7 to 54.9 m.) around; there may be less water.

A patch of 8 fathoms (14.6 m.) is charted in 10° 05′ N., 108° 02′ E.

Pulo Sapatu, or Shoe Island (9° 58′ N., 109° 06′ E.), 347 feet (105.8 m.) high, is the easternmost of three islands, named the Catwicks. It is a barren rock, 670 yards in length, and visible in clear weather from a distance of about 22 miles.

When viewed from some directions it resembles a shoe; at others appears as a large square column; and from the eastward as a pyramid.

With the exception of a rock awash, lying 50 yards eastward of its southern end, the island is steep-to; depths of 16 and 17 fathoms (29.3 and 31.1 m.) were found at 400 yards eastward of it, and at ½ mile off in that direction 25 to 30 fathoms (45.7 to 54.9 m.). On the western side the depths are greater.

Landing.—Under very favorable circumstances landing may be effected upon the rocks at the southern end of the island; otherwise it is inaccessible. It is frequented by sea birds in the breeding season.

Julia Shoal, with a depth of 2½ fathoms (4.6 m.), situated 3½ miles 124° from Pulo Sapatu, is of coral formation, and about ¼ mile in extent.

Pyramid (Little Catwick), well open northward or southward of Pulo Sapatu, leads ½ mile or more clear of the shoal. With the pyramid shut in behind Pulo Sapatu a vessel will be inside the Julia Shoal if the angle of elevation of Pulo Sapatu be 1° 22′ or upward, and outside the shoal if the angle of elevation be less than 0° 45′.

The Pyramid, or Little Catwick, is a pyramidal rock, 56 feet (17.1 m.) high and steep-to, lying about 2¼ miles northwestward of Pulo Sapatu.

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The channel between this rock and Pulo Sapatu has a depth of about 60 fathoms (109.7 m.), but it ought not to be used by a sailing vessel, as the currents are strong and irregular about these islands.

Round Island, or Great Catwick, is a barren rock 196 feet (59.7 m.) high, and about 300 yards in diameter, lying 11½ miles west-northwestward from Sapatu; it has depths of 30 to 50 fathoms (54.9 to 91.4 m.) at a short distance in all directions.

La Paix Rock is small, with a pinnacle awash and steep-to, lying in the channel between Round Island and Pyramid, the former bearing 275°, about 4¼ miles, and Pulo Sapatu is just open eastward of the Pyramid. Except in fine smooth weather, the sea always breaks upon this rock.

Volcanic islands.—Between La Paix Rock and Pulo Cecir de Mer, a volcanic islet, 1 foot (0.3 m.) high and erupting in May, 1923, has formed. It is situated about 5½ miles 11° from La Paix Rock. It is not probable that the height of this island will long remain correct, as in 1923 there was a 97-foot (29.6 m.) volcanic islet at 7½ miles 6° from La Paix Rock, and in 1924 this island had disappeared and now has a reported depth of 25 fathoms (45.7 m.) over its position.

Rock.—A rock awash lies about 4½ miles, 351°, from La Paix Rock.

Bank.—A bank of 12 fathoms (21.9 m.) with depths of 34 to 60 fathoms (62.2 to 109.7 m.) around, lies about 1 mile northward of the volcanic islet.

Caution.—In consequence of volcanic disturbance, great caution is necessary when navigating in the vicinity between Pulo Sapatu and Pulo Cecir de Mer.

Yusun Shoal (10° 16′ N., 109° 02′ E.) is a coral patch of 4 fathoms (7.3 m.) in the fairway of the channel between Pulo Cecir de Mer and Pulo Sapatu, 18 miles, 348° from the latter. Close around it are depths of 45 to 50 fathoms (82.3 to 91.4 m.), which is the general depth of the middle of the channel, but about 1½ miles west-northwest of the shoal are depths of 23 and 27 fathoms (42.1 and 49.4 m.). In fine weather the shoal is not easily seen, but in the strength of the monsoons the sea has been frequently observed to break upon it. The depths in the channel are very irregular.

Pulo Cecir de Mer or Kulao Thu (10° 33′ N., 108° 56′ E.) is 3½ miles in length north and south, and 1½ miles in breadth, with two hills toward its northern end. The southwest hill has a round top, is 360 feet (109.7 m.) in height, and is visible in clear weather from a distance of about 25 miles. The northeast hill, 300 feet (91.4 m.) high, is conical and has several masses of rock near its summit, which give it a jagged appearance.

Supplies.—Pulo Cecir de Mer, known to the natives as Hon Cau, is inhabited by poor fishermen and others, and is well cultivated, but no supplies can be obtained.

Islets and reefs.—Nearly ½ mile off the northeast end of the island are several rocks, one 60 feet (18.3 m.) high, on the edge of the shore reef.

On the eastern side is a sandy bay, and shown on the chart as fronted by a coral reef to the distance of a mile or more; the reef is steep-to. At ½ mile off the southern end is an islet 154 feet (46.9 m.) in height, with a black rock beyond 56 feet (17.1 m.) in height. The reef which fronts the bay encircles these islets and extends about 600 yards southeastward of the last-mentioned with rocks awash. The reef skirts the western shore at about 670 yards and is also steep-to.

Anchorage.—In seeking anchorage it must be borne in mind that the reef surrounding the island is steep-to. There is fair anchorage during the northeast monsoon period off the sandy shore forming the southwest and western sides of the island, in depths of 13 to 16 fathoms (23.8 to 29.3 m.), sand and shells; but the best position is just southward of the southwest point, where vessels may conveniently anchor in 10 to 14 fathoms (18.3 to 25.6 m.), at ½ mile from the shore reef, which is steep-to.

It is possible to obtain shelter in a steamer from the southwest monsoon by anchoring off the northeastern end in 14 or 15 fathoms (25.6 or 27.4 m.); but the bottom is rocky, bad holding ground, and by no means to be recommended as an anchorage.

High Rock, 66 feet (20.1 m.) high, and the resort of sea birds, lies nearly 5 miles northwestward of Cecir de Mer; 100 yards northward of it is a rock a few feet high, with a rock awash beyond it.

In the channel between Cecir de Mer and High Rock the depths vary from 9 to 14 fathoms (16.5 to 25.6 m.), coral. Near the rock are patches of 6 and 7 fathoms (11 and 12.8 m.).

The channel between High Rock and Holland Bank is about 9 miles wide, with depths varying from 7 to 10 fathoms (12.8 to 18.3 m.) on the patches, and to 14 to 27 fathoms (25.6 to 49.4 m.) between them; bottom generally sand, or sand and shells at the greater depths, and rocky on the patches.

Holland Bank is composed of coral, and within the depth of 10 fathoms (18.3 m.) is 7 miles in length by 4 miles in breadth. The shoalest patches are in its eastern half, and cover a space of about 2½ miles, with an irregular bottom; the least depth found was 2½ fathoms (4.6 m.), in 10° 39′ 30″ N., 108° 42′ 30″ E.

The depths around the bank are very irregular, and afford no certain guide, but the bank is much steeper on its eastern edge than elsewhere. The lead, however, is not to be relied on in approaching

that edge, for 20 fathoms (36.6 m.) may be obtained at one cast, and about 4 fathoms (7.3 m.) at the next. Vessels should pass westward of the bank. Shoals of 8½ and 6½ fathoms (15.5 and 11.9 m.) are reported to exist about 5 miles northward of Holland Bank.

Clearing marks.—Vessels passing northward of the bank should not bring the southwest hill of Cecir de Mer eastward of 131°; and those passing southward of the bank should not bring the same hill to the southward of 103°.

The dangers to the westward of Holland Bank are described with the mainland in Chapter V.

Marne Bank is charted 253°, distant 23 miles from the summit of Pulo Cecir de Mer, and is 3½ miles in extent east and west with a depth of 9 fathoms (16.5 m.) over it. It has not been examined.

In 1924, the American steamer *Narbo* reports sounding in 7½ fathoms (13.7 m.), coral bottom, about 10 miles southeastward of Marne Bank in (approximately) 10° 22′ 30″ N., 108° 43′ 30″ E.).

Juniata Bank.—The U. S. S. *Juniata*, 1888, reported having obtained soundings in 30 fathoms (54.9 m.), fine gray sand, in a position about 40 miles eastward of Pulo Cecir de Mer (10° 32′ N., 109° 38′ E.).

Bank.—In 1923 the American steamer *Lake Gitano* reported discolored water in 10° 02′ N., 109° 51′ E.

Gold Shell Bank.—In 1920, the American steamer *Gold Shell* reported sounding in 29 fathoms (53 m.) in about 10° 02′ N., 110° 00′ E.

The British naval vessel *Merlin* searched for this bank unsuccessfully in 1922, but discovered an extensive rocky bank, with a least depth of 229 fathoms (418.8 m.), about 6 miles westward of its assigned position.

Minerva Bank, with 28 fathoms (51.2 m.), the locality of which is doubtful, is said to lie near the Main Track (10° 38′ N., 110° 19′ E.).

Search was made in the surveying vessel *Rifleman* on and near the supposed position of this bank, but no bottom was obtained with 200 fathoms (365.8 m.); as a thorough examination was not made it may, however, exist somewhere near its assigned position. The *Sirius*, 1904, sounded near this spot, obtaining no bottom at 95 fathoms (173.7 m.). See Kiev Bank below.

Kiev Bank.—The commander of the steamer *Kiev*, of the Russian volunteer fleet, reported in 1908 as having sounded on a bank with about 39 fathoms (71.3 m.), apparently in 10° 15′ 45″ N., 110° 13′ 15″ E., and also in the year 1901, obtaining a sounding of 34 fathoms (62.2 m.) in about Lat. 10° 10′ N., Long. 110° 10′ E.

The surveying vessel *Waterwitch* unsuccessfully searched for the above two banks in 1912.

PARACEL ISLANDS AND REEFS

General remarks.—The description of these islands and reefs is principally from the German Government surveys, executed between the years 1881–1884.

The Paracel Islands and Reefs are an extensive group of low coral islands and reefs, lying between 15° 46′ N., and 17° 07′ N., 111° 13′ E. and 112° 47′ E. They consist of two principal groups, the Amphitrite and Crescent, and several reefs and islets. They were annexed by the Chinese Government in 1909.

In fine weather and a clear atmosphere there is no difficulty in navigating between the reefs of the Paracel Groups with a lookout aloft, as the trees on the several islands, the heads of rock above water on some of the reefs, and the sea breaking over most of them, give warning of approach to the dangers. In misty or bad weather they should be avoided, and there seems nothing to be gained in passing between them unless seeking anchorage. Sailing vessels should avoid these dangers at all times, for during calms they may be drifted onto the reefs, close to which there is no anchorage. Many wrecks occur here.

The anchorages are mostly open, affording shelter, only with the wind off the islands; these are mentioned with the several islands.

Tides and currents.—At the Crescent Group it is high water, full and change, at about 10h. 30m., springs rise 3 feet. The current runs generally with the wind in both monsoons, but in light winds between the monsoons they are continually changing their direction among the reefs, and sometimes attain the rate of 2 knots.

Triton Island (15° 46′ 30″ N., 111° 14′ 30″ E.), the southwesternmost of the Paracels, is a sand cay, about 3 feet (0.9 m.) high and a little more than 1 mile in length; it stands on a coral reef, which extends about 1½ miles northward and northeastward, and to about ½ mile in other directions. The reef has not more than 6 feet (1.8 m.) of water over it, and is steep-to.

This island is the breeding place of sea birds.

In 1918 this island was reported to lie 5 miles farther westward than charted.

Passu Keah, situated about 37 miles east-northeastward from Triton Island, is a sand cay situated on the western end of a coral reef, which is 5 miles in length in an east and west direction and steep-to.

This island was reported to lie 5 miles farther westward than charted.

Discovery Reef, about 9 miles northward of Passu Keah, is 16 miles in length in an east and west direction by about 5 miles in

breadth, and is steep-to, with several rocks a few feet above water; there is barely a depth of 2 fathoms (3.7 m.) over any part of it. There is a large opening on its southern side into the lagoon, and a smaller one on its northern side, used by the Chinese fishing boats; the overfalls are very heavy on the reef.

Vuladdore Reef, lying 6 miles northeastward of Discovery Reef, is 7 miles in extent, east and west, 2¾ miles in breadth, and steep-to. It has a few small rocks on it above water, with high breakers at times.

Bombay Reef forms the southeastern corner of the Paracels Group; it is of oblong form, 13 miles in length, east and west, inclosing a lagoon; some of the rocks on its edge are awash, and four of them are above high water. The reef is steep-to, and breaks. Eastern extremity lies in 16° 05′ N., 112° 38′ E.

In 1921 there were portions of a wreck above water on the eastern extremity of the reef.

In January, 1922, the wreck of the *New York Maru* was reported in an upright position on the northern side of Bombay Reef and to be visible about 14 miles.

Bremen Bank is situated about 12 miles northward of Bombay Reef, and is 12 miles in length within a depth of 20 fathoms (36.6 m.); the shoalest water found is 7 fathoms (12.8 m.) at the southwestern part of the bank.

Jehangire Bank, about 6 miles in length, consists of three detached patches lying about 5 miles east-northeastward of the Bremen. The depths on the bank are very irregular; 7 fathoms (12.8 m.) is the least known depth, and it is situated at the southwestern extremity of the southern one.

Lincoln Island (16° 40′ N., 112° 44′ E.), the eastern of the Paracel Islands, is 1¼ miles in length, a little more than ½ mile wide, and about 15 feet (4.6 m.) high, the northeastern side being bold. It is covered with trees and brushwood, and surrounded by a coral reef, dry at low water, which extends from 200 to 600 yards. One of the coconut trees is said to form a good landmark.

A narrow coral shoal projecting southward from its southeastern point is said to extend 11 miles and to be studded with rocks, but judging from the soundings that were obtained by the surveying vessel *Rifleman*, the dangerous part of the shoal does not extend more than 3 miles from the island; time did not admit of its being further examined. None of it should be crossed. Depths of less than 10 fathoms (18.3 m.) extend about 1 mile northwestward of the island.

On the northern and eastern sides of the island the depths increase rapidly, but towards the southwestward, depths under 40 fathoms (73.2 m.) were obtained as far as the Bremen and Jehangire Banks.

Anchorage.—Good anchorage can be obtained in either monsoon under the lee of the island, in a depth of 10 fathoms (18.3 m.), coral, about ½ mile from the shore.

In the center of the island, close to a stunted coconut tree, there is a well, dug by the Chinese fishermen, into which the water filters.

Pyramid Rock, a small cone-shaped rock, 17 feet (5.2 m.) high, lies about 7¼ miles southwestward from Lincoln Island; at a distance it might be mistaken for a junk.

Dido Bank, discovered by H. M. S. *Dido* in 1844, is a small bank with 13 fathoms (23.8 m.), sand, with 80 fathoms (146.3 m.) and greater depths around it; it lies 12½ miles, 50°, from the northern end of Lincoln Island.

The Amphitrite Group is the northeasternmost of the Paracels; the two portions of the group, lying north and south of each other, are separated by a deep-water channel, 4 miles wide.

The northern group consists of two reefs separated by Zappe Pass. The westernmost of these reefs is 6 miles in length by 1¾ miles in breadth, with a sand cay near its western end, and Tree Island 2 miles within its eastern end. The northern and eastern sides of these reefs are steep-to, but on the southern and western sides depths of 5 to 20 fathoms (9.1 to 36.6 m.) will be found at a short distance from the reef; at the southwestern corner of this group the 10-fathom (18.3 m.) curve is 1 mile from the reef.

Tree Island—Anchorages.—Tree Island, covered with mangrove bushes and surrounded by a white sand beach, may be recognized by the palm tree (30 feet (9.1 m.) high) near its center. It is much frequented by Chinese fishermen, the southwestern side of the island affording sheltered anchorage in the northeast monsoon period close to it for junks, in 13 feet (4 m.) water. The channel leading to this anchorage is on the southern side of the reef, and is 400 yards wide with a depth of 4 to 6 feet (1.2 to 1.8 m.) at low water. Under North and Middle Islands there is anchorage in from 11 to 16 fathoms (20.1 to 29.3 m.) sand.

The southeastern reef of this group, on which there are three islands covered with mangrove bushes, is 4 miles in length northwest and southeast, and has three sand cays near its southern end; vegetation is increasing on these cays.

Landing can be effected in the openings on the southern side of this reef between the islets and cays.

Zappe Pass is about ½ mile wide between the reef on either side, with a least known depth of 2½ fathoms (4.6 m.) in mid-channel; it is only available for small craft during smooth water. With a fresh breeze the breakers extend right across: there is usually a strong current through it.

The southern group consists of Woody and Rocky Islands lying near each other and on the same surrounding reef.

Woody Island (16° 50′ N., 112° 21′ E.), the southern and largest island of the group, is about 1 mile in length, surrounded by a white sand beach, and covered with trees; landing can be effected on the lee side.

Rocky Islet, northeastward of Woody Island, and on the same reef, is from 40 to 50 feet (12.2 to 15.2 m.) high.

The reef surrounding these islands extends to a distance of 600 yards in places, and dries at low water. There are depths of 16 to 30 fathoms (29.3 to 54.9 m.) at a distance of 1 mile from the north, west, and southwestern sides of Woody Island Reef, decreasing to 8 or 9 fathoms (14.6 or 16.5 m.) close-to; and a bank, having 3 to 10 fathoms (5.5 to 18.3 m.), extends upwards of 3 miles in a southeasterly direction from this reef, steep-to, on its eastern side.

Anchorage.—During southerly winds good anchorage may be obtained in 13 fathoms (23.8 m.), sand, about ½ mile north of Woody Island Reef. With northeasterly winds there is good anchorage in 18 to 20 fathoms (32.9 to 36.6 m.), sand, about ¼ mile from the southwestern side of the reef. The bottom for 5 miles seaward of this anchorage is fairly even with depths of 27 to 30 fathoms (49.4 to 54.9 m.).

Iltis Bank, 3 miles in length and 1½ miles in breadth, with depths of 8 to 10 fathoms (14.6 to 18.3 m.) and fairly steep-to, lies 7 miles 240° from Woody Island.

The Crescent Group of islands and reefs consist of six low sand islands, for the most part connected by reefs, stretching nearly east and west in the form of a crescent; on the southeastern horn of the crescent is Drummond Island, and on an isolated reef westward of it the two Duncan Islands, with an opening 5½ miles wide between its reef and the Antelope Reef, which lies about 4 miles eastward of Money, the western island of the group. This opening, with a patch of 5 fathoms (9.1 m.) charted in the fairway, is on the southern side of the chain; within the crescent are irregular depths of 20 to 40 fathoms (36.6 to 73.2 m.), with coral heads in places.

Anchorage.—The best anchorage is near to the reef, on the northern side of Duncan Islands, in 10 to 15 fathoms (18.3 to 27.4 m.), where there are some broad patches of sandy bottom. The Chinese fishing boats anchor on the reef between the two islands, where there are depths of 1½ to 2½ fathoms (2.7 to 4.6 m.).

Duncan Islands (16° 28′ N., 111° 44′ E.), of coral and covered with shrubs, are surrounded by a reef extending about 1¼ miles east and west, with a breadth of 1,350 yards, and steep-to. The eastern and larger island, with trees about 13 feet (4 m.) high, and

½ mile in length, has on its southern side a well, near two coconut palms. There is a white flagstaff on the northeastern end of the island about 10 feet higher than the trees. The bushes on the western island are about 10 feet (3 m.) high, and there is a coconut palm near its center, forming a good landmark.

Drummond Island, about ½ mile in length, with a breadth of 450 yards, is covered with brushwood and mangrove trees about 15 feet (4.6 m.) in height, with a higher palm near the center. It is separated from the Duncan Islands by a channel 1½ miles wide. In using this channel vessels should pass the Duncan Islands at a distance of ¼ to ½ mile; there is anchorage close westward of Drummond Island Reef.

Cays.—Observation Bank is situated at the northern extremity of the Crescent Group; there are several sand cays from 3 to 10 feet (0.9 to 3 m.) high on the reef between it and Drummond Island; the one on Observation Bank (and possibly others) is covered with brushwood.

Pattle Island, on the northwestern side of the group, is 1,000 yards in length, 500 yards in breadth, and about 30 feet (9.1 m.) high; on the southern side there is a bight where a boat may land, but not easily, at low water, as there are stones near the shore. The island is covered with brushwood and mangroves from 10 to 15 feet (3 to 4.6 m.) high, and at about one-third its length from the western end are three coconut palms, the top of the highest being about 40 feet (12.2 m.) above the sea, forming a good landmark.

The reef surrounding the island extends 1¾ miles northeastward of it, and has a rock above water on its edge, about 400 yards northward of Pattle. On either side of this reef there is a clear channel.

Water may be obtained by digging near the palms; it requires boiling to render it more palatable.

Robert Island, oval in shape and 26 feet (7.9 m.) high, is nearly 800 yards in length; it is covered with vegetation and has a well of water. A reef surrounds the island, but there is landing on the eastern side. There is a pier about 300 feet long on the north side of Robert Island.

Money Island is situated on the western side of a reef 3 miles in extent and steep-to; it is 1,400 yards in length, about 20 feet (6.1 m.) in height, and covered with brushwood. Several sand cays lie eastward of it on the same reef.

The tidal currents run parallel to the edges of the reef, at the rate of 2½ knots at times.

Antelope Reef, lying eastward of Money Island, is 3 miles in length by 2 miles in breadth, and partly dry at low water, with a cay on its southeastern extremity.

North Reef, the northwestern danger of the Paracels, is about 6 miles in length, east and west, 3 miles in breadth, and steep-to in most places. The edge of the reef all around has rocks just above water, and the noise of the breakers over the reef may be heard from some distance at times. On the southwestern side is a boat passage into the lagoon. In 1923 two conspicuous boilers lay on the southern side of the reef.

The position of this reef was reported (1923) to be 3¾ miles north-northwestward from its charted position.

Hotspur Shoal, on which an American ship of this name was said to have been wrecked in 1860, is charted in 16° 50′ N., 111° 30′ E.; it was probably the North Reef that this vessel struck upon. It was not seen by the British naval vessel *Linnet* when here in 1893. In 1923 it was unsuccessfully searched for by the British naval vessel *Iroquois.*

St. Esprit Shoal (19° 33′ N., 113° 02′ E.), about 172 miles northeastward of North Reef, of coral formation, is about 2 miles in length, east and west, and 1 mile in breadth, and is close to the 100-fathom (182.9 m.) curve. The general depths on this shoal are 9 fathoms (16.5 m.), the least water obtained being 7 fathoms (12.8 m.), with from 60 to 80 fathoms (109.7 to 146.3 m.) at a short distance.

Current.—Strong tide rips were observed in the vicinity of St. Esprit Shoal, but on examination deep water was found to exist. The current was found to set generally with the wind.

Hongkong approach.—For the approaches to Hongkong, see Chapter IX and Chapter X.

Annex 896

Government of France, *Memorandum* regarding Japanese claims to islets in the China Sea (8 Mar. 1928)

[illegible] *E 571-9* *20/2*

March 8, 1928

NOTE

Japanese claims to islets in the China Sea

According to *Instructions Nautiques* [Nautical Instructions] (China Seas, pages 612 and following) the group of islets and reefs alluded to by Mr. Kurosawa during his work in Hanoi consists of a vast extent of shallow-water coral shoals, over which the sea breaks dangerously in heavy weather, separated by trenches over 1000 meters deep.

Even at low tide, most of these reefs are covered by between three and four meters of water; some of them outcrop at the surface and reveal a lagoon or an extent of sand in their centers. Only three, Itu-Aba (Tizard Bank), Loaita Island, and Thibu Island, rise slightly above these waters and have vegetation, which is, moreover, quite meager, such as bushes and coconut palms. They are circular in shape, and their diameter is between 300 and 500 meters; two of them have springs.

Overall, this area is considered to be dangerous for navigation, because of the low visibility of the shoals, of which only a very few are marked by buoys in a rudimentary fashion. Shipping lines go around it carefully on their south-east edge, using the shipping lane that separates it from Palawan Island. The only observations, which are rather lacking in details, were made at the end of the last century by the

English ship, Rifleman, which took soundings and took the bearings of a few coasts as well. It found a goodly amount of jetsam washed up by the currents on the shoals. These waters are rarely frequented, except by Chinese fishing people from Hainan, who find turtles and sea cucumbers there in abundance. Some appear to have established small temporary dwellings on the above-mentioned islets; these are now for the most part destroyed.

2. No trace has been found in our departmental files of any document regarding the territorial situation of these islets.

Still, it should be noted that the quadrilateral [text cut off] by Mr. Kurosawa encroaches on the territorial waters and possessions of the Philippines at Barobac Island, the southernmost island in this latter archipelago. The delimitation of the Philippines, under Article III of the Treaty of Paris of December 10, 1898, placed the waters between 116 and 117 east longitude, and between $7^{o}40$ and [text cut off] north latitude, under American control. If one were holding strictly to the information supplied by Mr. Kurosawa, Japanese claims to these waters would then be in absolute opposition to the sovereignty rights granted to the United States; it is more probable to suppose that they stop at 115 or 116 degrees east longitude, and this would already bring

the Japanese to within a short distance of the southern islands of the Philippines and within immediate proximity to the Palawan Passage.

[See original for handwritten marks.]

In any event, the islets in question are attached neither politically nor geographically to the coast of Annam , from which they are separated by a continuous depression at a depth of from 1000 to 2000 meters; likewise, geographically speaking, they are separated from Palawan Island by a trench where the sounding weight descended to almost 3000 meters.

It seems then, as if France, as far as it is concerned, has no reason to get upset about the intentions revealed by Mr. Kurosawa's work, especially if, as he has assured France, the Japanese government is henceforth not interested in the Paracel archipelago, where we would be more interested in maintaining the *status quo*. It could be, however, that this lack of interest is just the official line, because information gathered in early 1925 by the French consul at Hoi Hao indicated that Japanese smuggling continued to be active within this archipelago.

Paracels

4. Nevertheless, one cannot hide the fact that any possible exercise by Japan of a right to surveillance within the region in question could, in the event of a conflict, constitute a threat to the security of maritime communication between the Insulinde and the Chinese or American ports in the China Sea.

note de Borgson

E 573-9 vol 2

8 mars 1928.

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N O T E.

Prétentions japonaises sur des ilôts de la Mer de Chine.

D'après les "Instructions Nautiques" (Mers de Chine, pages 612 et suivantes) le groupe d'ilôts et de récifs visé par M.Kurosawa dans sa démarche à Hanoï constitue une vaste étendue de hauts fonds coralliens accores séparés par des fosses de plus de 1.000 mètres et sur lesquels la mer brise dangereusement par gros temps.

La plupart de ces récifs sont, même à marée basse, recouverts par 3 à 4 mètres d'eau; certains affleurent à la surface et présentent alors en leur milieu soit un lagon, soit une étendue sablonneuse. Trois seulement, l'île Itu-Aba (banc de Tizard), l'île Loaita et l'île Thibu, s'élèvent légèrement au dessus des flots et portent une végétation d'ailleurs assez pauvre (buissons, cocotiers); elles ont une forme circulaire et leur diamètre est de 300 à 500 mètres; deux d'entre elles comportent des puits.

Dans l'ensemble, cette zone est réputée dangereuse pour la navigation, en raison du peu de visibilité des hauts-fonds dont un très petit nombre seulement sont balisés de manière d'ailleurs rudimentaire. Les lignes de navigation la contournent avec soin par sa lisière sud-est, utilisant le couloir qui la sépare de l'île de Palawan. Les seules observations quelque peu détaillées ont été faites à la fin du siècle dernier par le

navire anglais "Rifleman", qui a procédé à des sondages et relevé quelques cotes, non sans rencontrer de nombreuses épaves accumulées par les courants sur les hauts-fonds. Ces parages ne sont plus guère fréquentés que par des pêcheurs chinois d'Haïnan, qui y trouvent en abondance la tortue et l'holoturie; certains paraissent avoir établi sur les îlots mentionnés plus haut de petites habitations temporaires, aujourd'hui pour la plupart détruites.

2- Il n'a été trouvé trâce aux archives du Département d'aucun document relatif à la situation territoriale de ces îlôts.

Il est à remarquer toutefois que le quadrilatère indiqué par M.Kurosawa empiète sur les eaux territoriales et la dépendance de Philippines à hauteur de l'île Barobac, la plus méridionale des îles de ce dernier archipel. La délimitation des Philippines, telle qu'elle résulte de l'article III du traité de Paris du 10 décembre 1898, a fait passer sous la domination américaine les parages situés entre le 116ème et le 127ème degrés de longitude est de Greenwich, entre 7°40 et de latitude nord. A s'en tenir strictement aux indications fournies par M.Kurosawa, les prétentions japonaises sur ces parages seraient donc en opposition absolue avec les droits de souveraineté reconnus aux Etats-Unis; il est plus vraisemblable de supposer qu'elles s'arrêtent au 115ème ou 116ème degré de longitude est de Greenwich, ce qui amènerait déjà

Japonais à peu de distance des îles méridionales des Philippines et à proximité immédiate du passage de Palawan.

Dans tous les cas, les îlôts en question ne se rattachent ni politiquement, ni géographiquement au littoral de l'Annam, dont les sépare une dépression continue profonde de 1000 à 2000 mètres; de même, géographiquemebt parlant, ils sont séparés de l'île de Palawan par une fosse où la sonde est descendue à près de 3.000 mètres.

3. Il semble donc que la France, en ce qui la concerne, n'ait pas à s'émouvoir des intentions révélées par la démarche de M. Kurosawa, surtout si, comme ce dernier l'a assuré, le gouvernement japonais se désintéresse désormais de l'archipel des Paracels, où nous serions plus intéressés au maintien du statu quo. Ce désintéressement n'est cependant peut-être qu'officiel, car il résulte d'informations recueillies au début de 1925 par le Consul de France à Hoi-How qu'une active contrebande japonaise continuait à s'exercer dans cet archipel.

4. On ne peut néanmoins se dissimuler que l'exercice éventuel par le Japon d'un droit de surveillance dans la région dnnt il s'agit pourrait constituer, en cas de conflit, une menace pour la sécurité des communications maritimes entre l'Insulinde et les ports chinois ou américains de la Mer de Chine./.

Annex 897

Government of France, Ministry of Foreign Affairs, Asia/Oceania Section, *Memorandum*
(8 Sept. 1953)

MINISTRY
HD/SC
OF
FOREIGN AFFAIRS

ASIA OCEANIA

LIBERTY EQUALITY
FRATERNITY

FRENCH REPUBLIC

PARIS, September 8, 1953

Singapore

MEMORANDUM

Re: With regard to the Spratly Islands

A - GEOGRAPHICAL DATA. -

The Spratly Islands archipelago, located north of the British part of Borneo, west of the island of Palawan (Philippines), and southeast of Vietnam, draws its name from the island known in French as Île de la Tempête, named Spratly or Spratley Island by the English. It is made of coral.

That archipelago, which is visited and temporarily inhabited by fishermen of various nationalities, has more strategic than economic value.

B - THE FRENCH OCCUPATION. -

Spratly Island was the object, on 13 April 1930, of a reconnaissance mission conducted by the French Navy, which officially took possession of it. Several years later,

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the same Navy proceeded, from 7 August to 12 August 1933, with conducting the occupation of "all the islets north of the archipelago."

That French occupation did not result, at that time, in any claims, either on the part of China or of the United States (Philippines), or of the Netherlands (Dutch Indies). The British Government, however, asked for an explanation; once the latter was provided, it declared that it was satisfied with it (April 1930).

Only the Japanese Government protested, reporting an "occupation conducted beginning in 1917 by Japanese fishermen, with the support of the Imperial Government."

C - THE JAPANESE OCCUPATION -

At the end of 1938, Japan disembarked armed detachments on the Spratly Islands, with Formosan coolies. On 31 March 1939, a press release announced that the Japanese Government had decided to put "the Spratly Islands or Îles de la Tempête located off the coast of Indochina" under its jurisdiction.

In a memorandum from the French Ambassador in Tokyo to the Japanese Government, dated 4 April 1939, the French Government protested against a decision that it declared it "could not recognize."

In fact, the Japanese occupation of the islands continued until 1945.

****

D - ABANDONMENT OF THE JAPANESE CLAIMS. -

In the San Francisco Peace Treaty dated 8 September 1951, Japan formally renounced all rights to the Spratly Islands.

These French islands were not attached to Vietnam during the cession to that associated state of the former colony of Cochinchina in 1949. They are, therefore, a dependency of the French Ministry of Overseas Territories.

E - RECENT CHINESE CLAIMS. -

Nevertheless, the Beijing Government has claimed, since the time the Treaty of San Francisco was signed, that it has rights to these islands, which, furthermore, it does not occupy. We do not see on what bases the Beijing Government can rely to claim the Spratly Islands; in fact, while the most recent edition of "Geography of China Province by Province," a work that is popular in Communist China, includes the islands among the Chinese possessions, it merely indicates: Japanese fishermen visited the islands beginning in 1917; subsequently, in 1930, the French imperialists seized the Spratly Islands." No date for a Chinese occupation, either before or after that time, is provided in that book.

[initials]

11K-2 112

MINISTÈRE DES AFFAIRES ÉTRANGÈRES

HD/SC

ASIE OCEANIE

LIBERTÉ · ÉGALITÉ · FRATERNITÉ

RÉPUBLIQUE FRANÇAISE

PARIS, LE 8 septembre 1953

Singapour

NOTE

a/s: des îles Spratley

A - DONNEES GEOGRAPHIQUES.-

L'archipel des Spratleys, situé au nord de la partie britannique de Bornéo, à l'ouest de l'île de Palawan (Philippines) et au sud-est du Vietnam, tire son nom de l'île de la Tempête, dénommée Spratly ou Spratley par les Anglais. Il est d'origine coralienne.

Cet archipel, fréquenté et temporairement habité par des pêcheurs de diverses nationalités, a une valeur plus stratégique qu'économique.

B - L'OCCUPATION FRANCAISE.-

L'île de la Tempête fit l'objet, le 13 avril 1930, d'une reconnaissance par la Marine française qui en prit officiellement

....

possession. Quelques années plus tard la même Marine procéda, du 7 au 12 août 1933, à l'occupation de "tous les îlots situés au nord de l'archipel".

Cette occupation française ne donna pas lieu, à l'époque, à aucune réclamation, ni de la part de la Chine, ni des Etats Unis (Philippines), ni des Pays-Bas (Indes Néerlandaises) Le gouvernement britannique, toutefois, demanda des explications; celles-ci fournies, il s'en déclara satisfait (avril 1930).

Seul le Gouvernement japonais protesta, faisant état d'une "occupation effectuée dès 1917 par des pêcheurs japonais, avec l'appui du Gouvernement impérial".

C - L'OCCUPATION NIPPONE -

A la fin de 1938, le Japon débarquait aux îles Spratly des détachements armés, avec des coolies formosans. Le 31 mars 1939 un communiqué annonçait que le gouvernement japonais avait décidé de placer sous sa juridiction "les îles Spratly ou îles de la Tempête situées au large de l'Indochine".

Par note de l'Ambassadeur de France à Tokio au Gouvernement japonais, en date du 4 avril 1939, le Gouvernement français protesta contre une décision qu'il déclarait "ne pouvoir reconnaître".

En fait l'occupation nippone des îles persévéra jusqu'à 1945.

....

D - ABANDONS DES PRETENTIONS NIPPONES.-

Par le traité de paix de San Francisco du 8 septembre 1951, le Japon a formellement renoncé à tout droit sur les îles Spratley.

Ces îles, françaises, n'ont pas été rattachées au Vietnam lors de la cession à cet état associé de l'ancienne colonie de Cochinchine, en 1949. Elles dépendent en conséquence, du Ministère d'outremer.

E - PRETENTIONS CHINOISES RECENTES.-

Pourtant le Gouvernement de Pékin prétend, depuis l'époque du traité de San Francisco, avoir des droits sur ces îles qu'il n'occupe du reste pas. On ne voit pas sur quelles bases le Gouvernement de Pékin peut s'appuyer pour revendiquer les Spratley; en effet, si la plus récente édition de la "géographie de la Chine par provinces", ouvrage répandu en Chine communiste, inclut les îles dans les possessions chinoises, il indique simplement :" des pêcheurs japonais fréquentèrent les îles dès 1917; par la suite en 1930 les impérialistes français se saisirent de l'île Spratley". Aucune date n'est donnée dans cet ouvrage d'une occupation chinoise, antérieure ou ultérieure.

JR

Annex 898

Wenhua Li, "Research on Population and Sustainable Development in China", *in*
MODELING FOR POPULATION AND SUSTAINABLE DEVELOPMENT
(A.J. Gilbert & L.C. Braat eds., 1990)

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8

NATIONAL STUDIES

8.1. RESEARCH ON POPULATION AND SUSTAINABLE DEVELOPMENT IN CHINA

(*Li Wenhua*)

This section briefly describes the current status of studies in the field of population carrying capacity and its modelling for sustainable development in China. Special emphasis is placed on the introduction of the methodology for study of the Potential Productivity and Population Carrying Capacity of Land Resources (PCLR). This work is sponsored by the Bureau of Land Resources' Regionalisation and is co-ordinated by CISNAR with the joint efforts of scientists from different institutions. This work is carried out for the whole of China and for nine agricultural regions. Twenty-seven key areas have been chosen for detailed trial studies. Population growth is estimated by an exponential growth model and matrices transfer model. The potential productivity is estimated by the Thornswaite and Wageningen models and the method of exponential means with consideration of the further improvement of agricultural structure and investment. The carrying capacity is estimated from the balance between resource requirement and resource availability.

This research was completed in several regions. The simulation model for the entire PRED study will be started as from 1988, being the second phase of our work.

The relationship between population, resources, environment and development (PRED) is one of the major preoccupations of humanity at the present time. It is particularly acute in China because of the large population combined with rather limited natural resources and rapid development.

Since the mid-1970s, a number of studies have been launched to consider the population problem in China using a quantitative approach. In the first stage, dynamic population models were introduced to study the relationship between population growth, fertility and mortality, etc. The results are striking: the rate of mortality has sharply decreased while the birth rate has remained at a very high level. The Chinese population is facing a very critical situation. On the basis of the above-mentioned studies a dynamic model for population development was established. The scientific definition and method for estimation of a series of parameters have been developed, such as population size, mortality, fertility, growth rate, life expectancy and index of labour force, etc. Different indices of future population (1980–2080) are also a subject of intensive research and debate. The problem of stabilisation is studied both from the theoretical and policy making points of view.

Along with the revival of the national economy, culture and science during 1980–90, the new population policy based on quantitative population analysis has been implemented. The population control policy and the family planning programmes have met with great success. Along with these, of course, a series of economic and social problems have occurred which need to be solved. The team of quantitative population researchers is strengthened from year to year. A group of scientists has started to study age distribution, the dynamic process of mortality, and population projections for different regions and different times so as to provide the necessary information for preparation of the new population policy. The central population information system has been established and plays an active role in working out national policy for regional development. The Markov population migration model and random diffuse model have been established. In accordance with the characteristic features of the distribution of natural resources and population, simulation of the role of migration between Eastern and Western China and the approach for controlling this process has been developed.

During the last two years quantitative population research in China has paid great attention to the study of the relationship between population, resources and environment. One kind of such research is to study the dynamic relationship between population, employment, economic growth and its modelling.

Another important field of research is the so-called population regional planning model based on conditions of expected economic growth, social development, reasonable rises in living standards and feasible investment to decide the population target as well as strategy for controlling this process. Such a model has been implemented on a trial basis in several countries.

On the other hand, natural resource scientists who used to study the physical aspect of this complex problem are becoming more aware of the inextricable links between population, resources, environment and development and have started to work in close co-operation with economists and decision-makers. One of these studies is known as the PCLR project (Potential Productivity and Carrying Capacity of Land Resources), which is co-ordinated by the Commission for Integrated Survey of Natural Resources (CISNAR) under the sponsorship of the Bureau of Land Resources' Regionalisation with the active participation of scientists from different institutions.

The objectives of this project are as follows:

1 the potential productivity of food, fodder, cotton, sugar, oil, meat, milk, eggs, skins, timber, fuel, etc., in different periods and regions with different input and output conditions;
2 prediction of per capita productivity and living standards at different times and in various regions;
3 forecasting environmental change in different regions and at different periods under various conditions of exploitation of natural resources;
4 policy making towards sustainable development.

A series of resource accounts based on past, present and projected population, 1:1,000,000 land resources map of China, water-resource and climatic-resource data, existing policy and strategy for development and conservation of natural resources, etc., have been used. The temporal horizons are 2000 and 2025. Potential primary productivity is estimated on the existing system as well as on the basis of reform. There is a great potential for regulation of the agricultural structure and system in China; for example, regulation of the distribution and proportion of crop land, forests, rangeland, animal husbandry, etc., in space and time both between and within sectors.

Three different methods are used to estimate potential

primary productivity: the Thornswaite and Wageningen models and the method of exponential means.

Through the compensation of the resource requirements and their availability by 2000 and 2025, we could obtain the carrying capacity region by region as well as for the whole of China. Based on this study, a series of proposals towards sustainable development are expected to be made, which will in turn be submitted to the relevant decision-makers for further development, for example, of the strategy of land resource management and investment.

According to agricultural regionalisation, nine regions have been delineated and provide the basis for carrying-capacity studies. These regions are the north-eastern region, the semi-arid region of Inner Mongolia, the north plain, the Loess plateau, the north-western region, the south China region, the south-western region and the Chinghai Tibetan plateau. Within these regions, twenty-seven smaller areas have been selected for detailed studies.

So far we have completed the potential carrying capacity of land resource study for China as a whole, and for the north plain, the Xingjong autonomous region, and Province of Shangxi. Some interesting results have been obtained. For example, it is estimated that the total annual primary productivity for the whole of China is approximately 72×10^8 tonnes per year according to the Thornswaite model and 100×10^8 tonnes according to the Wageningen model. While current productivity is 32×10^8 tonnes it is predicted that this figure will reach 25×10^8 tonnes in 2000 and 40×10^8 tonnes in 2025 under medium investment. If we take 400 kg of crops per person per year as the minimum living standard for food, then the population carrying capacity will be 1.16 billion in 2000, and 1.48 billion for 2025, while the potential population carrying capacity estimated on the basis of the Thornswaite and Wageningen models will be 1.68 and 2.5 billion, respectively.

Another example is the study for the north plain of China. It has been found that the agricultural structure in this region is not reasonably organised. After the regulation of the agricultural structure with consideration of the balance between different crops and water resources, 9.7 million tonnes cereal productivity could be expected. The population carrying capacity is therefore about 243 million. To obtain such

results, the necessary input (in particular of fertiliser) is estimated.

According to family planning projections, the total population figure will be 221 million. Consequently agricultural productivity could not only meet the requirements in cereal crops, cotton, oil and vegetables but could export 8.53 million tonnes of commercial crops, 2.38 million tonnes of cotton and approximately 1 million tonnes of oil to support other regions.

From the above-mentioned example it is easy to understand that our work is characterised by its integrated features. It combines forecasting with practical reforms in agriculture; it integrates the general assessment with concrete compensation of natural resources between and within sectors. We also aim not to limit ourselves to seeking out questions but to try to point out the strategy for solving them. Although our work is still a PCLR rather than ECCO, it will provide a good basis for the forthcoming ECCO studies.

From 1988 onwards, we shall set up a new project which will cover not only agricultural production but also the entire economy in a holistic manner. It is to be expected that the ECCO model could be used in further studies.

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8.2. INTRODUCTION TO THE ZIMBABWE CARRYING CAPACITY ASSESSMENT PROJECT (*A. M. Ruboko*)

8.2.1. Project background

The association of the Zimbabwe Institute of Development Studies (ZIDS) with the Unesco-sponsored Carrying Capacity

Annex 899

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PRICES, REPRODUCTION SCARCITY

Christian Bidard

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present is not too high. The recent developments aim at the integration of these results into a general equilibrium framework (Bewley 1982). If the data are smooth, it is expected that the economy will evolve towards a regular growth path in the long run. The movement of the prices towards prices of production is only a tendency and the theoretical prices do not coincide exactly with prices of production.

2.2 *Single production*

Let us assume single production with constant returns and a given real wage, incorporated into the input matrix. The available methods are the same for all periods but the effectively operated methods depend on prices and, normally, vary with the period. With regard to joint production, single-product systems have two simple properties. First, the adaptation of the activity levels to the physical requirements is easy. Second, the no-profit condition

$$\overline{A}p_t = p_{t+1} \tag{1}$$

implies that the present prices for date $t + 1$ are determined by those for date t. By induction, all intertemporal prices are determined by today's prices and, in the absence of choice of technique, we have $p_t = \overline{A}^t p_0$. The initial price vector p_0 is determined endogenously but, under a primitivity hypothesis, its successive transforms by matrix $\overline{A}$ tend towards the Frobenius vector. In the long run, vector p_t is approximately equal to the Frobenius vector $\overline{p}$ of $\overline{A}$, and p_{t+1} to $\overline{p}/(1 + R)$. Equation (1) is then read $(1 + R)\overline{A}\overline{p} = \overline{p}$, therefore the prices tend towards prices of production (Duménil and Lévy, 1985). In the presence of several methods, the cost-minimizing methods at date t determine the prices at date $t + 1$ and the convergence result can be generalized (see Dana *et al.*, 1989a,1989b, for a more elaborated version).

Theorem 1. Let T_i be the finite set, independent of the period, of the available methods of production for the ith commodity ($i = 1, \ldots, n$). The input vectors a_i are assumed to be positive. The relative prices tend towards the Frobenius vector $\hat{p}$ of the square matrix $\hat{A}$ associated with the maximum rate of profit.

3 The corn–guano model

3.1 *Why?*

Sections 3 and 4 investigate the behaviour of a model with one exhaustible resource, guano, used as a fertilizer in the production of one commodity,

corn. Guano is considered here as a non-renewable resource with a zero extraction cost, whose stock is progressively depleted. The existence of a backstop method for the production of corn – that is, an agricultural method which does not use guano – guarantees the survival of the economy after exhaustion. Our objective is to determine the competitive path.

The theory of exhaustible resources is of great interest from a methodological standpoint. The challenge for post-Sraffian theory is whether it can adapt its long-term framework to deal with non-regular paths. In order of analytical complexity, the question of exhaustible resources follows that of single production, joint production and land and, therefore, constitutes the best starting point for further extensions. The royalty paid for an exhaustible resource is in some way similar to rent: a fertilizer upgrades land temporarily, so that a farmer is ready to pay for guano up to the level of the differential rent between the two qualities of land. The price of guano, or royalty, is indeed equal to the differential rent if the stock of guano is exhausted during the period. However, taking into account exhaustible resources introduces a qualitative gap in the analysis: the current price of an exhaustible resource increases at the interest rate in order to compensate its owner for waiting (Hotelling's rule). The intertemporal evolution of prices implies that a time index t is now attached to them. The question at stake is whether the 'classical method of long-period equilibrium' (according to the title of Parrinello's paper (1983) which introduced the topic in post-Sraffian debates) can be adapted to this framework.

Given this methodological aim, two objections are discarded from the very beginning. The first is that exhaustible resources, because of the extreme slowness of their depletion, can be treated on the same footing as land. The second maintains that the competitive solution, which presumes a perfect expectation of events that will happen in a distant future, is so unrealistic as to be of no relevance. These arguments carry weight for applications. The question we are interested in concerns the analytical treatment of the problem on the blackboard. An economist who is disturbed by the labour theory of value and imposes upon himself the intellectual requirement of working with a consistent theory of prices cannot be satisfied with the 'approximation' of royalty by rent. A consistent theory of exhaustible resources is as needed as a consistent theory of prices. The methodological issue explains the choice of the corn–guano model as a starting point. It constitutes an adaptation of the corn model to the case of exhaustible resources. Thanks to the simplicity of the model, the concepts remain transparent and the analytical treatment is straightforward, so much that the methodological issues are brought to the forefront.

Annex 900

Chen I-Ming, "Water Quality Survey in South China Sea and Taiping Island Sea Region", *in* POLITY GUIDING PRINCIPLES: THE REPORT FOR THE ECOLOGICAL ENVIRONMENT SURVEY ON SOUTH SEA (L. Fang & J. Li eds. 1994)

Policy Guiding Principles: The Report for the Ecological Environment Survey on South Sea

Li-Xing Fang & Jian-Quan Li

Council of Agriculture, ROC Executive Yuan, 1994

Water Quality Survey in South China Sea and Taiping Island Sea Region

Chen I-ming

[…]

[…]

I. Foreword

The present study was executed as a project resolved as a sub-topic of "how to maintain the ecology and environment of South China Sea" in the discussion meeting regarding South China Sea issues held on September 6-7, Year 83 of the Republic [1994] according to the South China Sea Policy Outline established by the Executive Yuan. The present study was responsible for investigating the water quality of sea regions of Nansha Islands and Dongsha Islands; the main purpose was to learn about variation in water quality near the islands and reefs, in order to serve as a reference for the sea region's ecological conservation, aquatic resources, and future development of tourism. For the present survey, the Council of Agricultural Affairs coordinated with "Fishery Training #2" training vessel on reserve at Fishery Sailor Training Center, departing on April 15, Year 83 of the Republic [1994] to Taiping Island sea region in the Nansha Islands. Even though the study focused on the coastal waters of Taiping Island, in order to collect

more data, in accommodation of plankton and fish research teams, survey and sampling were conducted at 8 sites on the way there and back. In order to understand whether the sea regions surrounding Taiping Island would be affected by high and low tides, four instances of sampling were conducted over three days. At the same time, two freshwater sources on the island were sampled for more information on the quality of potable water.

II. Materials and methodology

(1) Sampling

Sampling was conducted while sailing and on Taiping Island. Four samples were made on the way to Nansha Islands, then four samples were taken on the way back, for a total of eight times. See Figure 1 for the locations of sampling sites, and see Table 1 for the times. Water samplers were used to collect water; in order to accommodate operations on the vessel, the samples taken were measured for hydrological data such as water temperature, dissolved oxygen, and pH. Sampling depths were surface (1 meter), 5 meters, 10 meters, 30 meters, and 100 meters. Sampling along the coast of Taiping Island was conducted at high and low tide at the four sites on the east, south, west, and north of the island (Figure 2), for a total of four times. Hydrological data, including water temperature, dissolved oxygen, and pH were measured immediately. In addition, freshwater samples were taken from two locations on the island, as shown on Figure 2; water temperature, dissolved oxygen, and pH were recorded.

(2) Analytical items and methodology

A. Hydrology

a. Dissolved oxygen: WTW OX1 191 dissolved oxygen meter was used for testing.

b. Water temperature: Same instrument as the above, and the standard thermometer was used for calibration.

c. pH: WTW pH95 meter was used for testing.

d. Salinity: Silver nitrate titration method was used for testing

e. Turbidity: HACH Model 2100A turbidimeter was used for testing

B. Hydrochemistry

The samples were stored frozen; after they were taken back to the laboratory, they were fully thawed before being filtered by 0.45 μm MFS Cellulose nitrate membrane filter, because the filtration equipment on the vessel had malfunctioned and could not be used. Other than SiO_2, which had to be measured after the samples had sat for a week after thawing, the remaining items were analyzed as soon as possible within short periods of time.

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a. Ammonia-N: IndopHenol ethyl-alcohol method (Solorzano, 1969).
b. NO_2-N: N-(1-napHthyl) -ethylenediamine method (APHA, 1985).
c. NO_3-N: Cadmium reduetion [sic] method (APHA, 1985).
d. PO_4-P: Ascorbic acid method (APHA, 1985).
e. SiO_2: Molybdosilicate method (APHA, 1985).
f. COD: N_2MNO_4, 100 °C heat oxidation method (Marine Environmental Survey methods, 1979).

[…]

The turbidity in all sites were around 0.4 NTU except Site 1 and Site 4. The lowest values generally appeared at 10 meters and then the values increased with the increase of depth (graph 4). The surface turbidity could reach to 0.85 NTU at Site 1, the turbidity levels were larger than 0.4 NTU at the other three layers. Checking the materials of hydrology and water quality,

factors relating to variation in turbidity were not found. In the 5th site, upper layer water was also more turbid, while turbidity at 100 meters was similar to values at other sites at the same depth; the reason for higher upper level turbidity at the site is unknown.

Ammonia-N is shown in Figure 5. Other than higher levels of ammonia-N at 5 m at the third site, at 30 m at the fourth site, at 30m at the fifth site and at 1 m and 30 m at the sixth site, levels are around 20 ppb at different depths at the other sites. The areas with higher ammonia-N described above are all in upper levels. These sites had active photosynthesis and many organisms were congregated there. As previously described, the water samples were frozen before being filtered after thawing at the laboratory, because the vessel's filtration equipment malfunctioned, thus they could not be filtered before freezing. Therefore, the water sampled from water layers with active organisms was frozen without having been filtered first, which may have caused the death of organisms in the sample bottles before releasing substances such as ammonium salt. Therefore, it was not unusual for ammonia-N to reach 224 ppb at 30 m at the fourth site.

According to Figure 5, although the content of NO_2-N varied in the upper and lower layers, the scope of concentration of 0-6 ppb, thus this could be considered as being no difference (Figure 5).

The range of NO_3-N content was 0.05-0.17 ppm. Although the variations in water depths of 1-10 m were different, the range of variation was smaller, with lowest concentration at 30 m at the sites, while an increasing trend was present at 100 m (Figure 6). The vertical concentration variation among sites were positive at the third site between NO_3-N and ammonia-N (correlation coefficient 0.23), but there was a negative correlation at all other sites; in particular, the negative correlation coefficient at the fifth site was 0.92. Further exploration is required to verify whether the correlation was caused by ammonium salt formed by organic matter breakdown, thereby forming nitrates due to oxidation by chemistry or microorganisms.

The content of PO_4-P showed no fixed trends along with the depth at various sites; the range of content variance was around 20 ppb, except 53 ppb and 41 ppb at 100 m at the second site and at 30 m at the eighth site. These two were slightly elevated values (Figure 6).

The range of change of SiO_2 was 128-260 ppb, which was lower at water depth of 10 m or 30 m. Further investigation is necessary to discover whether this was caused by stronger photosynthesis of phytoplankton (Figure 7).

COD testing showed similar variation as correlated to depth at the first, second, third, seventh, and eighth sites. Similar variation occurred at the fifth and sixth sites according to depth. As for the fourth site, other than the top layer of water, variation at other depths was similar to those of the fifth and sixth sites. Thus, in terms of COD values, two sea regions can be divided in the south and north of Zhongsha Islands. At 30 m deep, the sea region on the south side showed higher levels, but the opposite was true for the north side, with lower values at 30 m deep. The scope of variance of COD in the entire sea region was 1.24-3.76 ppm.

II. Taiping Island

Four instances of sampling were conducted at high tide on April 21-23, Year 83 of the Republic [1994] and low tide on the 22nd on the eastern, southern, western, and northern coasts (Figure 2) of the island. At each site, if water depth exceeded 1 m, then two samples were taken, one at the top layer and one in the bottom layer. However, at the western site, first samples were taken from a small boat, thus four water samples were taken because the sampling location was relatively deep (Table 4).

See Tables 2-4 for the analytical results from surveys in four timeslots in three days. The mean water temperature from all sites was 28 °C, and the temperature difference between surface water and bottom water was within 1 °C. The mean dissolved oxygen values fell in the range of 7 ± 0.2 ppm; the mean pH value was 8.2. Salinity could not be tested at some sites because some sample bottles were improperly stored and broke, but the mean values of the four sites were in the range of 32.6-33.6 ppt. Other than the north site, mean turbidity at the other sites was in the range of 0.8 ± 0.02 NTU, while the bottom water turbidity at low tide on April 23 in the north site was 9.0 NTU; further exploration is necessary to discover whether this was because bottom layer sediment was stirred up at low tide. Discarding this value from the site yielded a mean value of 0.78 NTU, which was less different from values from the other 3 sites. Therefore, the foregoing hydrological data showed that the water regions surrounding the four sides of Taiping Island should be considered the same water region. The differences between surface water and bottom water were not great, thus, the means were computed from all data from the four sites at the same period of time, in order to understand variation between high and low tides. Results showed that water temperature was lower at high tide on the 22nd, but water temperature seemed to be unrelated to high and low tide, while the variation in dissolved oxygen showed similar trends to those of water temperature (Figure 8). Usually, when the water is cooler, there would be more dissolved oxygen, but this outcome was not discovered in this survey. Further exploration, in conjunction with other research data, is necessary to discover whether this is due to factors such as weather and photosynthesis. As for variation in pH, there were higher values at low tide, with greater variance among the sites. Although salinity increased with time, the variation in elevation was smaller than the variation between the sites. According to the previously described cause of higher turbidity at low tide, if the bottom water values of the north site are removed, then the mean of 0.97 is very close to the other means.

The mean values for water quality at the four times were also similar (Tables 2-5). Only east site's ammonia-N in the bottom water reached as high as 139 ppb at low tide on April 22, elevating the mean value to 34 ppb (Table 2). However, water quality surrounding Taiping Island, like the hydrological data, can be considered to be part of the same water region. The results from the four sites during the same period of time were averaged, as shown in Figure 9. At low tide on April 22, ammonia-N showed greater variation among the sites, as already described, because of high concentration of 139 ppb at the east site; if this result is removed, the mean value was 8.57 ppb, with a standard deviation of 12.87. In this way, the trends of change are similar to those of dissolved oxygen. Nitrates increased with time, but the increased amount was smaller than variation among groups during the time period; the range of mean values 2-3.5 ppb. The overall variation trends were similar to those of salinity. At low tide on the 22nd, NO_3-N showed higher mean values; its overall variation trend was the opposite the modified variation trend of ammonia-N (excluding 139 ppb of the east site). The same was true for seawater quality analysis in South China Sea. The mean values of PO_4-P

were around 20 ppb, and the range of variance was very similar. PO_4-P on the south side was higher than variance at other sites. The variation trends of SiO_2 were similar to those of nitrates, and occurred with time. However, the level of increase was also smaller than differences among the sites, with the means in the range of 140-180 ppb. The mean value of silicates was higher on the west site than at the other three sites. The mean values of COD were approximately 2 ppm, but the range of variance between high and low tide on the 22nd was greater than on the 21st and the 23rd.

On the trips to and from Taiping Island, of the eight sites in South China Sea close to Taiping Island, sites 4, 5, and 6 were on the slope of the mainland, while the remaining sites were in the central basin of South China Sea (deep basis of South China Sea) (Hsieh, 1981); the basin is approximately 4,000 m deep (Li, 1985). The sampling was limited by equipment, with the deepest sample taken at 100 m. In terms of overall depth, this was only surface water, but COD value showed that sites 4, 5, and 6 could be considered to be different water regions from the other sites. Further investigation is necessary to discover whether this was due to the influence of landform.

Currently, surveys of hydrology and water quality in South China Sea have been done to develop fishing grounds (Su, 1979; Wu, 1981; Lu and Hsieh, 1981; Lu, 1983), thus, generally they only covered water temperature, salinity, and depth. However, these are not comparable due to distance from the survey sites and difference in seasons from the present survey.

Taiping Island is the largest among 200 islands, atolls, shoals in Nansha Islands. Surrounding it is an atoll formed by coral reefs; it is 60 km long from north to east, and 20 km wide. The water in the reef lagoon in the atoll can be as deep as 70-80 m. Other than coral rocks, Taiping Island is also comprised of foraminiferal sand, as well as some guano layers. The reef base of Nansha Islands is a gently sloping platform under the water, at 1,500-2,000 m deep. The outer margins of islands and reefs sloped downward the Nansha Plateau. For instance, the northern slope of Taiping Island was 7.5°, while the slope from the north end of Nansha Plateau to the central deep sea basis was even more steep, reaching 8°-12° (Hsieh, 1984). Based on Taiping Island's landform, it is known that its coastal waters are easily affected by distant seas; this was confirmed by the outcomes of survey and analysis. Water quality around the island was not very different from that of South China Sea; there were similar water quality results other than lower SiO_2 compared to the Kenting sea region (Chang and Chen, 1987). However, turbidity and ammonium salt were still at higher levels at low tide in the waters around Taiping Island. Therefore, future development of the area should be cautious to avoid ecological impact due to changes in environmental factors.

See Table 6 for the results of analysis conducted on the samples of two freshwater sites on Taiping Island (Figure 1). Water temperature was the same at both freshwater sites, at 28.0 °C; dissolved oxygen was also very similar, but it was only 70% of saturation. At both sites, pH was more alkaline, at 8.2 and 8.6. Further exploration is necessary to understand whether this is because the main component of geological makeup on the island was coral. Salinity was 2.0 and 1.1 ppt, respectively; this may be because dissolved salt when the stratum formed, rather than because of seawater infiltration. Turbidity was as high as over 1 NTU, which meant that the water

was not clean. It is not yet known whether turbidity was caused by organic or inorganic materials. Although at the second freshwater site, ammonia-N was higher at 32 ppb, this does not yet constitute a problem. The content of NO_2-N was lower, while NO_3-N was excessively high, 5-8 times that of normal rainwater (Hanya, 1960). At the first water source, PO_4-P reached as high as 282 ppb; further investigation is necessary to discover whether this was because of a guano layer in the sediment. At both water sources, silicate was 1.4 ppm, ten times higher than in seawater. COD ranged between 1-2 ppm, which meant that the water contained a trace amount of organic matter or reducing substances. On the whole, the two freshwater sites actually had better water quality than in usual rivers or lakes (Hanya, 1960).

[…]

[…]

Table 1 The Dates and latitudes and longitudes of the sample spots in the trips of leaving and returning to Taiping Island

Name of site	Month/day	Degrees East	Degrees North
1	4/16	120°30'	21°59'
2	4/17	116°06'	17°01'
3	4/18	113°00'	15°15'
4	4/18	113°00'	12°01'
5	4/24	114°31'	12°03'
6	4/24	116°24'	13°29'
7	4/25	117°13'	15°59'
8	4/25	117°09'	17°44'

[…]

Table 2 Hydrological and water quality on the eastern coast of Taiping Island between April 21-23, Year 83 of the Republic [1994]

Date	Tide	Depth (m)	Water	Temperature (℃)	DO (ppm)	pH	Salinity (ppt)	Turbidity (NTU)	Ammonia-N (ppb)	NO_2-N (ppb)	NO_3-N (ppm)	PO_4-P (ppb)	SiO_2 (ppb)	COD (ppm)
21	High	0		29.2	6.7	8.2	31.9	1.20	65	2	0.05	15	109	2.07
	High	5		28.9	6.5	8.2	34.7	0.61	17	2	0.07	13	72	1.98
22	High	0		27.1	7.3	8.3		0.63	2	3	0.14	15	186	1.34
	High	5		27.2	7.1	8.3	34.0	0.55	5	2	0.06	12	158	1.21
	Low	0		27.2		8.5	32.8	0.69	8	3	0.15	13	167	0.86
	Low	4		27.7	7.2	8.3	33.3	1.30	139	5	0.10	14	183	3.22
23	High	0		29.8	6.7	8.2		0.80	38	3	0.06	16	85	1.91
	High	4		29.7	6.3	8.2		0.78	0	4	0.12	17	167	1.88
			Mean	28.35	6.83	8.28	33.34	0.82	34.3	3.0	0.094	14.4	140.9	1.081
			SD	1.17	0.38	0.10	1.08	0.28	47.8	1.1	0.039	1.7	45.3	0.699

[...]

Table 3 Hydrological and water quality on the southern coast of Taiping Island between April 21-23, Year 83 of the Republic [1994]

Date	Tide	Depth (m)	Water	Temperature (℃)	DO (ppm)	pH	Salinity (ppt)	Turbidity (NTU)	Ammonia-N (ppb)	NO_2-N (ppb)	NO_3-N (ppm)	PO_4-P (ppb)	SiO_2 (ppb)	COD (ppm)
21	High	0		29.0	7.8	8.2	32.1	0.56	21	3	0.07	38	110	2.62
22	High	0		27.0	6.6	8.2	33.8	0.75	10	2	0.11	31	161	3.99
	High	3		27.0	6.8	8.2	35.6	0.67	0	3	0.10	16	98	1.75
	Low	0		27.3	7.5	8.2		0.75	37	5	0.11	24	122	2.71
	Low	3		27.3	7.3	8.2	34.0	0.79	0	2	0.09	13	155	3.06
23	High	0		29.8	6.9	8.2		1.00	12	7	0.06	24	108	2.68
	High	3		29.8	6.9	8.2	32.1	1.10	33	2	0.11	29	213	1.24
			Mean	28.17	7.11	8.2	33.52	0.803	16.1	3.4	0.093	25.0	138.1	2.579
			SD	1.31	0.43	0	1.47	0.187	14.8	1.9	0.021	8.6	40.8	0.822

Table 4 Hydrological and water quality on the western coast of Taiping Island between April 21-23, Year 83 of the Republic [1994]

Date	Tide	Depth (m)	Water	Temperature (℃)	DO (ppm)	pH	Salinity (ppt)	Turbidity (NTU)	Ammonia-N (ppb)	NO_2-N (ppb)	NO_3-N (ppm)	PO_4-P (ppb)	SiO_2 (ppb)	COD (ppm)
21	High	0		30.1	7.0	8.2	33.3	0.74	38	4	0.07	17	216	1.05
	High	5		29.5	7.2	8.2	32.1	0.55	10	1	0.13	28	193	1.91
	High	10		29.5	7.5	8.2	33.6	0.51	26	1	0.09	27	166	1.79
	High	14		29.6	7.5	8.2	31.9	0.59	16	1	0.14	20	124	1.85
22	High	0		27.2	5.6	8.1	33.8	1.20	14	2	0.11	14	181	2.71
	High	3		27.3	7.2	8.1	33.1	0.75	0	4	0.09	25	198	1.02
	Low	0		27.6	6.5	8.3	35.6	0.75	1	0	0.12	11	190	1.15
	Low	3		27.8	6.4	8.2	35.0	1.40	3	2	0.15	43	322	1.24
23	High	0		29.9	7.9	8.3	33.1	0.68	0	3	0.10	11	335	2.27
	High	3		29.7	7.2	8.3	34.7	0.72	53	4	0.14	25	180	1.88
			Mean	28.82	7.00	8.21	33.62	0.789	16.1	2.2	0.114	22.1	210.5	1.687
			SD	1.18	0.67	0.07	1.20	0.287	17.9	1.5	0.026	9.7	66.8	0.534

[…]

Table 5 Hydrological and water quality on the northern coast of Taiping Island between April 21-23, Year 83 of the Republic [1994]

Date	Tide	Depth (m)	Water	Temperature (℃)	DO (ppm)	pH	Salinity (ppt)	Turbidity (NTU)	Ammonia-N (ppb)	NO_2-N (ppb)	NO_3-N (ppm)	PO_4-P (ppb)	SiO_2 (ppb)	COD (ppm)
21	High	0		29.2	8.4	8.2	33.3	0.55	21	3	0.06	24	125	2.30
22	High	0		27.0	6.5	8.2	30.3	1.30	20	3	0.11	21	140	2.94
	High	2		27.2	5.5	8.2		0.75						
	Low	0		27.6	6.6	8.3		1.10	4	3	0.13	17	202	3.45
	Low	2		27.6	6.4	8.3	31.0	9.00	7	3	0.05	17	91	1.18
23	High	0		30.0	8.3	8.4	35.6	0.93	0	1	0.12	16	156	1.91
	High	2		29.9	6.9	8.3		0.81	36	4	0.11	20	163	2.39
			Mean	28.36	6.94	8.27	32.55	2.06	14.7	2.8	0.097	19.2	146.2	2.36
			SD	1.30	1.05	0.08	2.40	3.07	13.5	1.0	0.033	3.1	37.5	0.72

Table 6 Hydrological and water quality of freshwater on Taiping Island

Station	Water	Temperature (℃)	DO (ppm)	pH	Salinity (ppt)	Turbidity (NTU)	Ammonia-N (ppb)	NO_2-N (ppb)	NO_3-N (ppm)	PO_4-P (ppb)	SiO_2 (ppb)	COD (ppm)
FW 1		28.0	5.2	8.2	2.0	1.40	8	6	1.07	282	1476	2.39
FW 2		28.0	5.5	8.6	1.1	1.80	32	3	1.36	70	1467	1.72

[...]

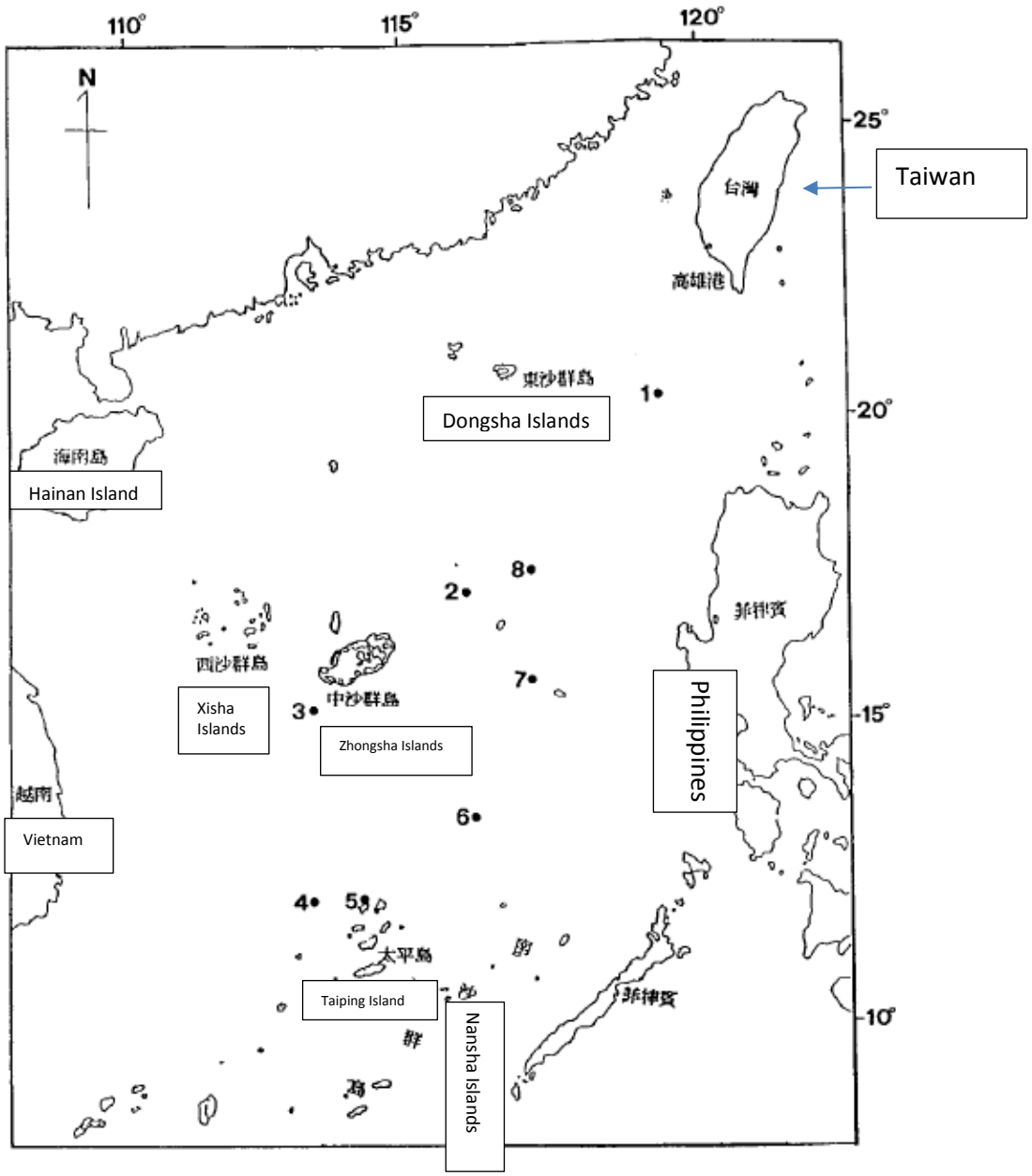

Figure 1 Sampling spots in South China Sea on the way to and from Taiping Island

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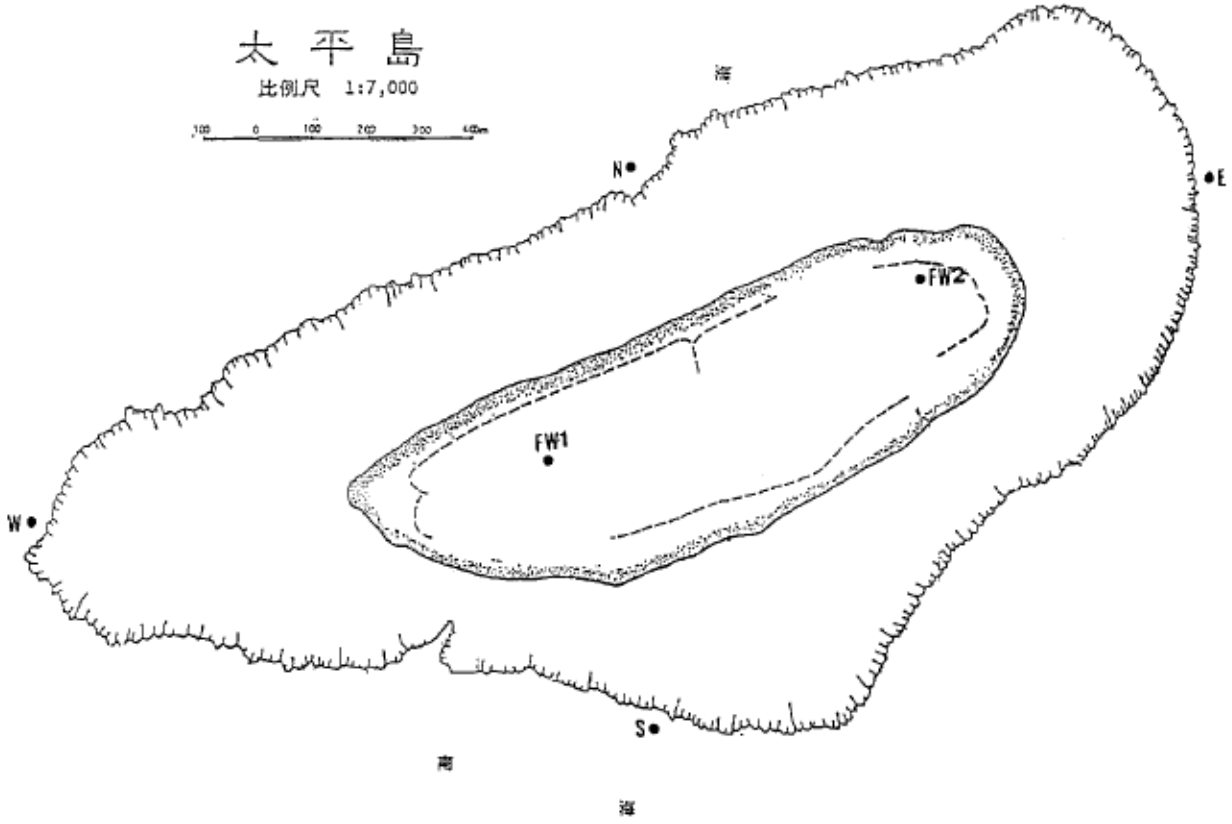


Figure 2 Sampling spots in sea regions on the coast of Taiping Island and at freshwater sites on the island

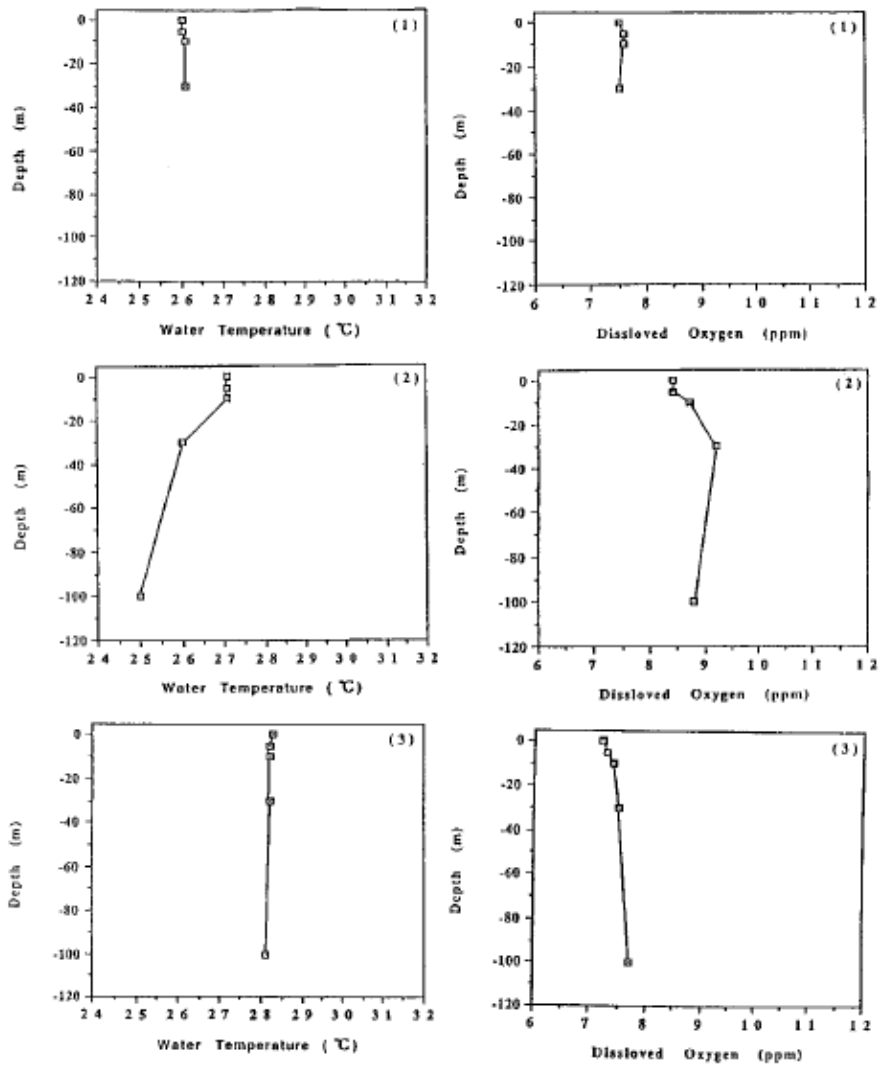
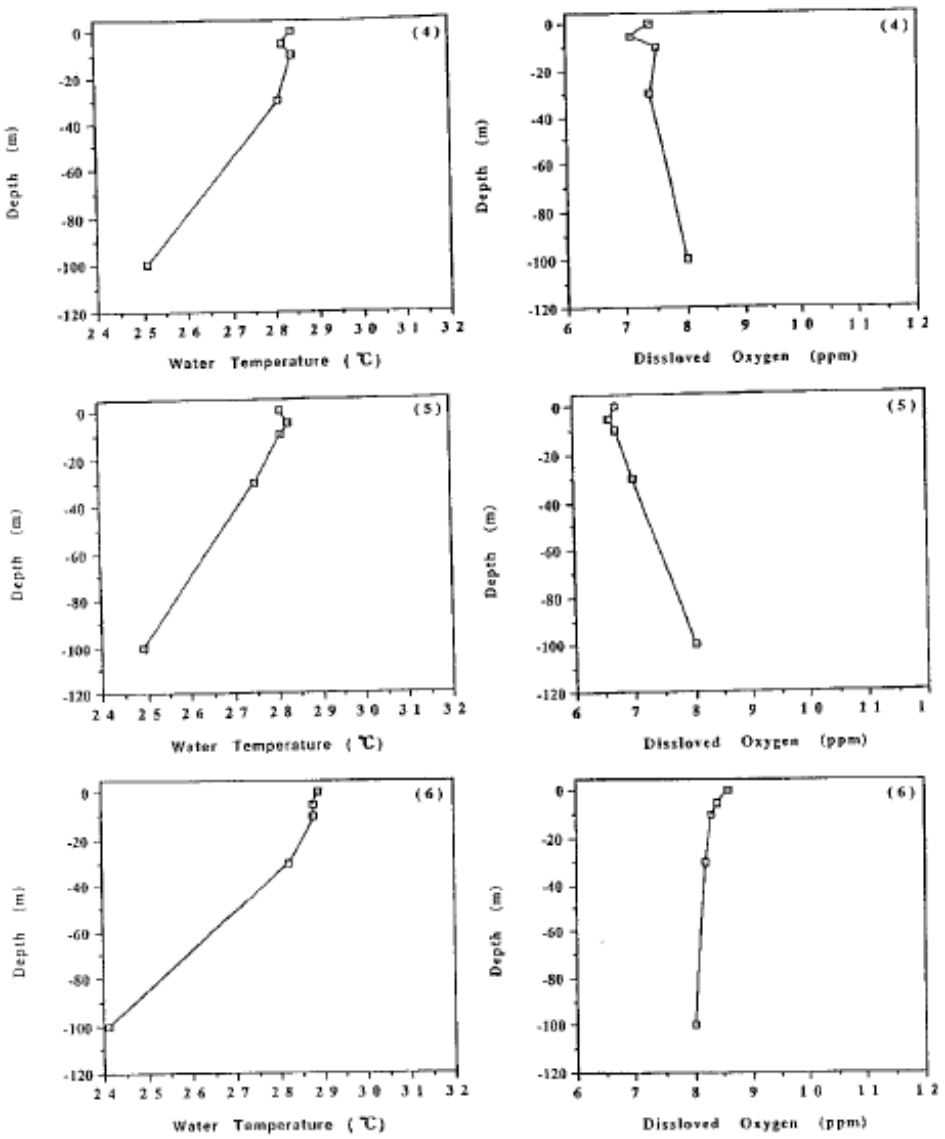


Figure 3 Variation in seawater temperature and dissolved oxygen in South China Sea
The numbers on the top right corner of the image are the numbers for the sampling sites



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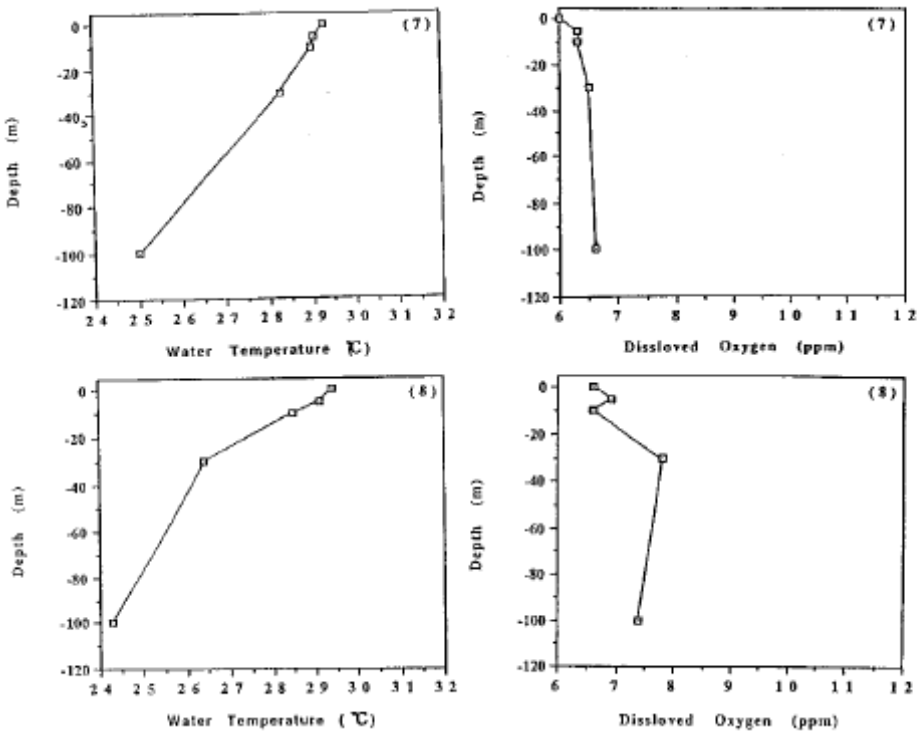

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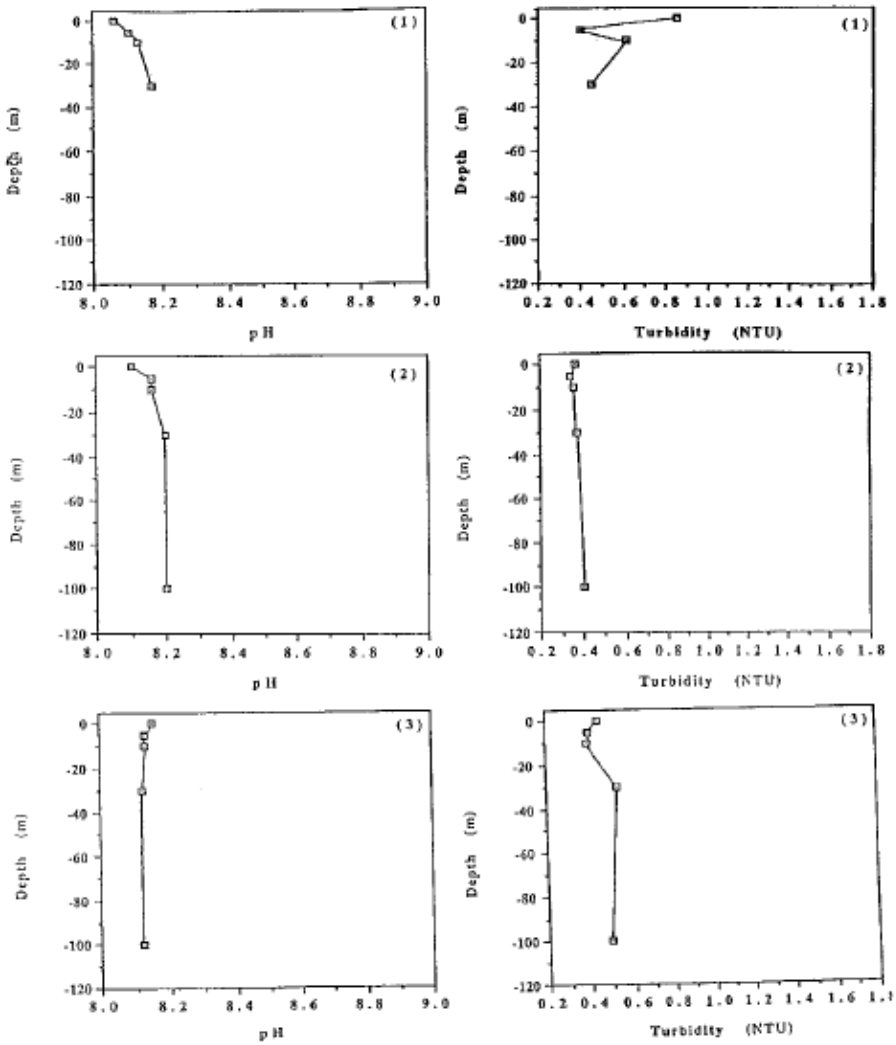

Figure 4 Variation in pH and turbidity in South China Sea
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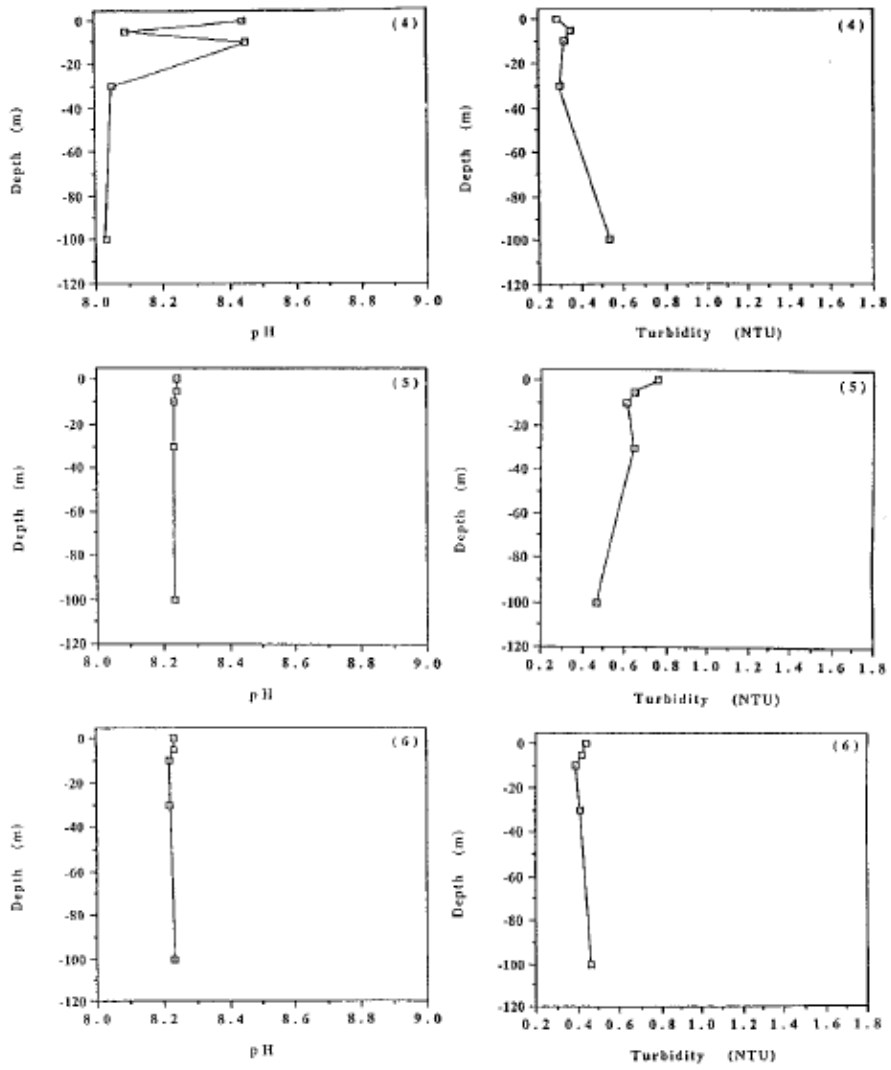

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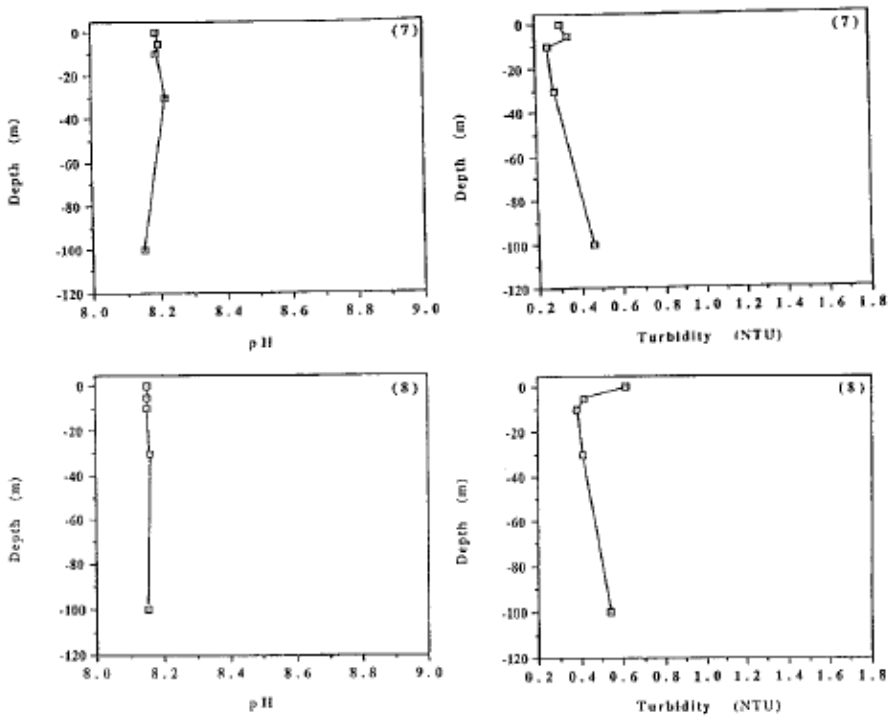

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計畫編號：八三科技--2・15--漁--13

行政院南海政策綱領
南海生態環境調查研究報告書

方力行
李健全 編輯

委託單位:行政院農業委員會
執行單位:國立海洋生物博物館籌備處

中華民國八十三年九月

南中國海及太平島海域水質調查

陳一鳴

摘 要

調查船於民國八十三年四月往返太平島航程中，於南中國海域進行了八站調查及採樣分析，其結果，表層水溫由北向南移有增高的趨勢，水溫分佈爲26～29℃，溶氧量均大於飽和狀態，pH爲8.1～8.2，濁度在0.4NTU左右，氨態氮爲20ppb，亞硝酸態氮爲0～6ppb，硝酸態氮爲0.05～0.17ppm，且隨深度之變化趨勢與氨態氮成負相關性。磷酸態磷變化範圍在20ppb左右。矽酸鹽則爲128～260ppb，各站在水深10m或30m處會呈現含量較低之情形。COD變異範圍在1.24～3.76ppm。

太平島沿岸四週之水質由本次調查可知可視爲同一水域，其溫度平均值在28℃，溶氧量在7ppm，pH爲8.2，鹽度爲32ppt，濁度爲0.8NTU，但在低潮時北站底層之濁度呈現9.0NTU。氨態氮扣除了東站低潮時高達139ppb外，其它高低潮時之平均變異範圍爲8.5～25.5ppb，亞硝酸爲2～3.5ppb，硝酸態氮爲0.08～0.11ppm，磷酸態磷爲20ppb左右，矽酸鹽爲140～180ppb，COD爲2ppm。太平島沿岸水質與南中國海水質相近似，但在低潮時會出現如濁度、氨鹽等較高值，故今後開發應須加注意。

太平島上兩處淡水源之水溫爲28℃，pH爲8.2及8.6，鹽度爲2.0及1.1ppt，濁度爲1NTU，氨態氮可達32ppb，亞硝酸態則爲6ppb，硝酸態氮爲1.4ppm，磷酸態磷兩處差異頗大分別爲282及70ppb，矽酸鹽爲1.4ppm，COD爲1～2ppm，整體而言該兩處淡水源還屬水質較佳的水源。

ABSTRACT

Four locations around the Taiping Dao(Itu-Aba island)and eight locations at the Southern China Sea between the Taiwan and the Taiping Dao were chosen for this survey on April, 1994. In the Southern China Sea, temperature of sea water was between 26-29 ℃and increased from north to south. Dissolved

oxygen concentrations were always oversaturate. Their pH, turbidity, ammonia-N, and PO4-P were very stable at 8.1, 0.4 NTU, 20 ppb, and 20 ppb, respectively. However, NO2-N, NO3-N, silicate and COD varied with the concentrations of 0-6 ppb , 50 - 170 ppb , 128 - 260 ppb , and 1.24 - 3.76 ppm , respectively. The concentrations of NO3-N were negatively correlated to those of ammonia-N along with the depth of sea for most of locations.

The water quality around the Taiping Dao was different from that of the Southern China Sea at the time of low tide period. During low tide period, the turbidity of northern station was 9.0 NTU and ammonia-N of eastern station was high at the concentration of 139 ppb. These results should be attended in future development of new construction. Even though there were some differences between the Southern China Sea and the Taiping Dao, the Taiping area still belong to the same session of the Southern China Sea. That is because other properties of the sea around the Taiping Dao were similar to those of the Southern China Sea during high tide period. Average temperature was 28 ℃; DO, 7 ppm; pH, 8.2; salinity, 32 ppt; turbidity, 0.8 NTU; ammonia-N, 8.5-25.5 ppb; NO2-N, 2-3.5 ppb; NO3-N; 0.08-0.11 ppm; PO4-P, 20 ppb; silicate, 140-180 ppb; and COD, 2 ppm.

There are two fresh-water resources on the Taiping Dao. Their temperature, turbidity, ammonia-N, NO2-N, NO3-N, silicate and COD were the same at 28 ℃ , 1 NTU, 32 ppb, 6 ppb, 1.4 ppm, 1.4 ppm, and 1-2 ppm, respectively. However, there was a singificant difference in PO4-P at the concentration of 282 and 70 ppb, respectively. The values of pH (8.2 and 8.6) and salinity (2.0 and 1.1 ppt) were slightly different from each other. On overall comments, the fresh-water resources of the island were still in good conditions.

一・前言

本研究是由行政院核定之南海政策綱領乃八十三年九月六日～七日南海問題討論會中”如何維護南海生態環境”之子題中決議項目而執行。本研究負責之部份爲南沙群島，東沙群島海域之水質調查，其主要目的是瞭解該等島嶼附近水質之變化，以便提供對該海域生態保育，水產資源，以及日後發展觀光等研究之參考。本次調查由農委會協調漁業幹部船員訓練中心備用「漁訓2號」訓練船，於八十三年四月十五日出發，前往南沙太平島海域進行調查，雖然本研究重點是在太平島沿岸水域，但爲了能收集更

多的資料，並配合浮游魚類研究等組，在調查船往返的途中分別進行了八站調查及採樣，以便能提供更多的資料。而爲了瞭解太平島四週海域是否會受漲退潮之影響而執行了三天四次之採樣調查，同時也對島上的兩處淡水源作採樣調查，可瞭解飲用水質狀況。

二．材料與方法

（一）採樣

分別在航行間及太平島上採樣，於前往南沙群島期間採樣四次；回程期間亦採樣四次共採八次，各採樣站位置如圖一所示，時間如表一所示。樣品的採取是利用採水器採水，並爲配合船上作業，採取之樣品裝瓶後，始量測水溫、溶氧及pH等水文資料。採樣深度分別爲表層(1公尺)、5公尺、10公尺、30公尺及100公尺。在太平島沿岸的採樣則依高、低潮分別於島的東、南、西、北等四處(圖二)採樣，共採四次，並於現場直接量測其水溫、溶氧及pH等水文資料。此外，並採取島上二處淡水樣品，採樣位置如圖二所示，同時測定記錄其水溫、溶氧及pH等資料。

（二）分析項目及方法

A. 水文

a. 溶氧量：以WTW OX1 191 型溶氧計測定。

b. 水溫：使用儀器同上，並以標準溫度計校正。

c. pH：以 WTW pH95型pH計測定。

d. 鹽度：以硝酸銀滴定法測定。

e. 濁度：使用HACH Model 2100A 光譜儀測定。

B. 水質化學

樣品以冷凍方式保存，攜回實驗室後，待樣品完全解凍利用0.45μm之薄膜濾紙(MFS Cellulose nitrate membrane filter)過濾，此原因是過濾設備在船上故障無法使用。除矽酸鹽須解凍放置一星期後量測外，其餘項目在短時間內儘快分析。

a. Ammonia-N ：IndopHenol ethyl-alcohol法(Solorzano, 1969)。

b. NO_2-N ： N-(1-napHthyl)-ethylenediamine法(APHA, 1985)。

c. NO_3-N ：Cadmium reduetion 法(APHA, 1985)。

d. PO_4-P ： Ascorbic acid法(APHA,1985)。

e. SiO_2 ：Molybdosilicate 法(APHA, 1985)。

f. COD ：K_2MnO_4，100℃加熱氧化法(海洋環境調查法，1979)。

三．結果與討論

Ⅰ、南中國海

調查船往返太平島航程中，於南中國海域共有八次進行水文調查及水質分析樣品之採樣，因須配合其他小組的研究工作而使採樣站形成逆時鐘旋轉方式進行的(圖一)。採樣均由水表向下分五層進行，唯有第 1 站因執行經驗不足未能採到100m水深之樣品。水溫、溶氧及pH等水文資料因船上並無CTD等設備，故在不同深度採水後裝樣品瓶時做的測定，其結果可知水溫會隨水深有遞減的情形，表層與100m水層最大溫差可達5℃(圖三，6、8 站)。表層水溫由北向南移有增高的趨勢(26～29℃)，此是否是因處於季節轉變的時期而形成，有待進一步去探討。第 8 站與 2 站較近表層至100m水深之溫度變化也有較相似的情形，而 4 站至 7 站之水溫隨其深度的變較相似。

溶氧量均呈飽和或過飽和現象，尤其隨其深度溶氧量會出現增加之情形，此可能因爲採水裝瓶後才測定，由水壓的改變而造成之影響，表層與100m水層最大差爲1.3ppm(圖三，5 站)。採樣站 2 及 6 之表層水溶氧量分別高達8.4及8.6ppm，已超過飽和度20％以上，此是否因採樣或儀器校正不夠準確而造成的結果則不得而知。

pH除了第 4 站表層及10m水深達8.4之外，其它站均維持在8.1～8.2之間，屬於標準外洋性pH值(圖四)。

鹽度是採樣後攜回實驗室以硝酸銀滴定其氯度後再換算出來的，但因爲樣品瓶保存不良產破裂，使鹽度未能得到數據。

濁度除了第 1 及第 4 站外，其它各站均爲0.4NTU左右，且最低值同常出現在10m處，再隨其深度會增加(圖四)。而第 1 站表層之濁度可達0.85NTU，其它三層均大於0.4NTU，但查看其它之水文、水質資料並未發現與

濁度相關變化之因素，第 5 站也是上層水之濁度較高，而100m 處之濁度則與其它各站同深度之值相似，該站上層水之濁度較高之原因也爲不明。

氨態氮如圖五所示，除了第 3 站5 m深，第 4 站30m深，第 5 站30 m第 6 站1 m及30m 深處有較高之氨態氮外，其它各站之不同深度均在20 ppb左右。前述有較高氨態氮之處均屬上層水深。該處均爲光合作用活躍，生物聚集之處，而本次採樣在前述方法中有提到採到之水樣是先冰凍後，回到實驗室解凍分析前才過濾，此因爲在船上過濾設備故障，故未能先過濾再冰凍。因此在生物活躍的水層中採得之水樣，未能先過濾就直接冰凍，可能會造成生物體在樣品瓶中死亡而釋出氨鹽等物質。故第 4 站30 m 深處氨態氮可達224ppb並不爲奇。

亞硝酸態氮之含量雖然由圖五可知各站間之上、下層變化均不一樣，但其濃度改變的範圍在0～6ppb，故可視爲無差異之變化(圖五)。

硝酸態氮含量之分佈範圍在0.05～0.17ppm，各站中1～10 m 水深之變化情形雖均不相同，但變化範圍均較小，各站中均以30 m水深處濃度最低，而100m處又呈升高之趨勢(圖六)。各站間之垂直濃度變除了第 3 站硝酸態氮與氨態氮成正相關外(相關係數0.23)，其它各站均呈負相關，尤其第 5 站負相關係數可達0.92。此是否由有機物分解形成氨鹽，再經化學或微生物的氧化而形成硝酸鹽之連動關係，有待進一步去探討。

磷酸態磷之含量在各站中隨深度之變化並無一定趨勢，其含量變化範圍一般均在20ppb左右，唯有第 2 站100m水深及第 8 站30m 水深分別達53及41ppb，呈現稍高之值(圖六)。

矽酸鹽含量變化範圍在128～260ppb之間，各站中均會產成在水深10 m或30 m處有含量較低的情形，此是否因爲該水層是浮游植物光合作用較强之處而造成，則有待進一步去探討(圖七)。

COD之測定結果得知 1 ～ 3 站及 7 、 8 站隨深度有相似的變化情形。5 、 6 站則隨深度也有相似變化趨勢，而第 4 站除了表層水外則其它深度之變化情形也與 5 、 6 站相似。故由COD值來看，可以由中沙群島之南北分成兩個海域。南側海域30m水深處會出現較高值，而北側海域剛好相反，30 m水深處會出現較低值。COD在整個海域變異範圍在1.24～3.76ppm。

II 、太平島

分別在該島東、南、西、北四處沿岸(圖二)於八十三年四月二十一日至二十三日之高潮時及二十二日低潮時，共採樣四次，各站超過水深1 m則均分表、底層採兩個水樣，唯有西側測站第一次採樣是隨小艇出去，採樣地點較深而採了四個水樣(表四)。

三天四個時段的調查，分析結果如表二～四所示，各站之水溫平均值均在28℃，表、底層水溫差均在1℃範圍內。溶氧量之平均值也均在7 ± 0.2 ppm範圍內；pH之平均值在8.2；鹽度雖然有些樣品瓶因保存不當破裂而未能測定，但四站之平均值均落在32.6～33.6ppt之間。濁度除了北站外，其它各站之平均值均在0.8 ± 0.02NTU範圍內，北站於四月二十三日低潮時底層之濁度呈現9.0NTU值，此是否果退潮將底層之沈積物攪起，有待進一步探討；該站扣除該值，其平均值則爲0.78NTU與其它三站比較則無差異。故由以上的水文資料可知太平島四週沿岸水域可視爲同一水域，且表、底層之差異也不大，因此將同一時段四站之所有數據做其平均值，以便瞭解高、低潮間之變化，其結果水溫在二十二日高潮時有較低值出現，但似乎水溫與高、低潮無關，而溶氧量之變化則與水溫有相似的趨勢(圖八)。一般水溫低時會有較高的溶氧量，但本次的調查並非如此，此原因是否是因爲天候、光合作用等因子所造成，這有待其它相關資料的研究配合，再進一步的去探討。pH之變化則在低潮時有較高值，且各站間也有較大的變異。鹽度雖有隨時間上升的趨勢，但其上升的變化較各站間的變化爲小。濁度於前面已經有敘述低潮時值較高的原因，若去掉北站底層的值，則其平均值爲0.97與其它平均值則很近似。

水質項目在各站四個時段的平均值也均呈現相似值(表二～五)，唯有東站氨態氮於四月二十二日低潮時底層高達139ppb而使平均值提高爲34 ppb (表二)之外，太平島沿岸四週的水域之水質也如同水文資料可視爲同一水域。將同一時段四站之結果作其平均值如圖九所示。氨態氮於四月二十二日低潮時各站間之變異範圍較大，其原因已在前面有敘述是因爲東站有139 ppb之高濃度出現，若去除該結果，其平均值爲8.57 ppb標準偏差爲12.87則其變化趨勢則與溶氧量之變化相似。亞硝酸鹽有隨時間增加之趨勢，但增加之量小於該時段的站間變化，其平均值之變範圍在2～3.5ppb。整體變化趨勢與鹽度有相似的變化。硝酸態氮則在二十二日低潮時有較高的平均值，其整體變化趨勢與修訂過的氨態氮(即去除東站139ppb值)之變化趨勢剛好相反，此現象在本次南中國海水質分析中也有相同情形。磷酸態磷之均在

20ppb前後，其變化範圍也很近似。由各站間的變化來看，南側之磷酸態磷較其它站爲高。矽酸鹽之變化趨勢有類似亞硝酸鹽之變化，隨時間有增加，但其增加量也是小於站間之變化，其平均值之變範圍在140～180ppb。矽酸鹽在西側站之平均值較其它三站爲高。COD之平均值均在2ppm，唯有在二十二日之高、低潮時之變化範圍較二十一及二十三日爲大。

本航次往復太平島而進行的南中國海域八測站的調查中接近太平島處之4、5、6站是在大陸斜坡處，而其餘各站均屬南海中央盆地(南海深海盆)處(謝，1981)，該海盆的深度約有4,000m (黎，1985)。本次採樣因受到設備之限制，最深之採樣爲100m，對全深度來說只能屬上表層之水，但在COD值上已可得知4、5、6站與其它各站是屬於不同水域，此是否是受到了地形的影響，有待進一步的去探討。

有關南中國海水文及水質方面之研究目前均屬於爲了漁場的開發而附帶所做的調查(蘇，1979；吳，1981；盧及謝，1981；盧，1983)，一般只有水溫、鹽度與深度資料，但因調查之地點、季節與本航次相差頗遠，故很難做比較。

太平島爲南沙群島200多座島嶼、灘、暗沙中最大的一個島，週邊主要有珊瑚礁所形成之環礁，北東向長60公里，寬20公里。環礁中之礁湖水深可達70～80m。太平島除了珊瑚岩外還含有有孔蟲類砂所組成，其中還夾有鳥糞層。南沙群島的島礁底座是南沙水下平緩台階，該台階水深爲1,500～2,000m。各島礁外緣以斜坡下降至南沙台階，如太平島北側坡度爲7.5°。南沙台階北緣至中央深海盆的坡度更陡，可達8°～12°(謝，1984)。由地形上可知太平島沿岸水域易受外洋水之影響，從調查分析的結果來看也是如此，島四週之水質與南中國海之水質並無很大的差距，再與墾丁海域之水質做比較，得知除了矽酸鹽較墾可海域爲低之外，其它項目均很相似(張及陳，1987)。但太平島沿岸水域在低潮時還是會出現如濁度、氨鹽等較高值，故今後對該地域之開發應須加注意，以免環境因子的變化而帶給生態上的衝擊。

太平島上兩處淡水源(圖一)調查採樣分析結果如表六所示。水溫在兩淡水源均相同爲28.0℃；溶氧量兩者也很相近，但只達飽和度之七成。pH兩者均偏鹼性分別爲8.2、8.6，此是否因爲島上地質組成主要爲珊瑚石而造成，則須進一步探討。鹽度分別爲2.0及1.1ppt，此可能是由地層形成時已含有的鹽分在溶出，而並非海水入侵。濁度可達1NTU以上，此表示水不清

淨，該混濁爲生物性或非生物性的物質，則有待進一步去探討。氨態氮在第二水源處雖有較高值32ppb，但還不會造成影響。亞硝酸態氮的含量較低，而硝酸態氮的含量過高，高過一般雨水之5～8倍(半谷，1960)。磷酸態磷第一水源可達282ppb，此是否因地層中夾有鳥糞的原因，有待探討。矽酸鹽兩水源均相同爲1.4ppm較海水高出了十倍。COD值則爲1～2ppm，此表示水中含有少量之有機物或還原性物質。整體來看該兩處的淡水源與一般河川或湖泊比起來，還屬水質較佳的水源(半谷，1960)。

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表一　往返太平島行程中採樣點之日期及經緯度

站名	月／日	東經	北緯
1	4/16	120°30'	21°59'
2	4/17	116°06'	17°01'
3	4/18	113°00'	15°15'
4	4/18	113°00'	12°01'
5	4/24	114°31'	12°03'
6	4/24	116°24'	13°29'
7	4/25	117°13'	15°59'
8	4/25	117°09'	17°44'

表二　民國八十三年四月二十一日至四月二十三日太平島東側沿岸之水文及水質資料

Date	Tide	Depth (m)	Water	Temperature (℃)	DO (ppm)	pH	Salinity (ppt)	Turbidity (NTU)	Ammonia-N (ppb)	NO_2-N (ppb)	NO_3-N (ppm)	PO_4-P (ppb)	SiO_2 (ppb)	COD (ppm)
21	High	0		29.2	6.7	8.2	31.9	1.20	65	2	0.05	15	109	2.07
	High	5		28.9	6.5	8.2	34.7	0.61	17	2	0.07	13	72	1.98
22	High	0		27.1	7.3	8.3		0.63	2	3	0.14	15	186	1.34
	High	5		27.2	7.1	8.3	34.0	0.55	5	2	0.06	12	158	1.21
	Low	0		27.2		8.5	32.8	0.69	8	3	0.15	13	167	0.86
	Low	4		27.7	7.2	8.3	33.3	1.30	139	5	0.10	14	183	3.22
23	High	0		29.8	6.7	8.2		0.80	38	3	0.06	16	85	1.91
	High	4		29.7	6.3	8.2		0.78	0	4	0.12	17	167	1.88
			Mean	28.35	6.83	8.28	33.34	0.82	34.3	3.0	0.094	14.4	140.9	1.081
			SD	1.17	0.38	0.10	1.08	0.28	47.8	1.1	0.039	1.7	45.3	0.699

表三　民國八十三年四月二十一日至四月二十三日太平島南側沿岸之水文及水質資料

Date	Tide	Depth (m)	Water	Temperature (℃)	DO (ppm)	pH	Salinity (ppt)	Turbidity (NTU)	Ammonia-N (ppb)	NO_2-N (ppb)	NO_3-N (ppm)	PO_4-P (ppb)	SiO_2 (ppb)	COD (ppm)
21	High	0		29.0	7.8	8.2	32.1	0.56	21	3	0.07	38	110	2.62
22	High	0		27.0	6.6	8.2	33.8	0.75	10	2	0.11	31	161	3.99
	High	3		27.0	6.8	8.2	35.6	0.67	0	3	0.10	16	98	1.75
	Low	0		27.3	7.5	8.2		0.75	37	5	0.11	24	122	2.71
	Low	3		27.3	7.3	8.2	34.0	0.79	0	2	0.09	13	155	3.06
23	High	0		29.8	6.9	8.2		1.00	12	7	0.06	24	108	2.68
	High	3		29.8	6.9	8.2	32.1	1.10	33	2	0.11	29	213	1.24
			Mean	28.17	7.11	8.2	33.52	0.803	16.1	3.4	0.093	25.0	138.1	2.579
			SD	1.31	0.43	0	1.47	0.187	14.8	1.9	0.021	8.6	40.8	0.822

表四　民國八十三年四月二十一日至四月二十三日太平島西側沿岸之水文及水質資料

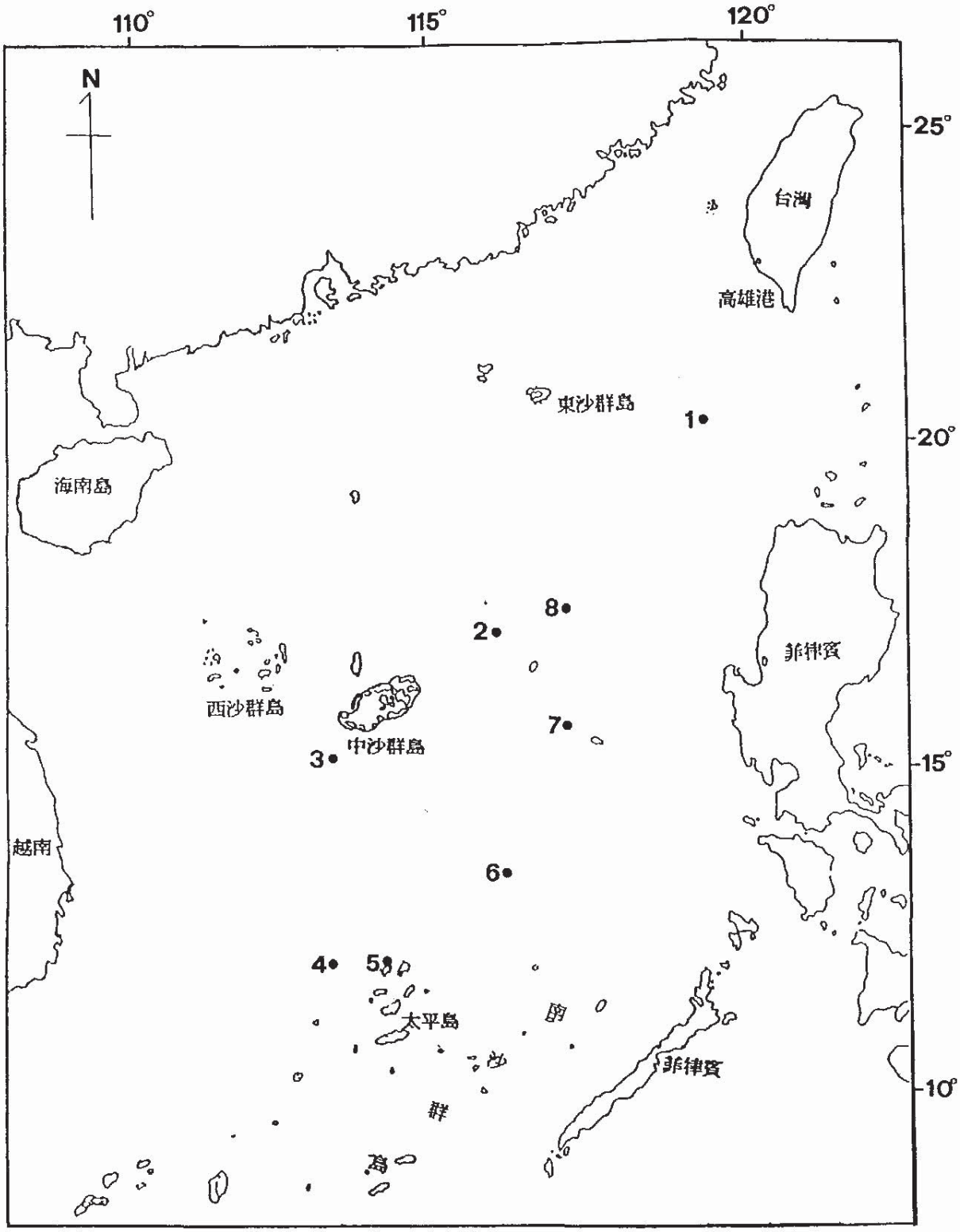
Date	Tide	Depth (m)	Water	Temperature (℃)	DO (ppm)	pH	Salinity (ppt)	Turbidity (NTU)	Ammonia-N (ppb)	NO_2-N (ppb)	NO_3-N (ppm)	PO_4-P (ppb)	SiO_2 (ppb)	COD (ppm)
21	High	0		30.1	7.0	8.2	33.3	0.74	38	4	0.07	17	216	1.05
	High	5		29.5	7.2	8.2	32.1	0.55	10	1	0.13	28	193	1.91
	High	10		29.5	7.5	8.2	33.6	0.51	26	1	0.09	27	166	1.79
	High	14		29.6	7.5	8.2	31.9	0.59	16	1	0.14	20	124	1.85
22	High	0		27.2	5.6	8.1	33.8	1.20	14	2	0.11	14	181	2.71
	High	3		27.3	7.2	8.1	33.1	0.75	0	4	0.09	25	198	1.02
	Low	0		27.6	6.5	8.3	35.6	0.75	1	0	0.12	11	190	1.15
	Low	3		27.8	6.4	8.2	35.0	1.40	3	2	0.15	43	322	1.24
23	High	0		29.9	7.9	8.3	33.1	0.68	0	3	0.10	11	335	2.27
	High	3		29.7	7.2	8.3	34.7	0.72	53	4	0.14	25	180	1.88
			Mean	28.82	7.00	8.21	33.62	0.789	16.1	2.2	0.114	22.1	210.5	1.687
			SD	1.18	0.67	0.07	1.20	0.287	17.9	1.5	0.026	9.7	66.8	0.534

表五　民國八十三年四月二十一日至四月二十三日太平島北側沿岸之水文及水質資料

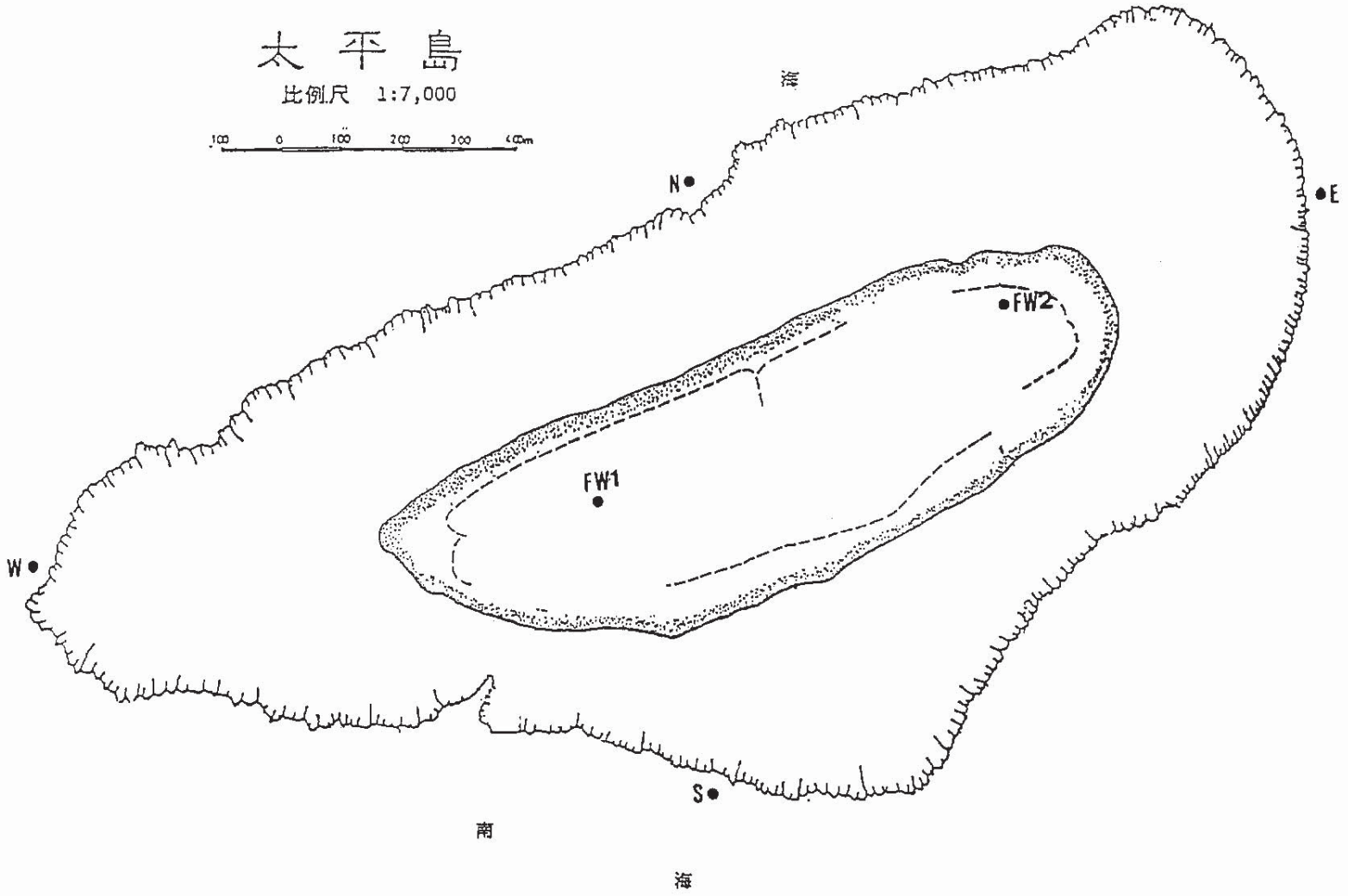
Date	Tide	Depth (m)	Water	Temperature (℃)	DO (ppm)	pH	Salinity (ppt)	Turbidity (NTU)	Ammonia-N (ppb)	NO_2-N (ppb)	NO_3-N (ppm)	PO_4-P (ppb)	SiO_2 (ppb)	COD (ppm)
21	High	0		29.2	8.4	8.2	33.3	0.55	21	3	0.06	24	125	2.30
22	High	0		27.0	6.5	8.2	30.3	1.30	20	3	0.11	21	140	2.94
	High	2		27.2	5.5	8.2		0.75						
	Low	0		27.6	6.6	8.3		1.10	4	3	0.13	17	202	3.45
	Low	2		27.6	6.4	8.3	31.0	9.00	7	3	0.05	17	91	1.18
23	High	0		30.0	8.3	8.4	35.6	0.93	0	1	0.12	16	156	1.91
	High	2		29.9	6.9	8.3		0.81	36	4	0.11	20	163	2.39
			Mean	28.36	6.94	8.27	32.55	2.06	14.7	2.8	0.097	19.2	146.2	2.36
			SD	1.30	1.05	0.08	2.40	3.07	13.5	1.0	0.033	3.1	37.5	0.72

表六　太平島上淡水之水文及水質資料

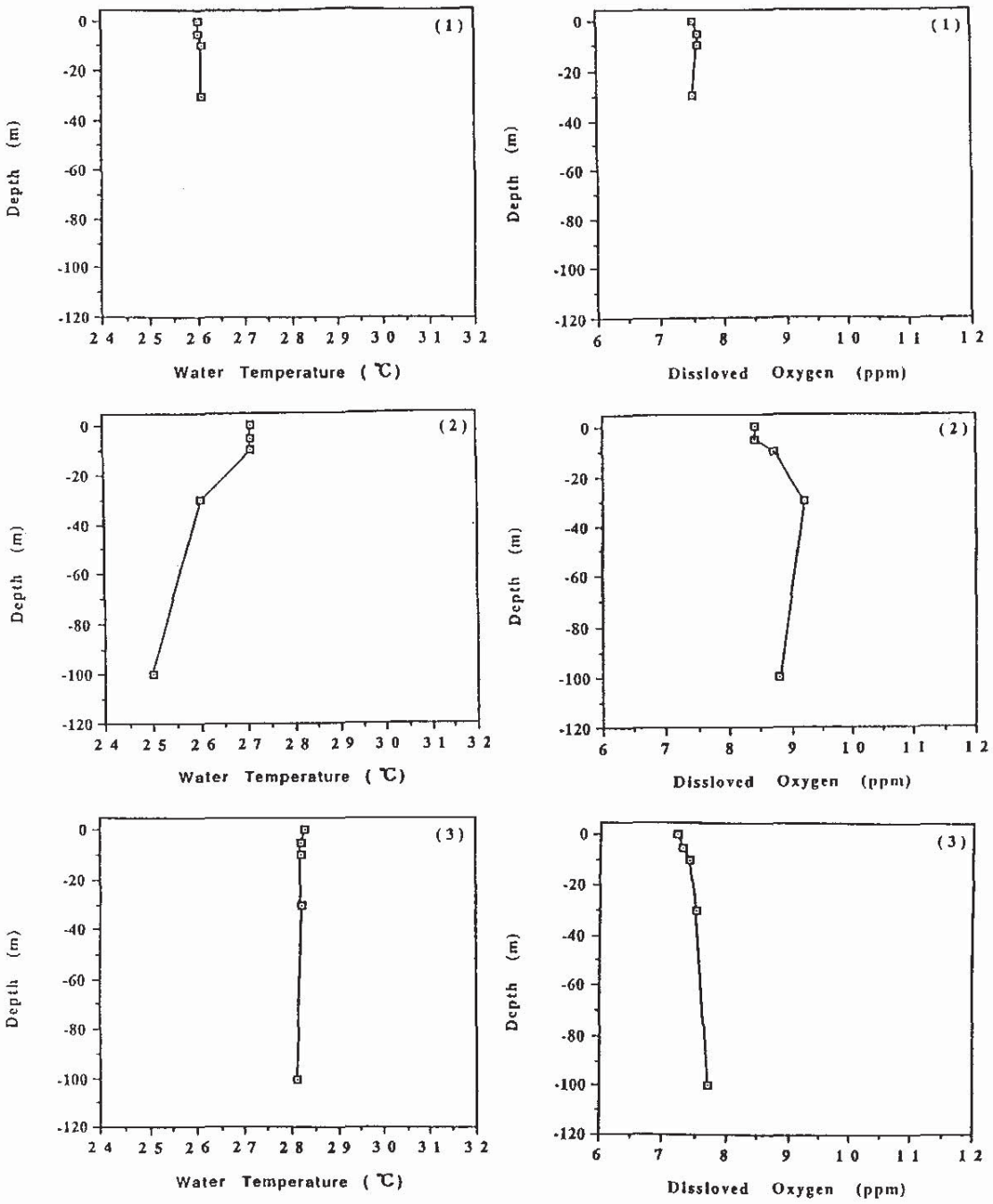
Station	Water	Temperature (℃)	DO (ppm)	pH	Salinity (ppt)	Turbidity (NTU)	Ammonia-N (ppb)	NO_2-N (ppb)	NO_3-N (ppm)	PO_4-P (ppb)	SiO_2 (ppb)	COD (ppm)
FW 1		28.0	5.2	8.2	2.0	1.40	8	6	1.07	282	1476	2.39
FW 2		28.0	5.5	8.6	1.1	1.80	32	3	1.36	70	1467	1.72



圖一　往返太平島行程中之南中國海採樣點

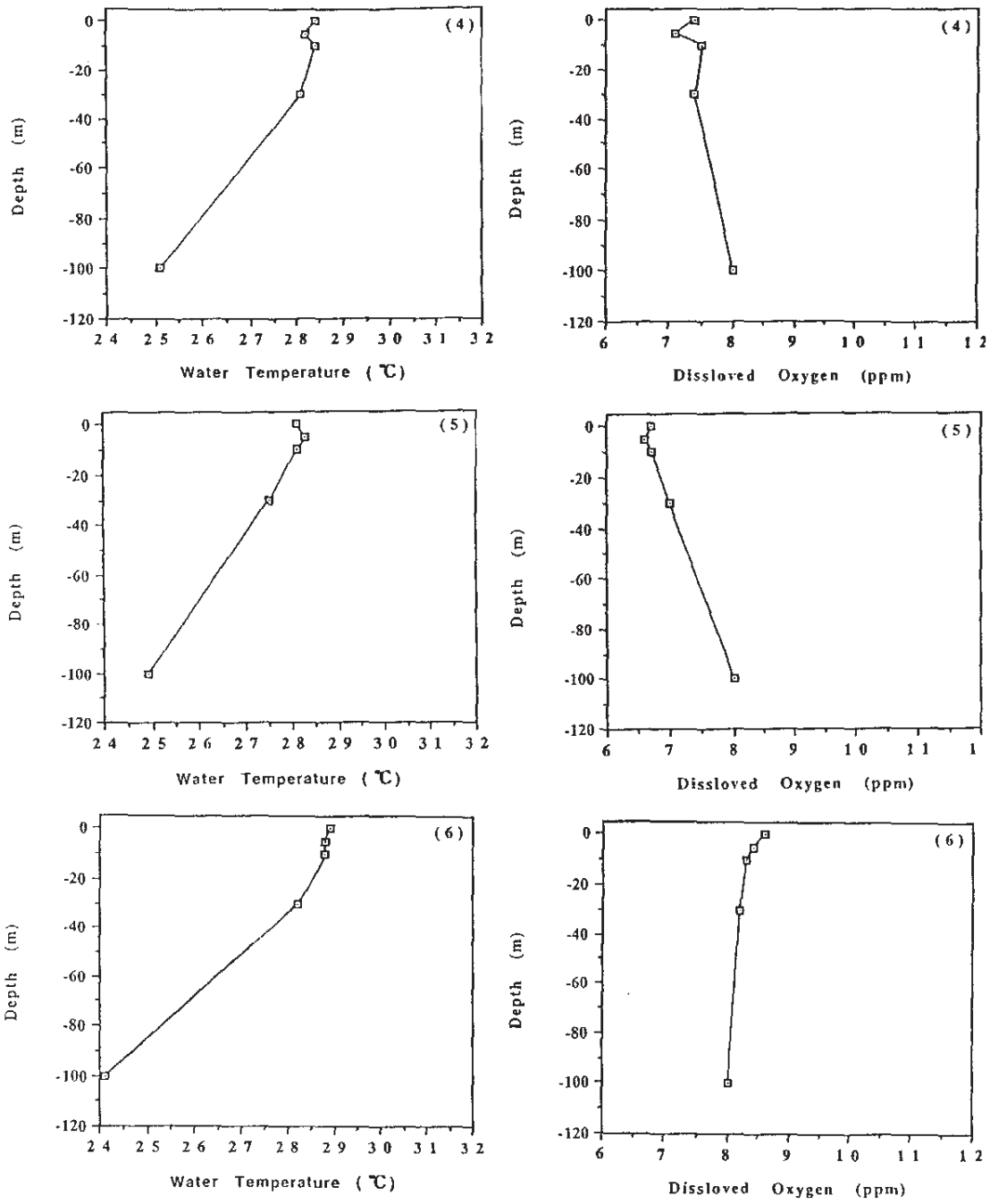


圖二　太平島沿岸四週海域及島上淡水源之採樣點

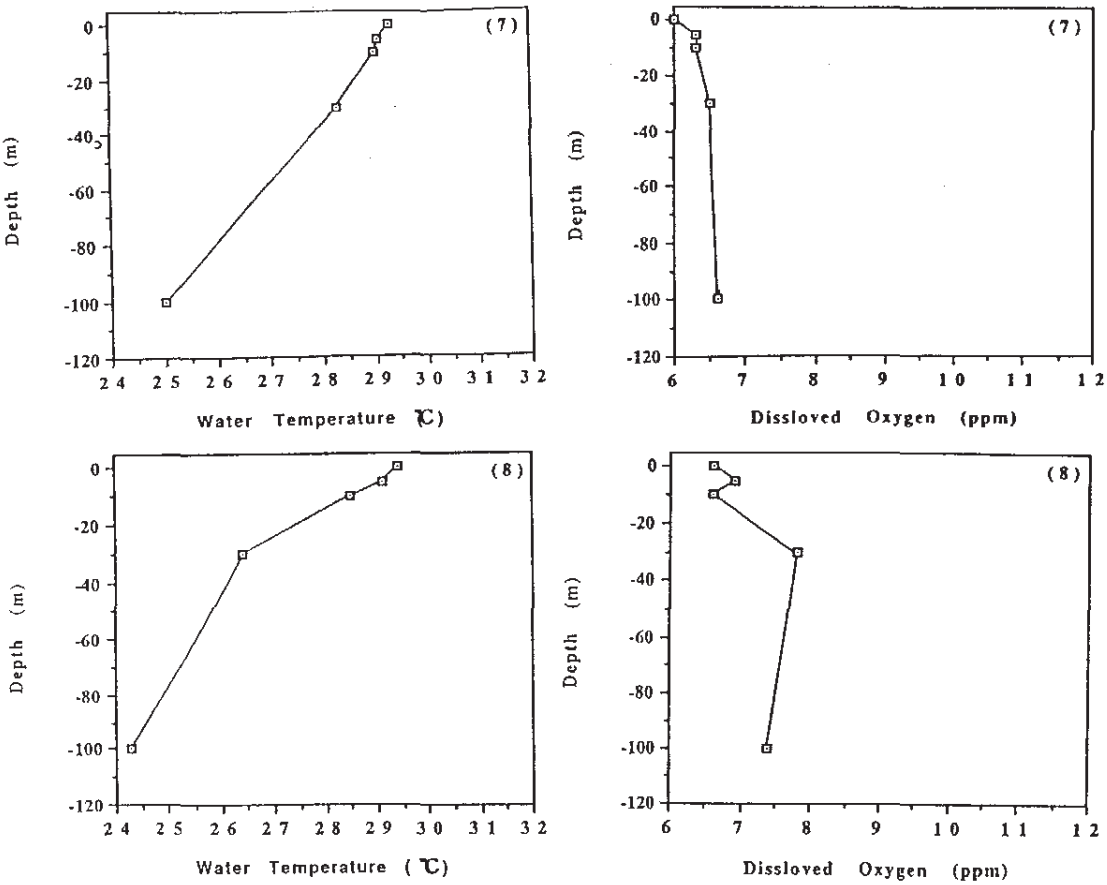


圖三　南中國海水溫及溶氧量之變化

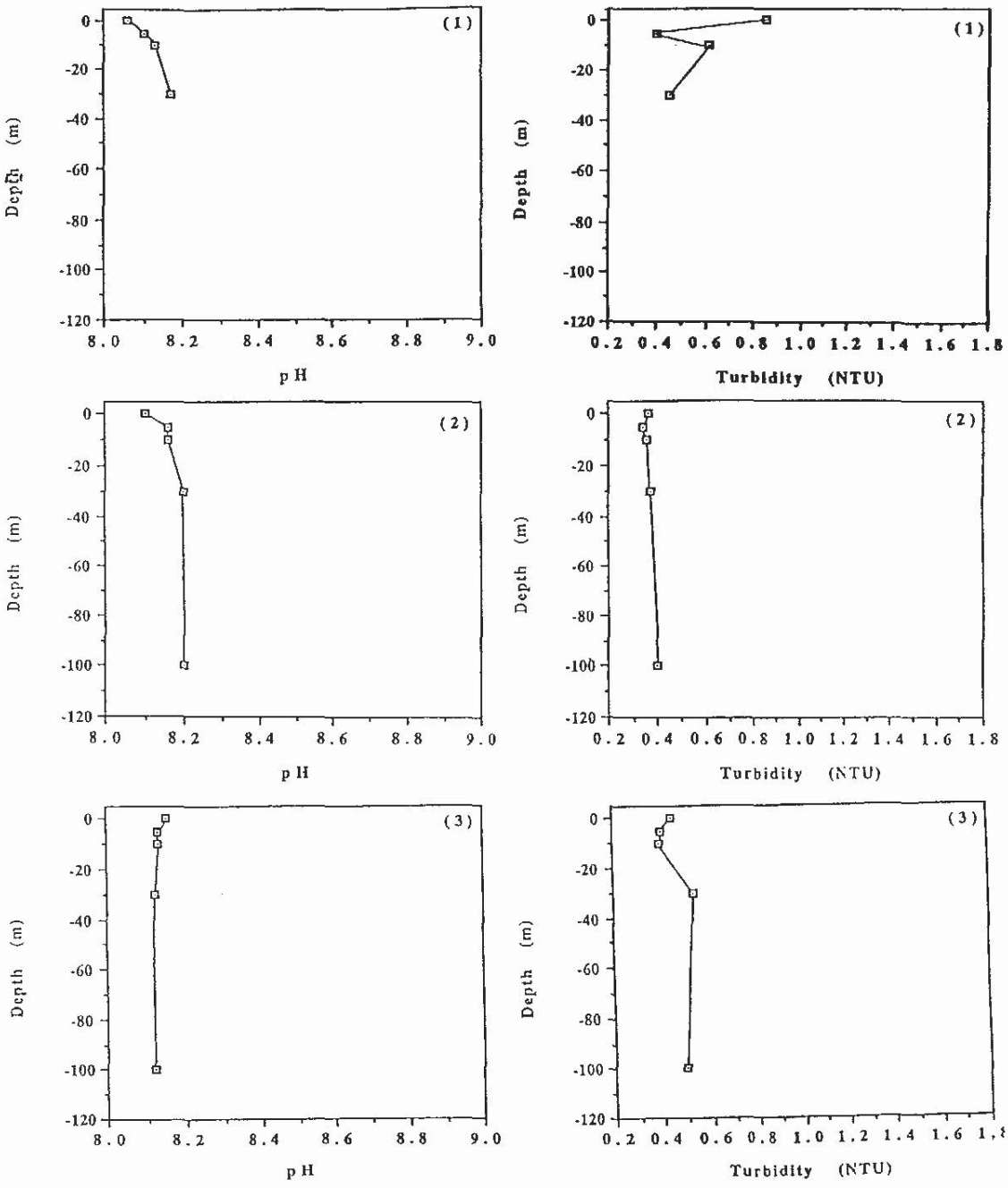
圖右上角之數字爲採樣站號


(4)
Depth (m)
0
-20
-40
-60
-80
-100
-120
24 25 26 27 28 29 30 31 32
Water Temperature (℃)
(4)
Depth (m)
6 7 8 9 10 11 12
Dissloved Oxygen (ppm)
(5)
Depth (m)
24 25 26 27 28 29 30 31 32
Water Temperature (℃)
(5)
Depth (m)
6 7 8 9 10 11 1
Dissloved Oxygen (ppm)
(6)
Depth (m)
24 25 26 27 28 29 30 31 32
Water Temperature (℃)
(6)
Depth (m)
6 7 8 9 10 11 12
Dissloved Oxygen (ppm)

圖三 (續上頁)

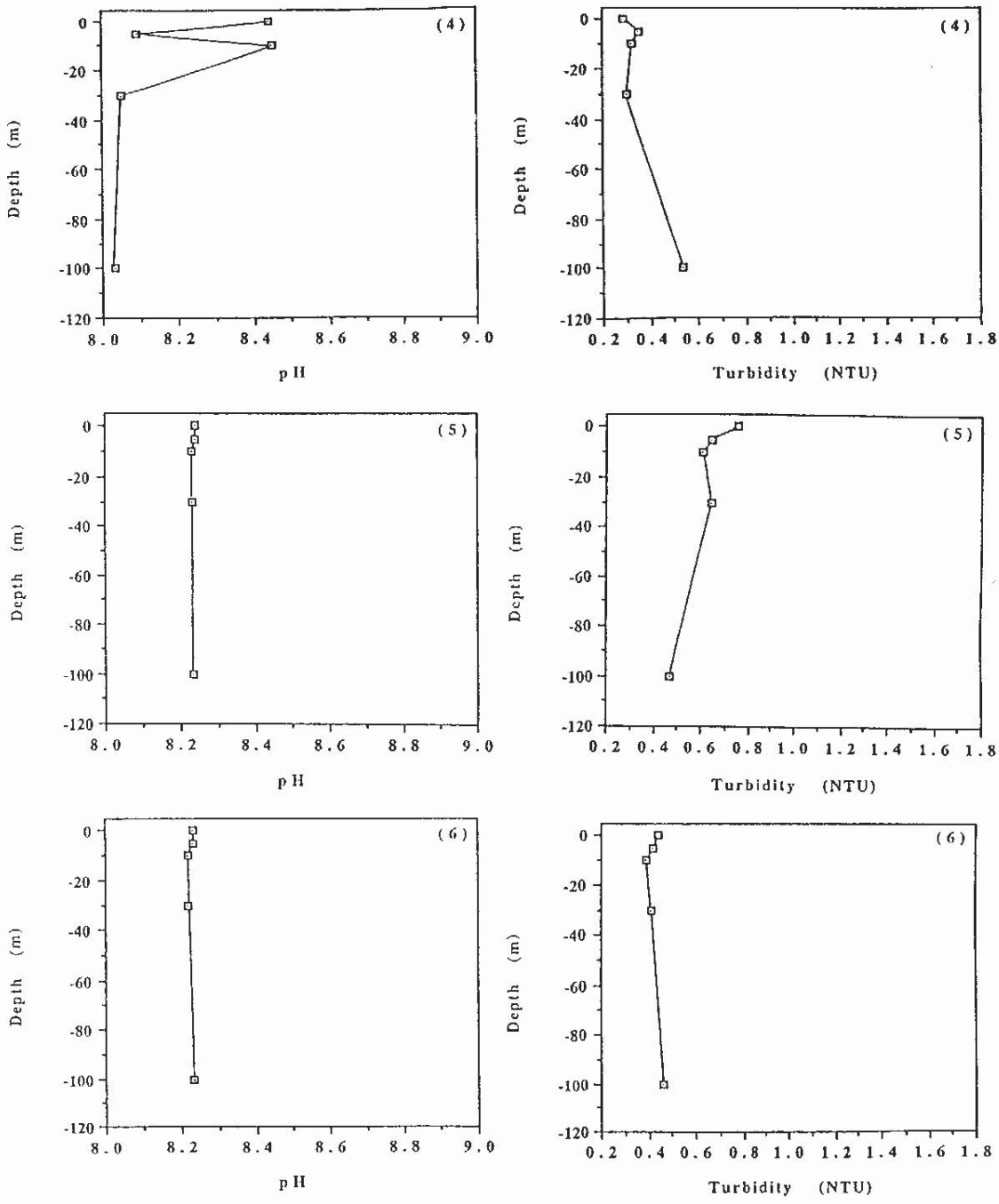

(7)
Depth (m)
0
-20
-40
-60
-80
-100
-120
24 25 26 27 28 29 30 31 32
Water Temperature (℃)
(7)
Depth (m)
6 7 8 9 10 11 12
Dissloved Oxygen (ppm)
(8)
Depth (m)
Water Temperature (℃)
(8)
Depth (m)
Dissloved Oxygen (ppm)

圖三 (續上頁)

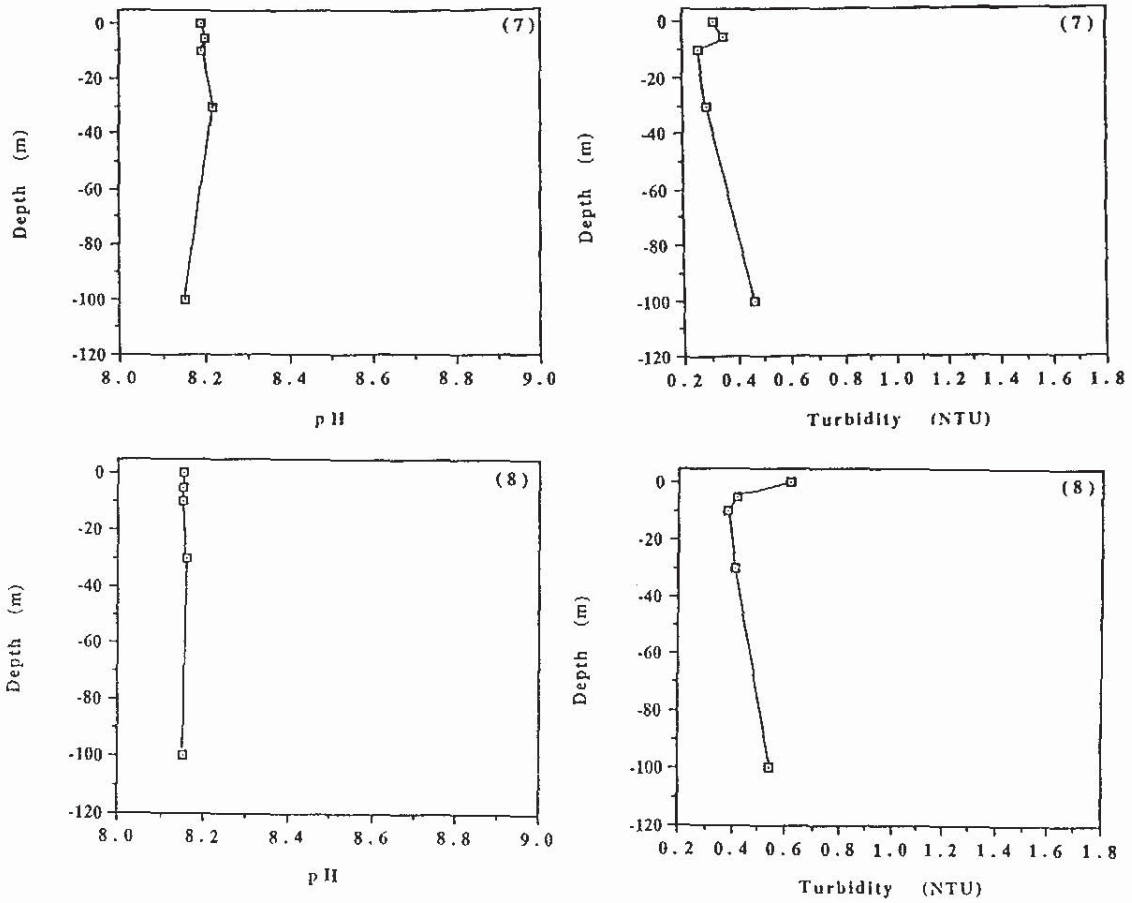


圖四　南中國海pH及濁度之變化

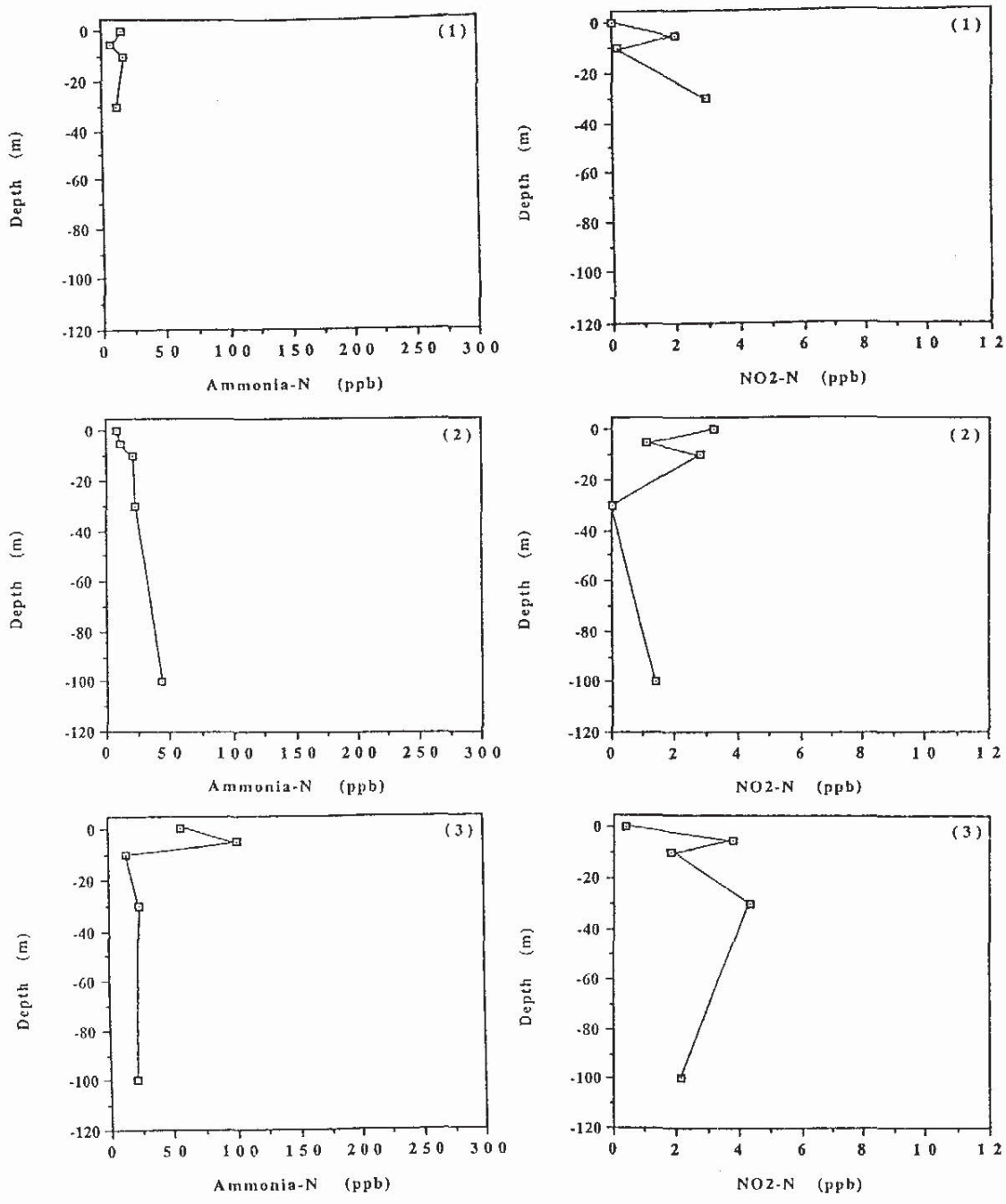
圖右上角之數字爲採樣站號


(4)
Depth (m)
0
-20
-40
-60
-80
-100
-120
8.0 8.2 8.4 8.6 8.8 9.0
pH
(4)
Depth (m)
0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8
Turbidity (NTU)
(5)
Depth (m)
pH
(5)
Depth (m)
Turbidity (NTU)
(6)
Depth (m)
pH
(6)
Depth (m)
Turbidity (NTU)

圖四 (續上頁)

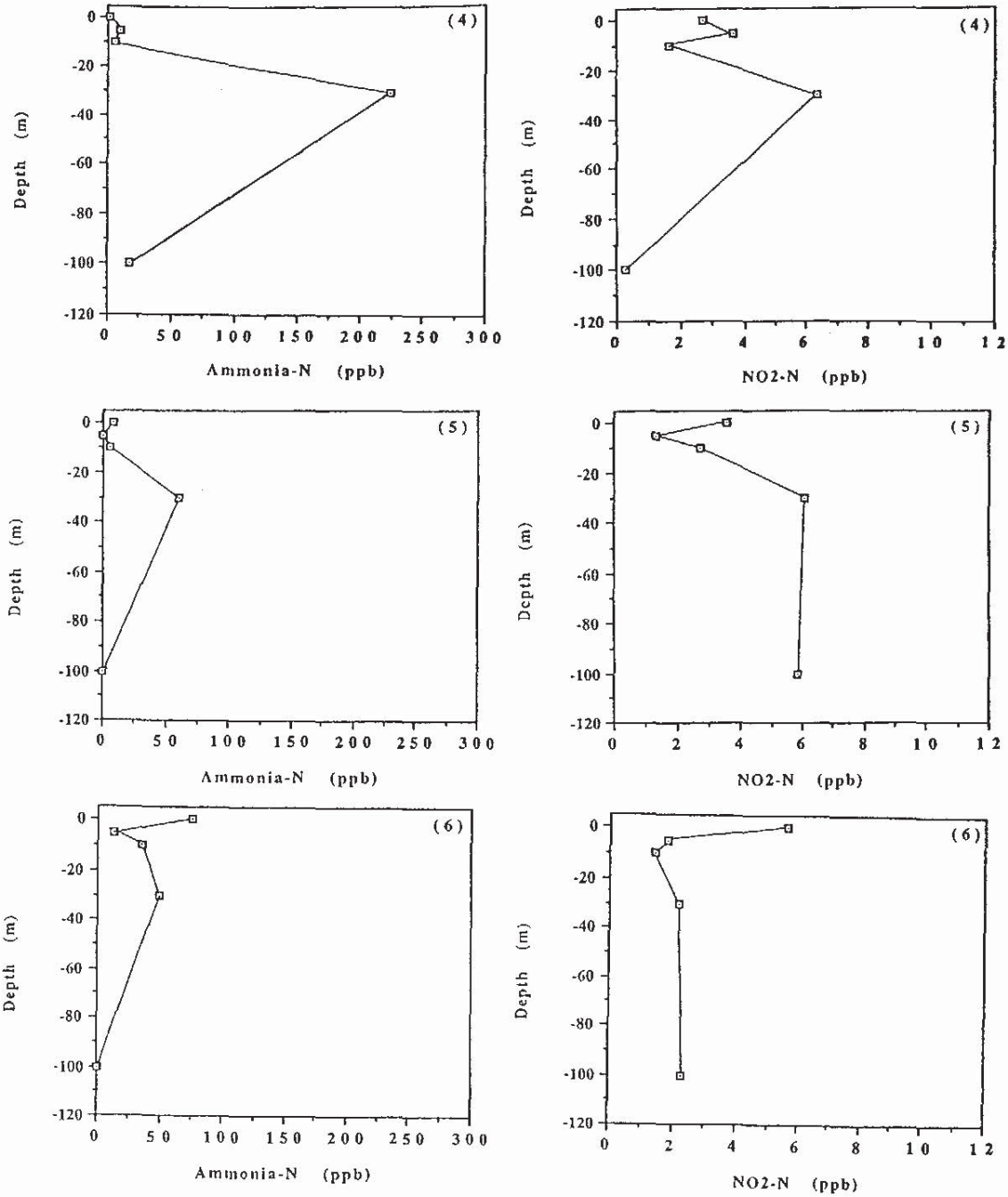

(7)
Depth (m)
0
-20
-40
-60
-80
-100
-120
8.0 8.2 8.4 8.6 8.8 9.0
pH
(7)
Depth (m)
0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8
Turbidity (NTU)
(8)
Depth (m)
pH
(8)
Depth (m)
Turbidity (NTU)

圖四 (續上頁)

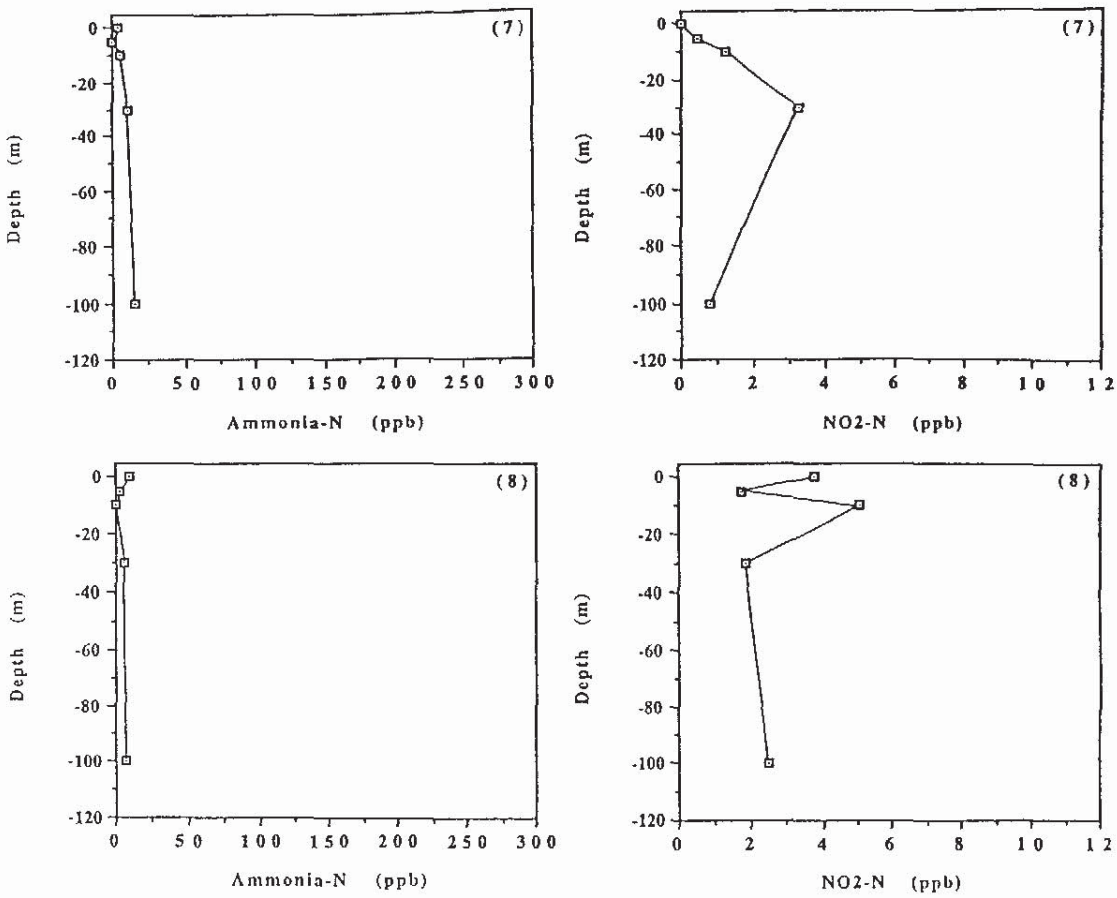


圖五　南中國海氨態氮及亞硝酸態氮之變化

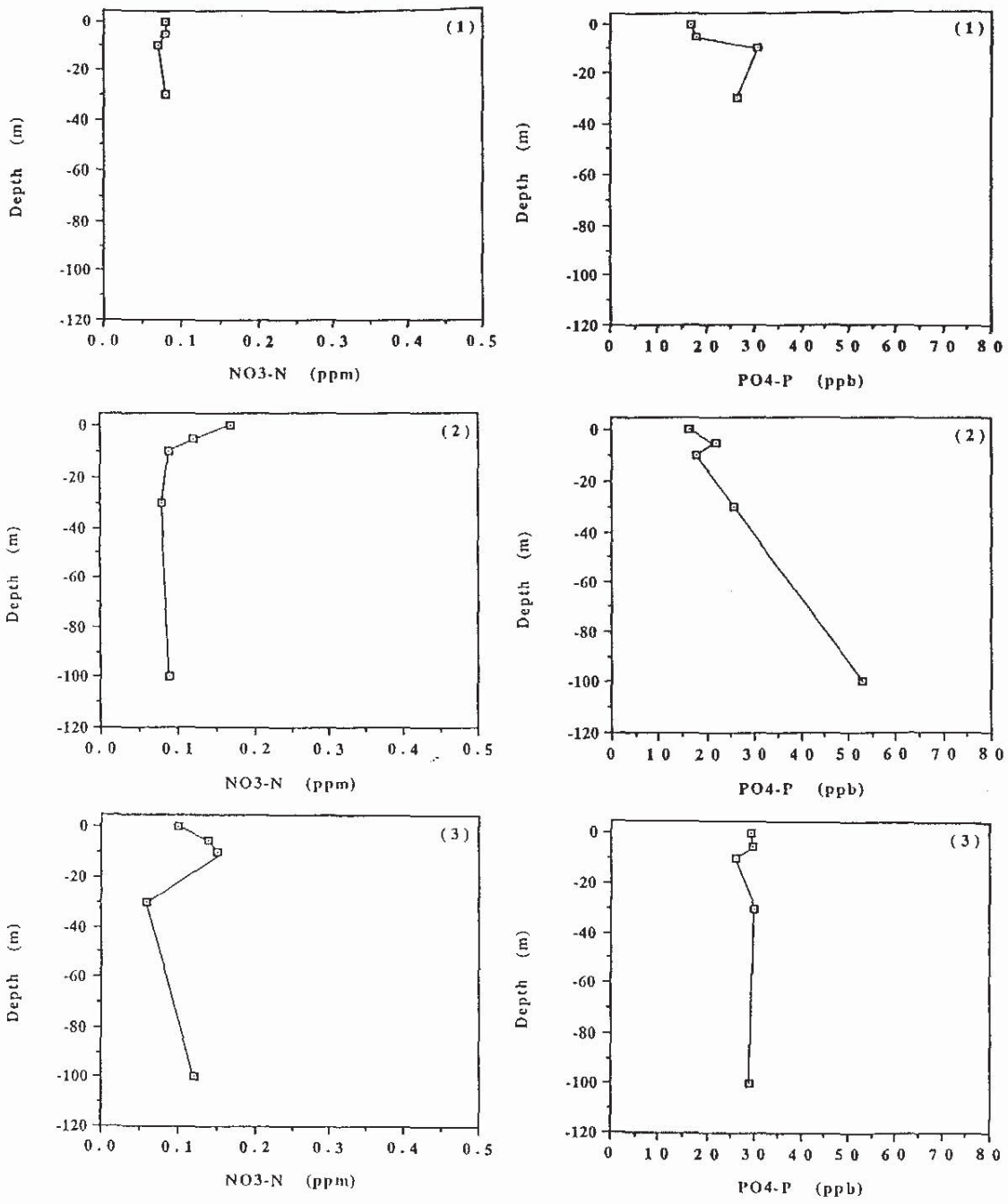
圖右上角之數字爲採樣站號


(4)
Depth (m)
0
-20
-40
-60
-80
-100
-120
0 50 100 150 200 250 300
Ammonia-N (ppb)
(4)
Depth (m)
0 2 4 6 8 10 12
NO2-N (ppb)
(5)
Depth (m)
Ammonia-N (ppb)
(5)
Depth (m)
NO2-N (ppb)
(6)
Depth (m)
Ammonia-N (ppb)
(6)
Depth (m)
NO2-N (ppb)

圖五 (續上頁)

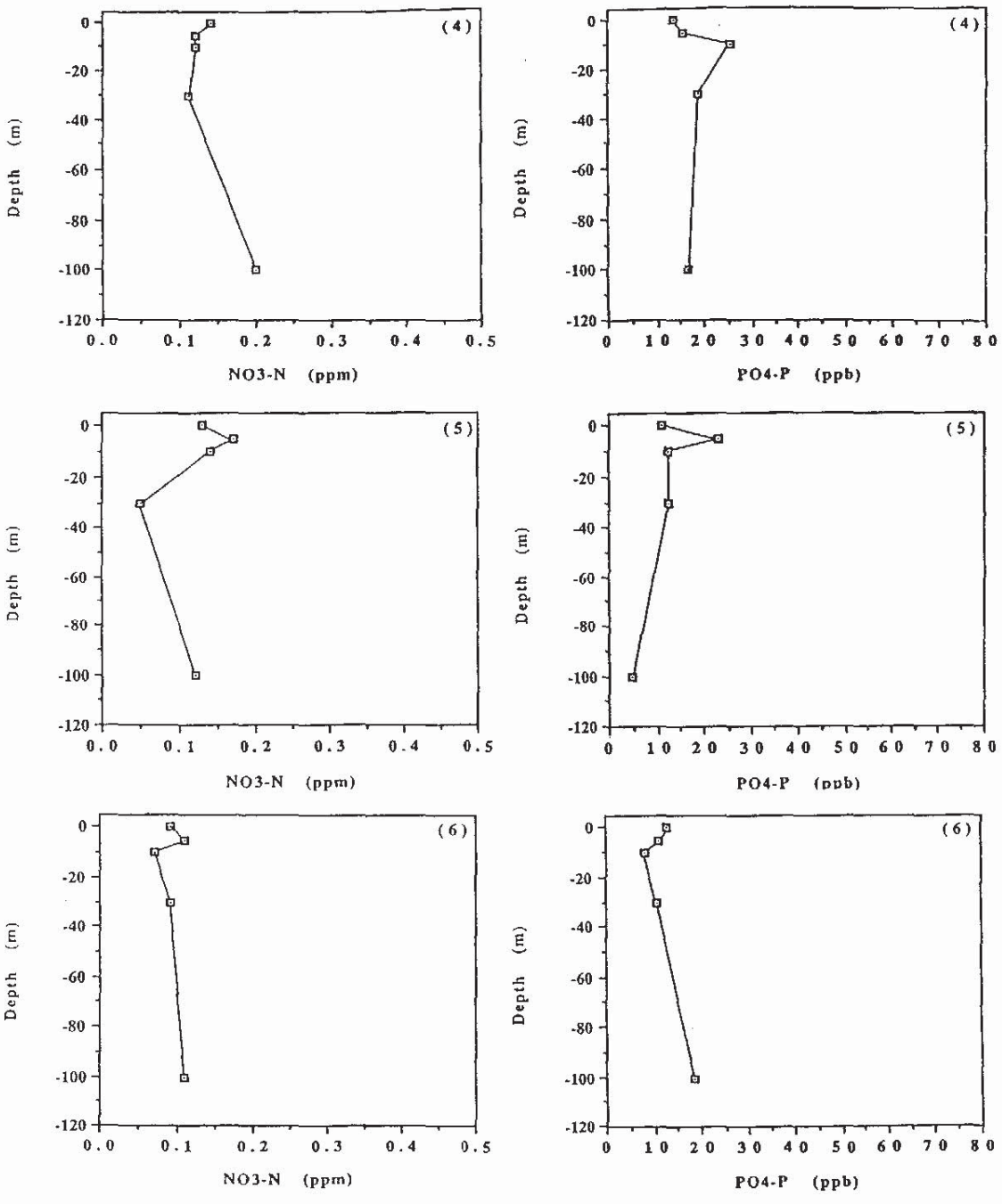

(7)
Depth (m)
0
-20
-40
-60
-80
-100
-120
0 50 100 150 200 250 300
Ammonia-N (ppb)
(7)
Depth (m)
0 2 4 6 8 10 12
NO2-N (ppb)
(8)
Depth (m)
Ammonia-N (ppb)
(8)
Depth (m)
NO2-N (ppb)

圖五 (續上頁)

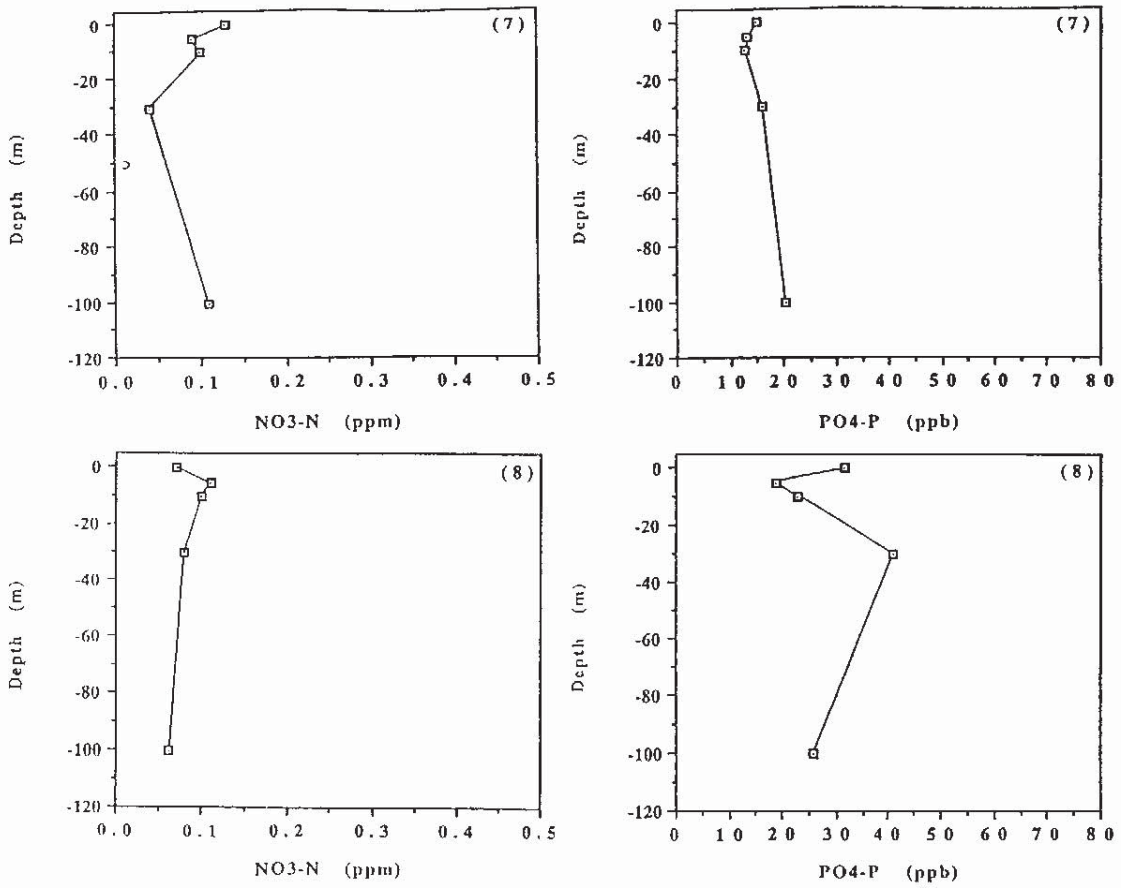


圖六　南中國海硝酸態氮及磷酸態磷之變化

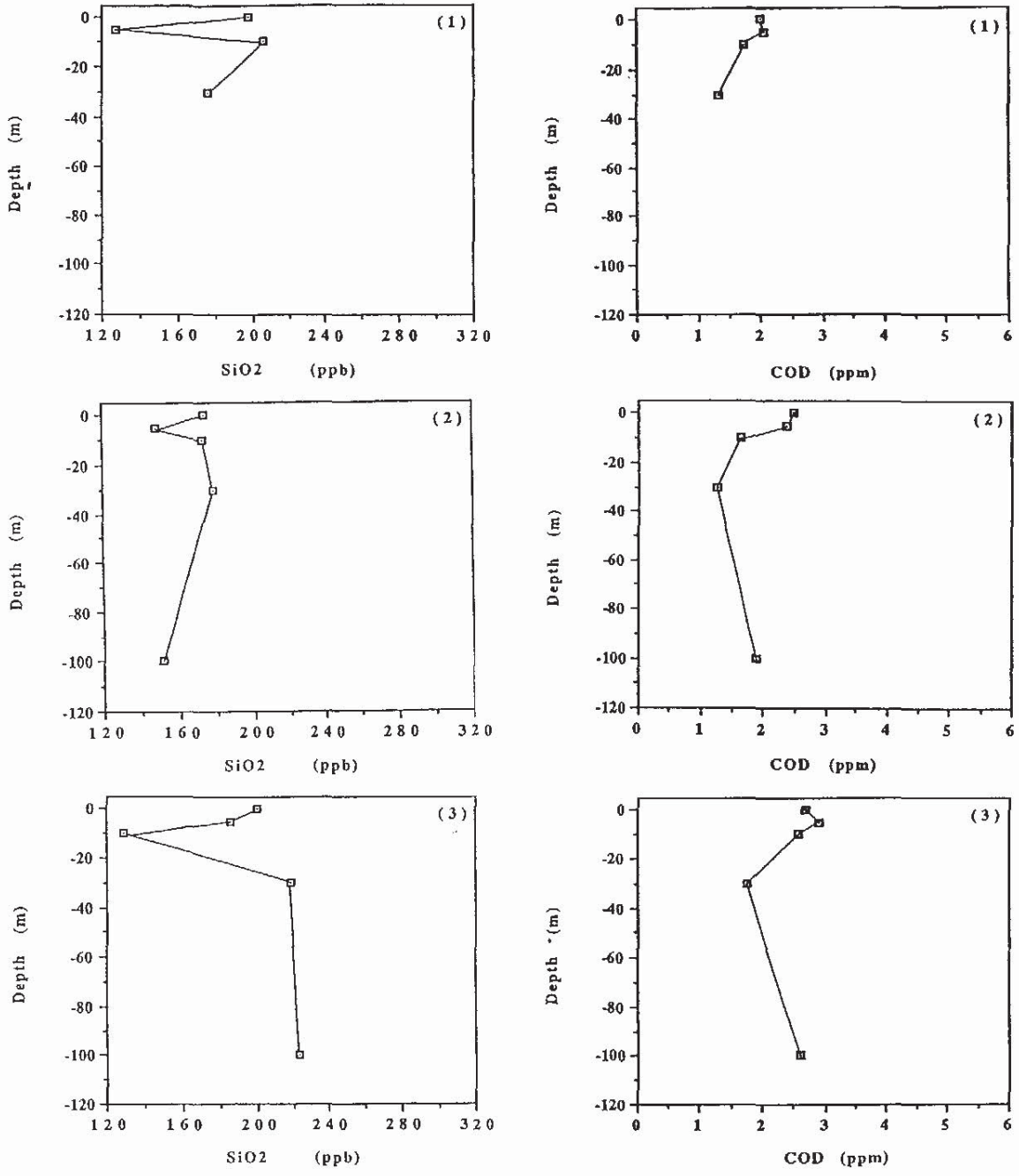
圖右上角之數字爲採樣站號


(4)
Depth (m)
0
-20
-40
-60
-80
-100
-120
0.0 0.1 0.2 0.3 0.4 0.5
NO3-N (ppm)
(4)
Depth (m)
0 10 20 30 40 50 60 70 80
PO4-P (ppb)
(5)
Depth (m)
NO3-N (ppm)
(5)
Depth (m)
PO4-P (ppb)
(6)
Depth (m)
NO3-N (ppm)
(6)
Depth (m)
PO4-P (ppb)

圖六 (續上頁)

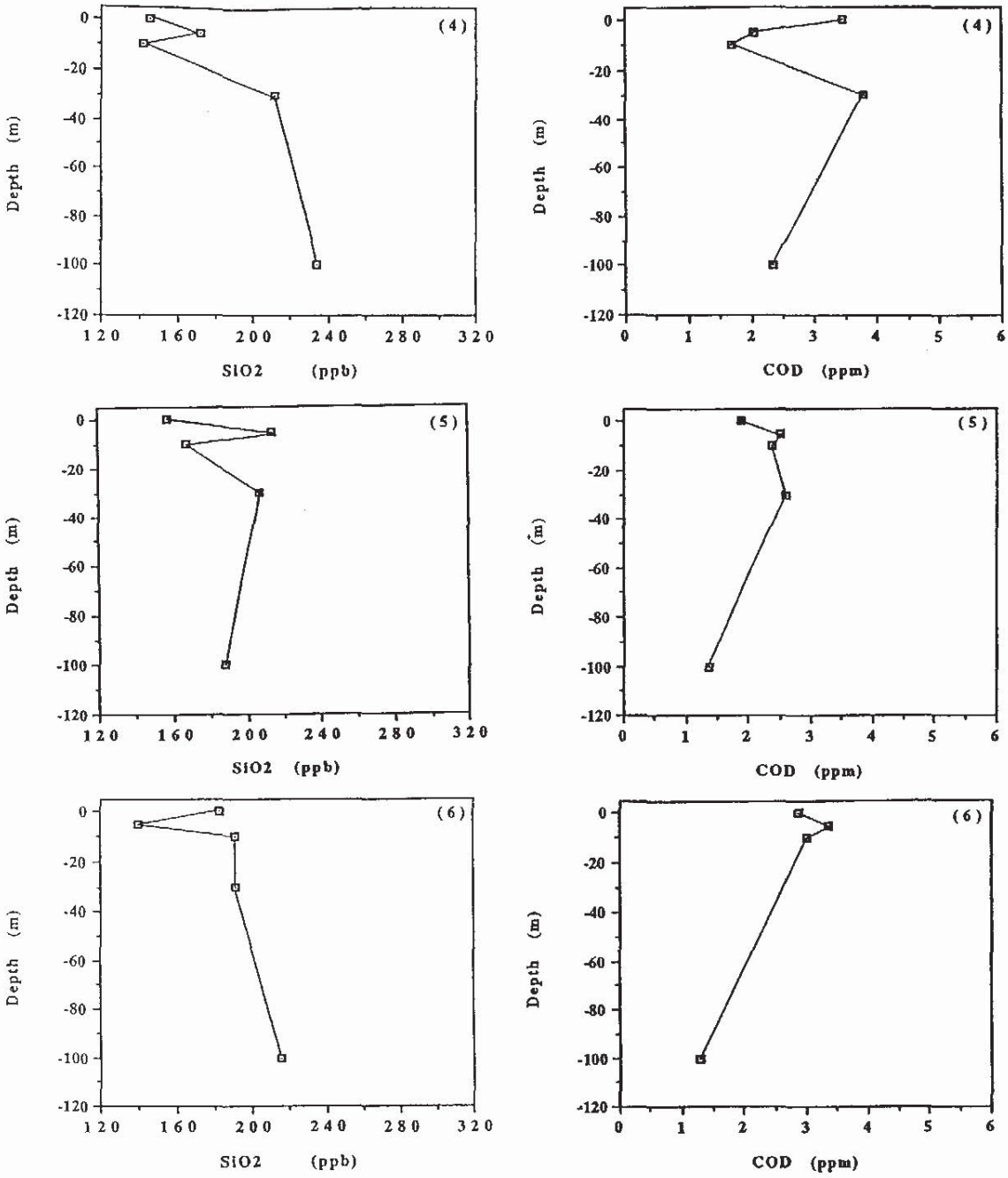

(7)
Depth (m)
0
-20
-40
-60
-80
-100
-120
0.0 0.1 0.2 0.3 0.4 0.5
NO3-N (ppm)
(7)
Depth (m)
0 10 20 30 40 50 60 70 80
PO4-P (ppb)
(8)
Depth (m)
NO3-N (ppm)
(8)
Depth (m)
PO4-P (ppb)

圖六 (續上頁)

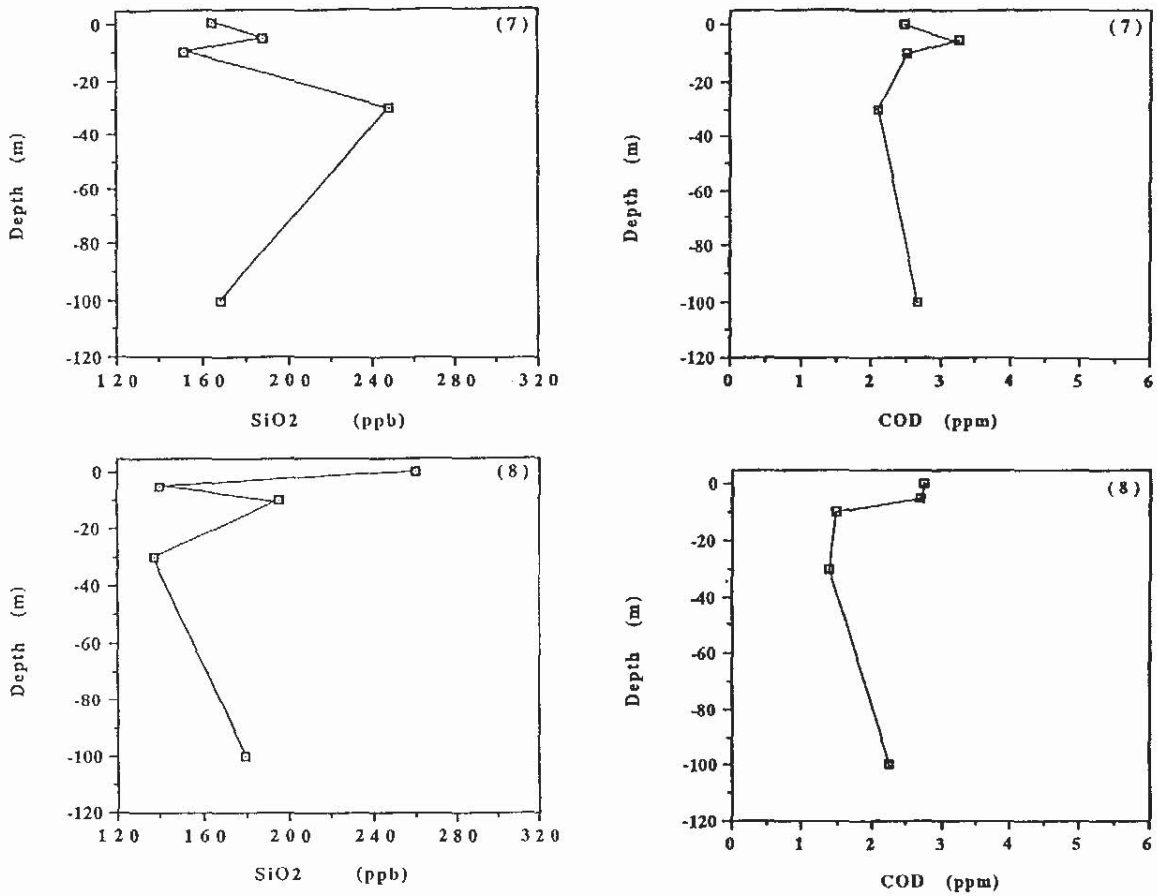


圖七　南中國海矽酸鹽及化學需氧量之變化

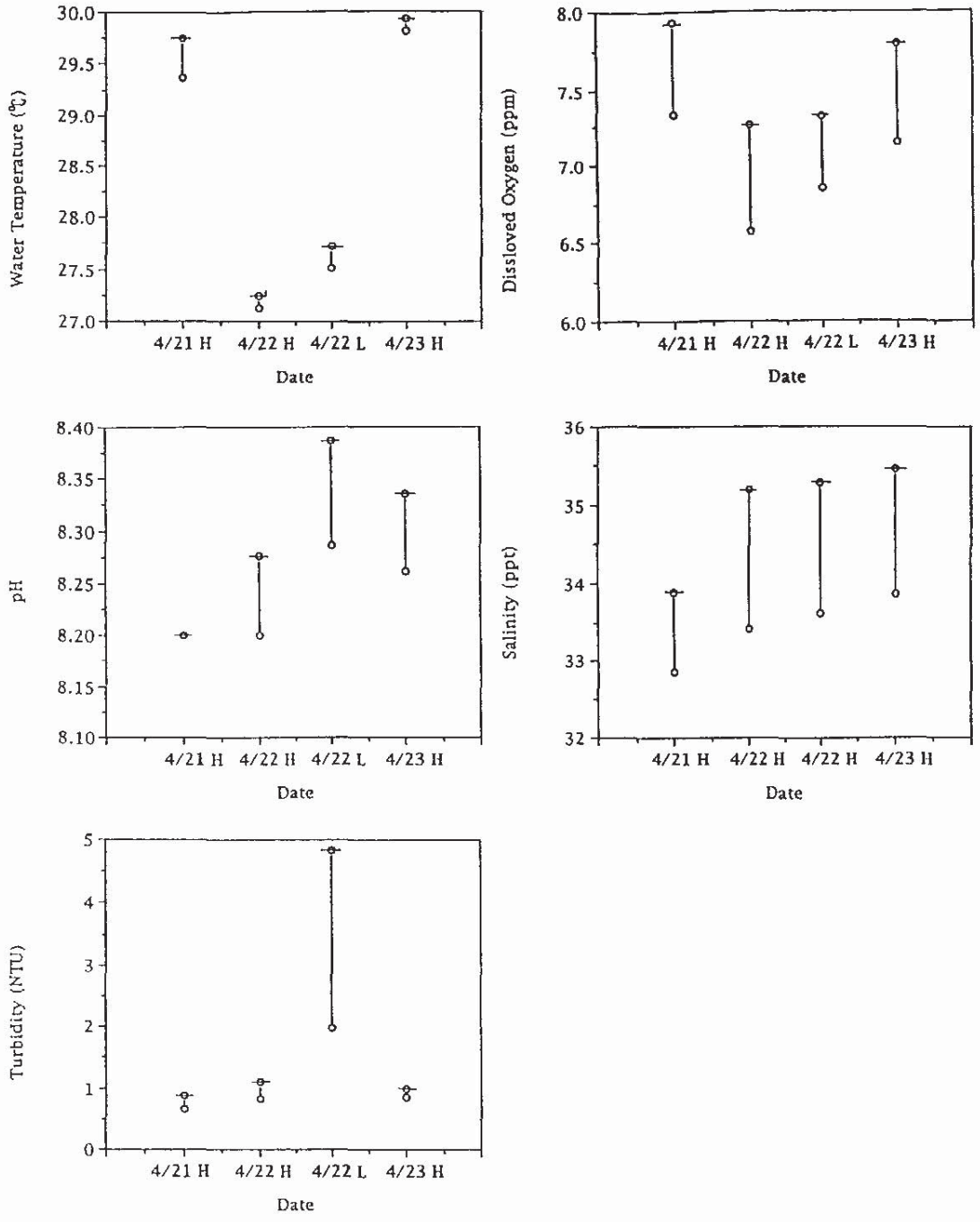
圖右上角之數字爲採樣站號



圖七 (續上頁)


(7)
Depth (m)
0
-20
-40
-60
-80
-100
-120
120 160 200 240 280 320
SiO2 (ppb)
(7)
Depth (m)
0 1 2 3 4 5 6
COD (ppm)
(8)
Depth (m)
SiO2 (ppb)
(8)
Depth (m)
COD (ppm)

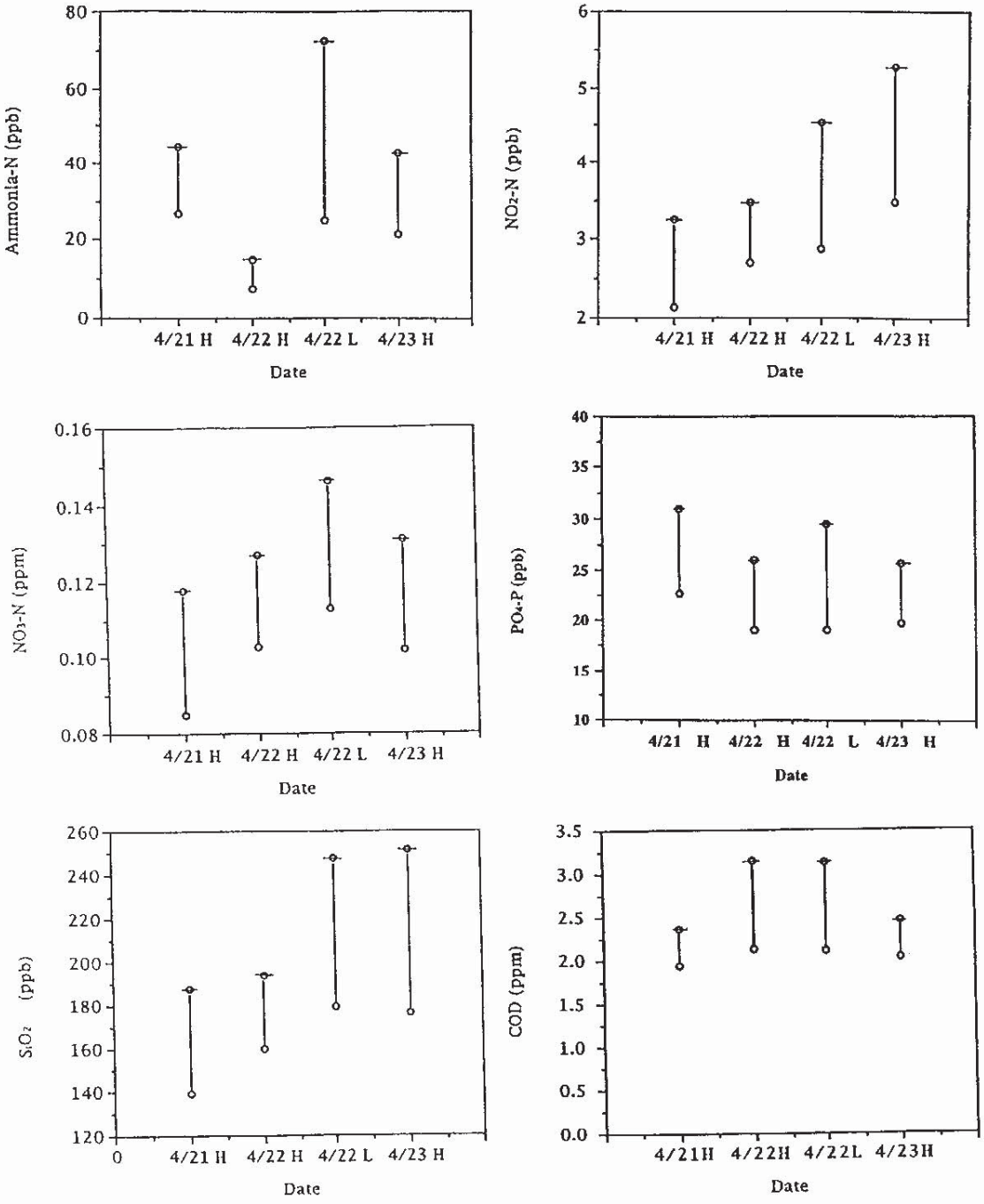
圖七 (續上頁)



圖八　民國八十三年四月二十日～二十三日太平島沿岸水域之水溫、溶氧、pH、鹽度及濁度在不同時段之變化情形

圖之表示爲平均值及正標準偏差之範圍

H: 高潮時　　L: 低潮時



圖九　民國八十三年四月二十日～二十三日太平島沿岸水域之氨態氮、亞硝酸態氮、硝酸態氮、磷酸態磷、矽酸鹽及化學需氧量在不同時段之變化情形

圖之表示爲平均值及正標準偏差之範圍

H: 高潮時　　L: 低潮時

Annex 901

Dunqian Li, "Chronicles of Stationing in the Spratly Islands", *Shanghai Miscellany*, Vol. 4, No. 6 (1998)

[…]

Chronicles of Stationing in the Spratly Islands
Foreign Magazine

Outstanding Service Setting the Dangerous Border

Chronicles of Stationing in the Spratly Islands

By Li Dunqian (Former Deputy Admiral Commander)
Foreign Magazine

Ordered to regain territory on the Spratly Islands

In late September 1946, the second year after our victory against Japan, I led eleven junior naval officers at all levels and a team of university students, who joined the army in response to Chairman Jiang's campaign for "one hundred thousand young people, one hundred thousand soldiers," and after we finished our ship training at the Central Navy Training Base in Qingdao, I succeeded the role as the captain of Zhong Ye Ship, a tank landing ship that the United States gifted our country. This was my first captain role since joining the Navy; I was very excited and decided to strive to serve the country. My class was lieutenant commander; the captains on the other three ships gifted by the United States were all senior-level colonels. Commanded by the training corps, I led 9 various types of amphibious warfare ships, which consisted of 1 tank landing ship (LST), 4 mid-size landing ships (LSM), and 4 infantry landing ships (LCI), to sail from Qingdao to Shanghai, to report for duty with the Navy fleet commander. We encountered terrible weather during our journey, which made communication on the ship very bad and commanding very difficult. When Mei Song Ship experienced a mechanical problem, the whole ship lost power and could not move forward. Fortunately, my rescue effort was successful and we all arrived in Shanghai safely. We all started to feel the hardships of sea duty service, with both bitterness and joy. The task was completed, and we were waiting at the Huangpu navy base in Shanghai for further duties. One day, we received an order from the headquarters, which asked that I lead the ships to regain the territory on the Spratly Islands. I had heard of the name Spratly Islands, but did not know anything about that place. After studying the maps, I found the location of the Spratly Islands in the most southern part of the South China Sea, near the Philippines. There were many islands, all scattered throughout the danger zone (DANGERAUS [sic] AREA). The islands seemed very, very small. My reactions to the case were: 1. the target seems small in

the danger zone; 2. the distance is quite far; 3. service in the South China Sea during wintertime is a difficult and dangerous task. I announced the order to all the crew members on the ship, and asked each department to prepare for the voyage and to collect meteorological data for the South China Sea.

To know more about this mission and the circumstances, I went to the headquarters in Nanjing the next day. After I asked each department and senior colleagues for advice, I finally knew the reason behind this mission. According to government intelligence, the Spratly Islands, since the withdrawal of Japanese troops, were then occupied by the French. So our country immediately sent navy ships to regain the territory and station there. Headquarters was very concerned about this mission. It reportedly intended to appoint a senior captain to serve the role, but a few colonel captains could not sail due to mechanical problems on their ships. Then the opportunity came to me, which made a lot of people worried. Finally I went to meet with Commander in Chief Gui Yongqing, who said before I could open my mouth: This is an important mission, work your best to execute it, and [I] wish you luck. So I took everyone's concern and good wishes back to Shanghai. After emphasizing the importance of this mission, we discussed the whole situation and the preparation. I saw the pride and passion in these soldiers; I felt safe and happy.

Ship observation with government officials

Besides regaining the territory in the Spratly Islands, headquarters was also implementing a plan to enter the Paracel Islands. Therefore, the two troops could join task forces in a journey from Shanghai to the south. The troops would separate after we arrived in Hainan Island. So the two marshaling troops were established at the same time. Each side would send two warships: Tai Ping Ship and Zhong Ye Ship would be for the Spratly Islands troop and the commander was Commodore Lin Zun; Yong Shun Ship and Zhong Jian Ship would be for the Paracel Islands troop and the commander was Commodore Yao Yuyu.

In addition to the various necessary supplies for long voyages and meteorological data that we had to prepare for the ship, there were also necessities that needed to be prepared for troops sent to station on the islands. A trailer that the soldiers could live in as well as livestock such as cattle, sheep, pigs and chickens to be bred on the islands, and a variety of vegetable seeds and pest control agents, etc., must all be prepared. In order to facilitate the transport of goods and people and equipment at headquarters, and because of time urgency, I

already started arranging for the supplies to be sent to the ships on a daily basis as soon as Zhong Ye Ship arrived at Nanjing Pukou Navy Pier from Shanghai.

With respect to regaining the territory in the Spratly Islands, there were many internal affairs and military affairs that the government had to handle; thus, each relevant unit would send a representative to observe with the fleet. Representatives from the internal affairs department were Zheng Ziyue and Cao Ximeng, representatives from the air force department were Jiang Xiaotang and Zhong Jingyuan, the representative from joint service headquarters was Dai Xufan, the representative from Guangzhou field headquarters was Li Eunsun, and the representative from the Navy hydrographic office was Liu Tianmin, a total of seven people. They were all required to station on Zhong Ye Ship, and because of that, there was a big fuss with arranging for the accommodation and storage of materials on the Zhong Ye Ship. Fortunately, because everything was well coordinated, it was all carried out smoothly and everything was well organized.

Double benefits from opening to the public

The task force was determined to set sail from Shanghai on October 24, and Zhong Ye Ship would then disembark in Nanjing on the 23rd. On the eve of sailing, the captain of Zhong Ye Ship, Officer Sun Youren, had a sudden medical emergency, which required him to leave the ship and go onshore for medical treatment. Since the ship was scheduled to disembark soon, there was not enough time to handle the staffing issue; thus, we had to let the ship sail short of staff temporarily until we completed our task and returned, at which time we could add more staff. On October 22, various types of supplies and equipment had all been transported to the ship as planned. In the morning on the 23rd, after all the representatives from various government units and troops stationing the islands had arrived at the ship, the whistle blew and the ship disembarked from the dock, sailing away from Nanjing. There was a big crowd at the dock, and the crowd kept waving at the ship, giving us their blessings. In the morning on the 24th, Zhong Ye Ship arrived at Huangpu estuary, where it joined the task force to sail south together. The destination in our navigation plan was Guangzhou and the second destination was Hainan Island. Because the Paracel and Spratly Islands are located in the South China Sea, very close to Guangzhou, the government thought that it could be included in the Guangdong Province territory. Therefore, we could take the opportunity to visit the then Chairman of the National Government in Guangzhou Field Headquarters Director, General Lo Zhuoying. Our fleet arrived in Guangdong on the 26th, anchoring at the Humen

estuary. The two commanders, along with the four captains and government representatives, went to the Guangzhou provincial government to meet with Guangzhou Field Headquarters Director and Governor of Guangdong Province General Lo Zhuoying. After we reported our tasks for this trip and the situation, Governor Lo learned that the ships in our fleet were all new warships from the United States and they all weighed at least one to two thousand tons, he immediately stated that people there had only seen old-fashioned warships that weighed a couple hundred tons and were all suffering a threat from Japanese warships during the war. Now that our country had such large and modern warships, he hoped we could open the ships to the public and the people in Guangzhou would be really happy. So we returned to the ships immediately, sailed the ships to the Guangzhou White Swan Pond, and opened for the public to visit. On October 29, we hosted a grand reception on the Zhong Ye Ship, and invited Governor Lo and party officials, police and reporters, as well as [people from] all walks of life in Guangzhou to attend. The guests all praised how new the ships' equipment was and how well they were maintained. Given that the ships were open to the public, not only were the people in Guangzhou really happy, but at the same time our troop was encouraged and felt comfort from this. Thus, this was a successful political activity outside of sailing.

Return Sail Upon Strong Winds and Waves

After the fleet stopped in Guangzhou for five days, it was determined to continue sailing south, arriving at the harbor of Yulin Gang in Hainan Island; Yulin Gang is a beautiful natural deep water harbor in the south of Hainan Islands with a wide outer harbor, mountain barrier, built with a complete inner harbor that allows four vessels of three hundred feet to pass through side by side. There were good barracks onshore, with our own naval patrol which made routine supplying of materials for our fleet rather convenient. In addition to coordinating fleets and observing the weather conditions there, the fleet interviewed the fishermen regarding the situations in the Spratly Islands and learned that the slopes are generally low in the Spratly Islands, leading them to purchase two wooden rafts there and take them for backup use. The Paracel Islands are about one hundred and fifty nautical miles from Yulin Gang, which can be reached within one day of sailing. The Spratly Islands are about five hundred and fifty nautical miles from Yulin Gang, which can be reached after sailing for three days and nights. After we arrived at Yulin Gang, there had not been a day without strong winds and waves at sea. After more than one week Commander Lin had still not decided on a sail date. Government delegates were unaccustomed to staying on the ship for a long period of time, and after learning that the Paracel Islands crew had completed their

mission and returned, they became very anxious and once again discussed with me to urge Commander Lin to set sail as soon as possible, advising the Commander to set sail on November 10. That day was a sunny day. The sun was glaring from the surface of the ocean. After two fleets departed from the harbor consecutively, only waves could be seen as the body of the fleets wavered. As the navigation plan was about to be put in place, the flagship raised the signal flag which led the Zhong Ye Ship to sail in front of Tai Ping Ship by two hundred nautical miles. Although at the time the reasoning was not understood, obedience is a military duty, so the subordinates were ordered to execute and accelerate toward the position in front of Tai Ping Ship. Delegates were still in bed due to seasickness. Zhong Ye deputy captain Yang Hong Xiu was also bedridden after suffering from a bad cold that day and unable to participate in the sailing work. Therefore I was fully responsible for the sailing. After sailing for about three hours, I received a phone call from the flagship informing that there was a failure in Tai Ping Ship's compass which required the ship to return to Yulin Gang for repairs. We then followed the ship and returned to dock at Yulin Gang. After the delegates learned of the return sail matter and how during sailing Zhong Ye Ship was sailing in front of Tai Ping Ship, they expressed their impatience and grievances of inequality. Therefore, one delegate wrote a limerick. I remember two of the lines were: "could it be new naval regulations, goes as far as putting the front in the back." This became a joke for some time. The strange thing was that when I went to the flagship, Commander Lin told me that after Tai Ping Ship arrived at the harbor the compass became normal. It was unbelievable.

After we returned, we stopped for more than a week. Once again I requested the consent of the Commander, who agreed to set sail again on November 19. That day was also sunny with sea waves surging. After we departed the harbor early in the morning, the flagship raised the signal flag again, leading the Zhong Ye Ship to sail to the left and rear of Tai Ping Ship by one hundred yards. Speculating its intention, it seemed to be using Zhong Ye Ship to shield the winds and waves for a brighter future. As the winds were blowing fast and the waves were surging high, the two ships were still wavering continuously in the big waves and could not help each other. Someone once who wrote an essay, saying: in the winter, the South China Sea is like a bad-tempered young woman, raging unsparingly. I would think this was a good opportunity for someone like me with no maritime experience to hone my determination and courage. It was this way that everyone had silently battled the strong winds and waves for one whole day. Around five o'clock in the afternoon, I received a phone call from the flagship, saying that in front of the ship was a large low pressure with the possibility

of becoming a typhoon. If we continued sailing ahead, it would be very dangerous. They asked me for my opinion, and I answered that we should let the Commander decide, and he immediately responded by saying the fleet should return to Yulin Gang. I could only follow and return. It was very hard to sail for one hundred nautical miles and now we had to sail against the winds and waves for another one hundred nautical miles. It wasted both time and energy. After returning and docking at Yulin Gang, it was another week or so without news. It was already difficult for the government delegates to live at sea. Now seeing that recovering the Spratly Islands might not be in the foreseeable future, one after another of the delegates called Nanjing service unit to ask for instructions on return. However, Nanjing replied that they could not return as the mission was not complete, and everything was at the disposal of the Navy.

Lone Ship Completed the Arduous Mission

Since we were stranded at sea for a long period of time, caring for the equipment, livestock, and various materials on the ship became very difficult. I was also very anxious, and at the time felt ashamed that as a Navy soldier, I could not accomplish the mission for a long time due to adverse weather conditions. It was at that moment I suddenly came up with an out-of-the-ordinary idea, which was to get rid of the timid and incompetent Commander's constraints and set sail on my own. I was determined to make the voyage to the Spratly Islands and complete the mission to show my new Navy officer spirit of defying hardships and difficulties.

My heart was at once filled with energy. At dinner that day (December 7), I announced to the delegates my decision, and said I could sail alone to the Spratly Islands and show everyone what we planned on recovering, which was the main island of the Spratly Islands: Long Island. Whether the island was occupied by the French and whether our troops could land and recover the island would be determined once I arrived and observed the conditions. What I worried was that, if Commander Lin was enraged by my actions, he would accuse me of disobeying orders. The delegates were willing to testify on my behalf that I was not only not disobeying orders, but was actually executing orders. Since then, I was determined to do as I intended. I informed the various departments of the fleet to pay attention as the following morning I would board the Tai Ping Ship to agree with Commander Lin on setting sail again on December 9. That day at eight o'clock in the morning, the two ships consecutively departed the harbor, with Tai Ping Ship in the front, and Zhong Ye Ship in the back. Once we

were at sea, the flagship, like it did in the two previous times, raised a signal flag. However, this time I disregarded it and sailed ahead according to my navigation plan toward my goal. Even though the delegates were afraid of seasickness and still in bed, they were aware that this time we were certainly heading toward our goal in the direction of the Spratly Islands. I stayed on the bridge for a long period of time to pay attention to navigation. While at sea, other than the sharp sounds coming from the ship ropes being blown by strong winds and the deafening noise coming from the waves surging against the sides of the ship, there was only ocean spray in the air. I turned around to look at the stern of the ship and only saw Tai Ping Ship swaying back and forth six nautical miles behind the back of my ship. I thought to myself that this was exactly what he wished for. I fully concentrated on watching the pointer on the compass in the bridge, hoping to stabilize the ship's position without too much deviation, so that we could reach our destination safely. It was just that the waves were big and the body of the ship could not be stabilized, and I could not work day and night to predict the weather conditions and select the correct ship position, which made me feel uncertain. Therefore I could only repeatedly remind the steering soldiers to pay attention. For three days I remained on the bridge, and even had food delivered to me. Even though that was the case, in such an adverse sea, on a three-day-and-night-long voyage, it was almost impossible to ensure the ship position did not deviate. Fortunately, since Zhong Ye Ship had set sail this time, the conditions on the ship had been good, which gave me peace of mind. On the third day, according to the navigation plan, the ship was entering the dangerous zone of the sea. Success was not too far away. I was both excited and nervous. I spent the night counting it by the minute and second. Based on my calculation, the following day (December 12) at six o'clock in the morning, we would arrive at the northwest side of Long Island, covering an area of ten to twenty nautical miles, which would allow us to see Long Island. Therefore, at four o'clock in the morning of the 12th, I ordered deck personnel to each use their binoculars to look out at the surroundings, specifically focusing straight ahead to try to search, in hopes that there would be a discovery as soon as possible. I was very anxious on the inside because six o'clock was a key moment. If there was no discovery, I could no longer trust the ship's position at that moment and would be trapped in a dangerous zone. In addition to opening my eyes wide to look, I ordered everyone to pay attention. As time passed by the minutes and seconds, I tried to be patient and keep calm, waiting for a miracle to happen. The sky slowly became dim. I repeatedly asked everyone if there was any discovery and they all replied no. I was very nervous.

Lived Up to Expectations and Arrived at the Destination

Strange to say! It was at that moment when I suddenly realized in a place straight ahead very far away, there was a wave that did not move. I stared at it closely for fear of losing it, and told everyone to look ahead. Because the target was too small, it could not easily be found, and everyone said they did not see it. The more I looked at it, the more I was preoccupied: at first it was like a line on the horizon, then the line slowly became thicker. Since the ship was continuously sailing ahead, the distance became shorter. And since the sky was clearing up, visibility became better and this line on the horizon became the place I pursued until an uneven and prominent phenomenon gradually emerged. I shouted and told everyone to quickly look, then they discovered it. After six o'clock as the sun rose, it shined on the splendid scenery ahead. I could already see trees, and could clearly see an island appearing in front of us. It did not deviate much from the time and location I had calculated. It was a miracle. My heart was filled with joy, and everyone was jumping for joy, crying loudly; we had arrived at the Spratly Islands. As we got closer it became more visible.

After dawn, the sea was calm and the ship sailed in a vast expanse of coral reef layers. The deep blue waters reflected the bright white coral reefs in spectacular colors, which made everyone feel great. Once we sent a telegram to the Nanjing headquarters to report our arrival at the Spratly Islands, the delegates were called to come ashore. Once the delegates saw the small, beautiful island in front of them, they felt joy that could not be described with words. Everyone congratulated me and the ship was full of joy at the moment. After sending the telegram to headquarters, I immediately notified the Tai Ping Ship, which was the ship trailing behind me. When the Tai Ping Ship received the news, it immediately accelerated forward until large underwater coral reefs were seen ahead. At an anchor seven nautical miles from the outlying islands, I wanted to implement unloading operations as close as possible to the side of the island. Looking at the island from a distance, there had not been any activity whatsoever, so I let out the anchor about two hundred yards from the island, and promptly dispatched two groups of armed soldiers. They traveled in two separate dinghies to land at the beach for raid and search. At the same time, those who were on the ship were preparing for backup support. After a twenty-minute-long observation, we raised a white flag on the island. There was no known enemy and the situation was favorable; therefore we immediately issued an order to transport the crew members and unload supplies. While we were simultaneously gathering more information about the landing and search, and actively carrying out the transporting and unloading operations, the telegraph headquarters received an award from the

Commander to the delight and satisfaction of all of the soldiers. According to reports by the crew members who were gathering information about the landing and search, there was only a German shepherd dog and a few buildings on the island. The forests were dense and many were coconut trees covered with coconuts. Once we began transporting the crew members and unloading supplies, I immediately issued rules for everyone to abide by: (1) before the transporting operations were complete, no one on the ship was allowed to disembark to sightsee; (2) no one was allowed to pick the flowers, plants, and fruits on the island because they should be saved as food supplies for the officers stationed on the island. By this time, the delegates had regained their spirits and prepared to disembark in order to carry out their individual assignments. Commander Yang of the Zhong Ye Ship had also completely recovered and was busy directing every department to actively work on their assignments. Everything was going very smoothly. The plan was to complete the unloading operations within three days and to make proper living arrangements for the officers stationed on the island, so that they would be ready to set sail without experiencing any difficulties in case there were inclement weather conditions.

Feeling Energized Upon Landing on the Island for Patrol

Although I had not slept or rested in three days, at this moment, I was in very good spirits to see that the unloading operations were going very smoothly and was very happy on the inside. I promptly accompanied the delegates to disembark and tour the island, but I did not see Commander Lin disembark. Special government officials sent a small ship toward the Tai Ping Ship to receive everyone onboard and ordered for the Commander, captain, and certain officers to be picked up first, followed by the other officers in batches later on. They informed the high ranking officers about the rules set by the Zhong Ye Ship, without any exception, that they were not allowed to pick the fruits on the island and so forth. When Commander Lin and Captain Mai of the Tai Ping Ship arrived, they immediately inspected the island with the delegates, happily witnessing trees, flowers, and plants everywhere. Everyone said it was like a beautiful garden on the sea. A stone was then found on the island, with the date of October 1946 carved on it in French. Apparently after the Japanese army retreated, the French talents had landed there. Touring the inner part of the island, there was an ancient Chinese-style temple building. There was an old clear spring in the center of the island, which served as the water source for the officers stationed on the island, and the water was refreshing and delicious. A German shepherd was also seen, and it still looked physically healthy and mentally strong. It was speculated that the dog fed itself off the shrimp and fish

left behind in the reefs that appeared when there was low tide on the beach. When we returned to the ship, we saw that the officers from the Tai Ping Ship had carried coconuts back. According to the crew on the Zhong Ye Ship, all of the coconuts on the island had been picked. I could only force a smile. For dinner, I prepared special dishes to go along with wine and invited Commander Lin and the delegates over to eat and celebrate. While we were joyously chatting, we suddenly heard gunfire from the sea and everyone was shocked. At first, I wondered whether it was an attack on my fleet by another country's ship and therefore immediately ordered the crew to turn on the radar so we could investigate. After continuously observing from the lookout, we did not see any target at sea. The discovered gunfire was shot from the Tai Ping Ship to the sky. I immediately called Tai Ping Ship to inquire the purpose and there was initially no response as it continued to fire shots. After about five minutes, the gunfire stopped. Tai Ping Ship called and stated that the gunfire was shot in celebration of success in recovering the Spratly Islands. After the delegates learned of the response from Tai Ping Ship, they were very angry. They challenged and directed at Commander Lin, saying: "Was it you who advocated these actions taken by Tai Ping Ship? Why was Zhong Ye Ship not informed? The gun power on these military ships is equipped to defend against enemies. How can it be recklessly manipulated to threaten friends of the ship?"

Even though Commander Lin forcefully denied this, there was no delegate who was not extremely shocked, who could suppress their anger, which caused everybody to raise their fists to hit Commander Lin. Since I feared that a serious incident would occur, I used light force to obstruct them and then asked each delegate to temporarily calm down and allow me to send Commander Lin to the Tai Ping Ship to investigate the truth and then handle it from there. That resolved the problem, and then I took Commander Lin away. According to the rules for our mission this time, the Tai Ping Ship was responsible for other security alerts and the duty of patrolling between the islands while the Zhong Ye Ship unloaded. However, the Tai Ping Ship actually left the next morning and sent a telegram to report to the Zhong Ye Ship that it was heading back to Guangzhou. Due to the good weather and cooperation between the Zhong Ye Ship and the officers stationed on the island, the unloading operations were carried out very quickly and were completed on the 14th as planned. Then a holiday was declared and everyone was touring the island, all cheering along.

Highest Honor of Marking Boundaries through Hardships and Perils

On the morning of December 15, I gathered all of the brothers on the island, officers from the Zhong Ye Ship, and the government delegates, and held a successful ceremony celebrating our arrival in the Spratly Islands. We established a Chinese monument there as well to mark our boundaries. At noon, I shared a meal with the delegates and the officers stationed on the island to bid each other farewell. I also looked around at the living facilities of the officers stationed on the island, which everyone was satisfied with. The Zhong Ye Ship left the Spratly Islands on the morning of December 16. After it arrived first in Guangzhou, Chairman Luo learned about our victory in recovering the Spratly Islands and expressed his happiness. A grand feast was thrown and awards were granted to the officers of the ship. In the local Guangzhou newspaper, it was continuously reported for several days that the government sent ships to recover the Spratly Islands. The delegates also used the voyage route of the fleet that carried out this mission of recovering the Spratly Islands to design a picture with words and explanations. The first and last name of every one of the delegates, and the ship's captain, secondary commander, chief engineer, engineering officers, and others were engraved on both sides of an ivory tile. Everyone held one tile as commemoration. They contained deep meanings. I copied the text of the accompanying notes, which are as follows: "December 12 of the thirty-fifth year of the Republic of China [1946] is the date that the country's delegates and the Tai Ping and Zhong Ye Warships entered our Spratly Island's main island Tai Ping Island pursuant to orders. On October 23 of the same year, the ship set sail on a course of two thousand nautical miles, braving through perilous situations over fifty-one days and exploring upon arrival. The Chairperson will, through practical examination methods, create protocols for permanent construction. Landing, exploration, survey, establishment of monument and other tasks were all completed. From here on, mountains and rivers are in permanent existence. The colleagues who won the battle are to be remembered." Using the phrase and naming the mission as "marking boundaries through hardships and perils," it represented depth and longevity. At this moment, the mission of recovering the Spratly Islands was fully completed. Representatives departed Guangzhou on ships and returned to their respective homes.

After the Zhong Ye Ship had been in Guangzhou for a week for repairs, it then returned to Shanghai. Shortly thereafter, the officers were respectively rewarded at headquarters and everyone was really happy. President Jiang Zhong Zheng gave three of the islands as part of the Spratly Islands their names, which are Zhong Ye Reefs, Dun Qian Sandbars, and Hong

Xiu Island, while Deputy Chief Yang and I received the highest honor and are remembered for this mission, especially for stationing at the main island Tai Ping Island.

Editorial Report **Editor**

- In issue 380 page 15 of this magazine, top column line 8 should be "eight six years of age." The first character in the middle column line 15 should be "designate," the eighth character in line 16 should be "country." In the bottom column of page 19, the last character in line 5, "attack," should be deleted.
- In issue 381 page 22, top column, "Gu Gong Liang Travels to Shanghai and Beijing" poem, the second to the last verse should be corrected as "borrowed carpet sent by irony." Readers please be advised.

Foreign Photo Page

[photo]
(1) Group photo of author Li Dui Qian and good friend Li Li Bo (back center), Tang Chi (back right), Wang Cheng Sheng (front left), and others.
(2) Before Li Dui Qian was stationed in the Spratly Islands, he went to visit Commander Gui Yong Qing. Pictured here is a photo of Gui Yong Qing (right) and Zhou Zhi Rou (left).

[photo]

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[photo]
(1) Group photo of author Li Dui Qian (back row right) earlier at the Institute for Defense, with researcher Wang Jie (front row second from the right) and others.
(2) Photo of Li Dui Qian (second from the right) and Professor Wang Cheng Sheng (second from the left).

[photo]

[…]

[photo]
1) When General Li Dui Qian recovered the Spratly Islands and returned to Guangzhou, he received a feast and hospitality from Guangdong Bank Director, General Lo Cho Ying. Pictured here is a photo of Lo Cho Ying (third from the left) with his colleagues at the time he was commanding operations.
2) Lo Cho Ying at the time he was at Bao Ding Military Academy.
3) Photo of Lo Cho Ying when he attended the first meeting of the National Assembly in 1946.

[photo]
[…]

艱險定疆奇功立

進駐南沙群島記實

● 李敦謙（前海軍中將副總司令）

奉命收復南沙群島

民國三十五年（一九四六），我國對日抗戰勝利後的第二年，九月下旬，我帶領十一位海軍各級初級軍官，和一夥抗戰期間服膺蔣委員長「十萬青年十萬軍」號召，投筆從戎的大專學生，在青島中央海軍訓練團接艦班受訓完畢，接任了美贈我國坦克車登陸艦中業號艦長。這是我投入海軍後首任艦長職務，好興奮，我決心要努力爲國家服務。我的階級是海軍少校，當時另有美贈我國同型艦三艘，艦長都是資深上校；我奉了訓練團的命令，率領已接收美贈各型兩棲登陸作戰艦隻九艘，計坦克登陸艦（LST）一艘，中型登陸艦（LSM）四艘，步兵登陸艦（LCI）四艘，自青島駛往上海，向我海軍艦隊指揮部報到。途中遇惡劣天候，艦隊通訊不良，指揮十分困難，美頌艦又發生電機損壞，全艦失去動力，不能航行。幸經我拖救成功，全部安全抵達上海，初嚐海上服勤艱辛，苦樂兼具，任務完畢後，正在上海黃浦江海軍基地整補待命。有一天，接到總部命令，要我率艦執行收復南沙群島的任務。南沙群島這一名詞我曾聽過，那地方的情形卻不清楚，經翻閱海圖後，我在南中國海最南邊靠近菲律賓的地方，找到了南沙群島的位置，島很多，都散佈在註有危險區的範圍內（DANGERAUS AREA），顯得很小很小。當時我對本案的反應是：1.目標小，在危險區；2.航程相當遠；3.時候在冬季的南中國海，是一件艱苦兼具危險性的任務。我向艦上宣布了這個命令，並囑各部門即著手遠航的準備，要蒐集一些南中國海的氣象資料。

我爲了要多瞭解些有關此次任務的情形，次日我即趕往南京總部，由各部門打聽並請教一些前輩們的意見，才知道此案之來由，是因政府情報得知南沙群島自日軍撤走以後，現爲法國所佔據，特令海軍從速派艦前往收復進駐。總部對此案非常重視，據說原擬選派一位資深艦長擔任的，因幾位上校艦長均以艦機故障爲由，不能出航。才臨到了我的，因之不少人爲我十分擔心。最後我去見桂永清總司令時，他不待我開口便說：這是一項重要的任務，努力去執行，祝你成功。就這樣我帶著大家的關心和祝福回到了上海，我除了對艦上官兵強調此次任務之重要性外，便和大家研討全般準備的情形，看到了官兵們高昂的工作情緒時，我內心裡覺得平安和

愉快。

政府官員隨艦勘察

總部爲了收復南沙群島之同時，對西沙群島之進駐工作也一同實施，以便兩組任務兵力可以一同自上海結隊南下。到了海南島之後，再各自分開執行任務，於是兩組兵力編組同時奉令成立，每一方面規定軍艦兩艘，南沙群島任務支隊爲太平艦和中業艦；指揮官是林遵代將，西沙群島任務支隊爲永順艦和中建艦，指揮官是姚汝鈺代將。

準備工作除了艦上本身長途航行中必須之各項補給品和南中國海方面之氣象資料外，還有派駐島上之衛戍兵力與彼等在島上生活必需之物品，包括一個連官兵居住之活動房屋以及計劃在島上生產繁殖之畜類，如牛、羊、豬、雞等和各種蔬菜種子與殺蟲滅鼠等之藥劑，皆已備妥，爲了與總部各部門聯絡及物資和人員裝備運送之方便，我將中業艦自上海開抵南京浦口海軍碼頭，因時間急迫，各項物資已開始逐日不斷的運送到艦。

政府爲此次南沙群島之收復，關係內政、軍事各方面事務甚多，特由各有關單位派代表隨同艦隊前往勘察，計內政部代表爲鄭資約、曹熙孟，空軍總部代表蔣孝棠、仲景元，聯勤總部代表戴蕃瑱，廣州行轅代表李恩蓀，海軍海道測量局代表劉天民，共計七員，規定均駐宿中業艦，因之中業艦對物資之存儲和人員住宿之安排大費周章，幸皆因協調良好，進行順利，一切都得以安排妥善。

開放參觀雙重收穫

任務支隊決定十月二十四日由上海啓航，中業艦定廿三日離開南京，在開航之前夕，中業艦航海官孫幼仁上尉突告病發，不能隨艦工作，留岸就醫；又以開航在即，不及辦理人員補充，祇有暫時任其缺員，俟任務完畢返航後，再行補充。十月二十二日各類物資器材均已全部按計劃運送到艦完畢，二十三日清晨政府各單位代表和駐島兵力到艦後，艦在一聲汽笛長鳴之後離開了碼頭，駛離南京。碼頭上站滿了送行的人群，不停的向艦上揮手，給我們祝福。中業艦於二十四日上午到黃浦江口與任務支隊各艦會合，一同編隊出海向南行駛，我們航行計劃的第一目標是廣州，第二目標是海南島。因爲西、南沙兩個群島均位於南中國海域，接近廣東省，政府考慮，將可劃歸廣東省版圖，所以順道去拜訪當時國民政府主席廣州行轅主任羅卓英將軍。我們艦隊於二十六日抵達廣東，錨泊虎門口外，兩位指揮官四位艦長，和政府代表們一同登岸赴廣州省政府拜會廣州行轅主任兼廣東省主席羅卓英將軍，經面報此行任務及兵力情形後，羅主席得悉艦隊兵力皆爲美國新式軍艦，且噸位有達三千噸以上者，當即謂此間民眾以往只看過我們自己幾百噸之老式軍艦，抗戰期間更受盡日本軍艦之威脅，如今我國已有如此新式大軍艦，望能開進廣州給民眾看了高興高興。於是我們立即回艦，將艦隻開到廣州白鵝潭水面錨泊，開放給市民參觀。並於十月二十九日在中業艦上舉辦盛大之酒會，邀請羅主席及廣州市黨政軍警記者和各界人士登艦參加，集一時之盛，貴賓們異口同聲讚許軍艦裝備之新穎和保養維護之良好。由於艦隊之開放參觀，不但歡娛了廣州市民眾，同時使艦隊官兵受到了鼓舞和慰藉，是此次艦隊航行在外一次成功的政治活動。

狂風暴浪再度回航

艦隊在廣州停了五天，啓錠繼續向南航行抵達海南島之榆林港靠泊碼頭；榆林港是海南島南面一個美麗的天然深水港灣，外港寬暢，有高山屏障，內港築有一完整之碼頭，可供三〇〇呎長之船隻單靠四艘而有餘。岸上有寬大良好兵舍，我海軍設有巡防處在此，對我艦隊一般物資之補充甚爲方便。艦隊在此除各艦之整補與對天候海象之觀察外，並探訪此間漁民有關南沙群島方面之情況，得悉南沙諸島一般都坡度很低，特就地購置了木划兩艘帶往備用。西沙群島離榆林港約一五〇浬，一日航程可達，南沙群島離榆林港約五五〇浬之遙，須三晝夜之航程方可到達，我們抵榆林港之後，海面上竟然無一日不是大風大浪，一個多星期來林指揮官迄無啓航日期之決定，政府代表們長居艦上甚不習慣，得知西沙群島任務支隊已經完成任務回航之消息後，更是非常著急，一再和我商量催林指揮官早日開航，經請示指揮官決定十一月十日出航。是日也天晴日出，海面陽光刺眼，兩艦相繼出港後，只見海浪掀天，艦身顛擺，正按航行計劃就位時，見旗艦拉上信號旗令中業艦駛向太平艦前方二〇〇碼，當時雖不了解是何道理，但服從是軍人天職，即令屬下執行，加速航進到太平艦之前就位。代表們因暈船均睡在床上未起，中業艦副長楊鴻庥亦於是日患重感冒臥床不起，無法參與工作，因此航行作業由我一人完全負責。航行了約三個多小時收到旗艦的電話，告以太平艦的羅經發生故障，必須回榆林港修理，於是便隨之回到榆林港靠泊，當代表們知道了回航之事和在航行中著中業艦在太平艦之前領航，益增心急和不平之氣，因此有代表作了打油詩一首，記得其中兩句是：「莫非海軍新規定，竟把前行當後行」，一時傳爲笑話，奇怪的是當我到旗艦時，林指揮官告訴我說太平艦進港後羅經便正常了，真不可思議。

回航後又停了一個多星期，經我又請得指揮官之同意，決定十一月十九日再出航。當日也是陽光普照，海面浪濤洶湧，一早出港後，旗艦又掛信號旗令中業艦航行於太平艦左後方一百碼處，揣其用意，似有利用中業艦爲其阻擋風浪，然而海闊天空，風急浪高，兩艦仍然都是在大浪裡搖擺不停，誰也幫不了誰的忙，曾有人寫文章說：冬季裡的南中國海像潑辣的少婦一樣，一點不留情的肆虐，我倒以爲這正是磨練我這無海上經驗者堅毅奮勇的好機會。就這樣大家默默無聲的和狂風暴浪搏鬥了一整天，到下午五時左右，接到旗艦的電話說：航向前方有一個大低氣壓，有形成颱風的可能，若繼續前進，正好碰上非常危險，問我意見如何，我答當由指揮官決定之，他即回話艦隊回榆林港，我只得又跟隨回航，很艱苦的航行了一百多浬，現又要頂風頂浪再航行一百多浬，時間和體力全都浪費了，回到榆林港停靠後，又是一個多星期沒有消息，政府代表們對艦上生活本感辛苦，如今又見收復南沙群島遙遙無期，乃紛紛電南京服務單位請示離艦回京，但南京覆電以任務未完成不可回京，一切聽由海軍處置。

獨航完成艱鉅任務

由於滯留海上日久，艦上裝備之畜類和各種物資料理更是十分困難，我自己也焦急得不得了，且時感以身爲海軍軍人竟因天候不良，久久不能達成任務也感到抱愧。就在此時，心裡忽然起了一個非凡的想法，就是要擺脫那個膽小無能的林指揮官的約束，單獨航行，決心航抵南沙群島，完成任務，以顯現我新海軍不畏苦，不

怕難之精神。一時內心裡充滿了熱力，就在當日（十二月七日）晚餐席上，向代表們宣布了我此一決定，並說我可以單獨航行到達南沙群島，給各位可以親眼看到我們要收復南沙群島中之主島—長島，但島上有無法國人佔領，我們的兵力能否登陸作收復行動，要到達之後看情況再作決定。惟我所耽心的是，假如林指揮官以我如此行動，激怒了他，他將會告我違抗命令的，當時代表們一致願為我作證，並謂我非但不是違抗命令，而是真正的執行命令。經此之後，我便決心照我的想法去做，當即告知艦上各部門特別注意，次日清晨我登太平艦和林指揮官商妥，定十二月九日再出發，是日早上八時，兩艦相繼出港，太平艦在前，中業艦在後，一到海上，旗艦和前兩次一樣掛出旗號，但這次我卻未予置理，按照我自己的航行計劃一往直前，航向我的理想。各代表雖然仍是怕昏船睡床未起，但他們內心裡都明白此次是確定的向南沙群島目標前進的，我則長時間留在駕駛台上注意航行，海上除了狂風吹著艦上的繩索發出尖銳的聲響和浪濤洶湧的打擊船邊震耳欲聾的聲音外，祇有滿天浪花的飛揚。我回頭遙望艦尾後方，只見太平艦跟在本艦後方六浬水面上搖搖擺擺，我心裡想這也許正合了他的心願哩，我全心的注視著駕駛台上羅經的方位指針，希望穩住船位，不要發生太大偏差，能安全的到達目的地。只是海面浪大，艦身不得穩定，日夜皆無法作測天工作，不能較正船位，令我最不放心，因此只有不斷的提醒操舵士兵注意。三天來我一直逗留在駕駛台上，連飲食都是送上去吃的。雖然如此，在這樣惡劣的海上，三晝夜長遠的航程，要確保船位之不偏差，簡直是不可能的。所幸中業艦此次自出航以來，每天在強風大浪中航行，艦上的情況，一切均尚保持良好，頗感心安，到了第三天，按計劃艦已航進到危險區的海域，離成功之時也不遠了。我既興奮又緊張，一夜之中我是在一分一秒的計時中度過。照我的計算，次日（十二月十二日）早上六時天將吐白之際，可以到達長島之西北面十至二十浬處，能夠看得到長島的，因此我十二日凌晨四時，便吩咐艙面人員各持望遠鏡向四週瞭望，特別注意正前方，盡力搜索，以求儘早能有所發現。內心裡確實焦急得不得了，因為早上六點鐘是一個關鍵時刻，若到時無所發現，我將不能相信此刻的船位，而將陷我於危險之境。我除了自己睜大眼睛極力瞭望，一面囑咐大家注意，時間一分一秒的過去，我盡力忍耐，力持鎮定，等待奇蹟出現，天色漸漸有些昏昏暗暗的樣子，我不停的問大家有無發現，都回答沒有，我好緊張。

不負眾望到達目的

說也奇怪！就在此時我突然發覺正前方很遠很遠的地方，有一個波浪沒有變動，我極力的盯住他，生怕會失掉，並叫大家向前方看。因為目標太小，不易被人發現，都說沒有看到，我自己卻越看越出神：起初像是天邊的一線，漸漸的線變粗了，又由於艦不停前進，距離縮短，加上天色漸明，視界轉好，於是這天邊的一線便成了我一心追求的地方，漸漸的現出了不平和突出的現象。我便大聲叫喊，要大家趕快看，這才被大家發現了，六點鐘過後，天邊日出，照耀得前方景色燦爛，已可以看到樹梢了，而且已清楚的看見一個海島出現在我們的前面，正和我計算的時間和地點幾無甚偏差，真是奇蹟。我心裡充滿了喜悅，大家也都高興得跳起來，大聲的叫著南沙島到了，越接近便越看得清楚

，天亮以後，海面也平靜了，此時艦航行在一片一望無際珊瑚礁層的海面上，深藍色的海水裡反映著白色珊瑚礁艷麗壯觀的色彩，令人覺得偉大無比。當即發電到南京總部，報告到達南沙群島情形，並喚請代表們到艙面上來，代表們看到了此一美麗小島就在眼前時，個個歡欣之情溢於言表，都齊向我祝賀，一時全艦充滿了歡樂。我於電報總部之後，即通知尾隨我後之太平艦；太平艦得報後，立即加速超前，但一見海底碩大之珊瑚礁層，便停駛不敢前進，就在離島約七浬處錨泊，我艦爲要實施卸載作業，儘可能向島邊接近。遙望島上沒有任何動靜，便在離島約二百碼處下錠錨泊，並即派武裝士兵兩組，分乘兩艘登陸小艇，實施搶灘登陸，突擊搜索，同時艦上備戰支援。經約二十分鐘之偵察後，見島上發射出白色信號，知是沒有敵情，情況良好，此即下令開始運送人員和物資作業，一面將登陸搜索情形與正積極展開運輸卸載作業，電報總部，當即收到總司令覆電嘉獎，官兵皆大歡喜。根據登陸搜索人員回艦報告，全島只發現一隻德國狼犬和一些建築物，樹林很茂密，其中不少是椰子樹，都結滿了椰子。艦上在開始人員和物資卸載作業後，我即發布大家應遵守事項：(1)登陸運輸作業未完成之前，艦上官兵不得上陸遊覽；(2)島上花草和水果不可採摘，留與駐島人員食用。此時代表們皆已恢復精神，正準備上陸執行各別的任務作業，中業艦楊副長也已痊癒，正忙於指揮各部門積極作業中，一切都進行得很順利，計劃三日之內一切下卸完畢，並須對駐島官兵生活有關事項作妥善之安排，以防天候發生變化時，隨時可以啓航離開，不致遭遇困難。

精神百倍登島巡視

我雖然不眠不休達三晝夜，此時我卻精神百倍，看著下卸工作極爲順利，內心至感愉快，即欲陪同代表們登島巡視，惟久未見林指揮官下船，特派官員乘小艇前往太平艦迎接，並囑咐此次先接指揮官和艦長及部分官兵，以後再派艇接送分批下艦之官兵，且將中業艦規定登島之艦上官兵，一律不可採摘島上之水果等事項告知。當林指揮官和太平艦麥艦長到時，即會同代表們登島視察，欣見島上綠樹成蔭，花草遍地，均稱是一所美麗的海上花園。隨即發現石碑一座，上刻法文，日期是一九四六年十月，顯見是日軍撤走後，法國人才佔駐過的。巡至島內見有房舍及我國式古代建築寺廟一座，島之中央地點有清泉土井一口，水質清涼味美，正是我駐島官兵飲用水之泉源。狼犬一頭也被看到，仍然是體格健壯，精神旺盛之狀，據猜測當是取食海灘退潮後留於礁洞中之魚蝦果腹爲生者。當我們回艦時，見太平艦士兵有手攜椰子回去的，據中業艦島上工作人員報告稱，島上椰子已被摘一光矣，我只得苦笑置之。晚餐時，我特別加菜備酒，並留林指揮官在艦與代表們聚餐，以示慶祝，正當大家高興歡談之時，忽聞海上炮聲大作，頓使大家驚愕不已，我當時意味到是否有某國軍艦向我艦隊攻擊，隨即命艦上開啓雷達搜索偵察，並且一直在駕駛台瞭望，結果海上並無任何其他目標。發現炮火是從太平艦向本艦上空所發射，當即以電話呼叫太平艦，詢以所爲何故，初無回答，仍繼續發炮，約五分鐘後，炮火停止，太平艦來電話說是爲收復南沙島勝利，發炮慶祝，代表們得悉太平艦之答話後，極爲氣憤，指向林指揮官質詢說：「太平艦此項行動，是否爲其所主張，何以中業艦無所悉，且軍艦上之炮火，爲抵抗

敵人之裝備，豈可任意玩弄而致威脅友艦。」雖然林指揮官力予否認，無如代表們極度驚駭之餘，氣憤無法平息，遂群起舉拳向林指揮官打擊，我爲恐發生嚴重事端，便力加攔阻，並請各代表們暫且息怒，待我送林指揮官回太平艦調查事件真相後，再作處置，才得解了圍，把林遵送走了。按照此次任務規定，在中業艦卸儀期間，太平艦應負責基地之安全警戒，和各島嶼間巡察任務，但次日清晨，太平艦竟開航離去，並致電中業艦告已回廣州去矣。由於天氣良好，加以中業艦和駐島官兵合作良好，卸儀工作進行非常迅速，於十四日全部按計劃圓滿完成，隨即宣布放假，大家登島遊覽，個個稱快。

艱險定疆最高榮譽

十二月十五日上午，我集合了駐島弟兄和中業艦官兵，同政府代表們，在島上舉行了進駐南沙群島成功典禮儀式，並建立我國石碑一座，以定國疆。午間我會同代表們與駐島官兵聚餐，互道惜別，並參觀駐島官兵生活設施，大家都認爲滿意。中業艦於十二月十六日晨離開南沙群島回航，先到廣州，羅主席得悉勝利收復南沙群島情形後，至表愉快，對我艦官兵盛大款宴，獎勉有加，廣州地區報紙，一連數日報導政府派艦收復南沙群島情形，代表們更將此次奉命執行收復南沙群島艦隊航程路線，設計爲一圖案，並爲文加以說明，附以全體代表及本艦艦長、副長、輪機長、輪機官等之姓名，刻於象牙牌之兩面，每人各持一塊，以爲紀念，咸表意義深遠。茲將其所附說明文字抄記如下：「大中華民國三十五年十二月十二日，爲我代表等及太平、中業軍艦，奉命率軍進駐我南沙群島主島太平島之期，計同年十月二十三日乘艦離京，歷程二千海里，冒盡驚濤駭浪，費時五十一日，方克探索到達，本主席將以實際考察方式，作永久建設之指示，舉凡登陸勘查測圖建碑諸任務一一完成，從此山河永固並壽南天，同人等榮膺行役，爰爲之記」，並以「艱險定疆」四字，爲此次任務之命名，寓意至爲深長，至此收復南沙群島之任務即告圓滿完成，代表們皆從廣州離艦登岸，各自賦歸矣。

中業艦於廣州整補一週後返航上海，不久官兵們皆分別獲得總部之獎勵，大家非常高興，太平、中業兩艦，本人和楊副長皆獲得總統蔣中正以南沙群島中之三個島，分別以名字命名，即中業群礁、敦謙沙洲、鴻麻島，而以進駐之主島以太平島名之，爲此次任務中獲得最高之榮譽，故爲之記。

編輯報告

編者

△本誌三八〇期第十五頁上欄第八行應爲「年八十六歲」。中欄第十五行第一字應爲「委」，第十六行第八字應爲「國」。第十九頁下欄第五行最後「攻」字應刪掉。

△第三八一期二十二頁上欄「辜公亮上海北京行」詩的倒數第二句應爲「**願借氍毹寄諷諫**」特此更正，敬請讀者注意。

①作者李敦謙（前右）與好友李立柏（後中）、唐智（後右）、王成聖（前左）等合影。

②李敦謙進駐南沙群島之前，曾去拜見桂永清總司令，圖爲桂永清（右）與周至柔（左）合影。

①作者李敦謙（後排右）早年在國防研究院與研究員王潔（前右二）等合影。
②李敦謙（右二）與王成聖教授（左二）合影。

①李敦謙將軍收復南沙群島回航到廣州時曾受到廣東行轅主任羅卓英將軍的盛宴款待，此爲羅卓英（左三）在上高指揮作戰時與同袍合影。

②在保定軍校時的羅卓英。

③羅卓英一九四六年出席國民大會第一次會議時留影。

Annex 902

Jacque Wilson, “What’s the danger of an all-fruit diet?”, *CNN* (30 Jan. 2013), *available at* http://www.cnn.com/2013/01/29/health/steve-jobs-all-fruit-diet/

By Jacque Wilson, CNN

Updated 6:47 AM ET, Wed January 30, 2013

11 photos: Top 10 superfoods to fill your plate

Top 10 superfoods to fill your plate – Eating an all-fruit diet isn't the best way to keep your body he Incorporate these 10 "superfoods" into your meals to ensure you're getting the nutrients you superfoods are easy to find in the grocery store, contain nutrients that are known to enhanc have other health benefits that are backed by peer-reviewed, scientific studies.

1 of 11

Story highlights

Ashton Kutcher is playing Steve Jobs in Joshua Michael Stern's biopic "Jobs"

Kutcher ended up in the hospital after trying to follow Jobs' all-fruit diet

All-fruit meals can exclude valuable nutrients

After learning that Ashton Kutcher had landed in the hospital trying to follow Steve Jobs' all-fruit diet, CNN reader Sumday had just one question: "All I really wanted to know was why this diet was bad?"

Jobs first fell for extreme diets during his freshman year of college, according to Walter Isaacson's biography "Steve Jobs." Jobs and his college friend Daniel Kottke became vegetarians after reading "Diet for a Small Planet."

Then Jobs read "Mucusless Diet Healing System" by

from your diet, nutritionist says

Arnold Ehret; Ehret believed in eating nothing but fruits and starchless vegetables like spinach, carrots and cucumbers. Jobs began with two-day fruit fasts, eventually going for a week or more. "I got into it in my typical nutso way," Jobs told Isaacson.

Ehret's fruitarian diet, also called the Eden Garden Diet or Ehretism, is often used as a type of cleanse, according to LiveStrong.com. Designed to detoxify the system, it can do more long-term harm than good.

When you only eat fruit, you're excluding a lot of valuable nutrients from your diet, says Marisa Moore, registered dietician and spokeswoman for the Academy of Nutrition and Dietetics.

"Protein is one of the main ones that comes to mind," she says. "(Without protein) you lose body weight. Protein acts like a building block for your muscles and skin and organs."

The same goes for fats, Moore says. Although they often get demonized, fats play an important role in our hormone levels and brain function.

Kutcher told reporters at the Sundance Film Festival that he ended up in the hospital with pancreas levels that were "completely out of whack."

Steve Jobs movie premieres to mixed reviews

Fruit contains a lot of natural sugar, which needs to be controlled by insulin in the body, Moore says. It's the pancreas' job to release that insulin; Kutcher's pancreas may have been overworked if his body was receiving an overload of sugar.

Many readers wondered if an all-fruit diet could have led to Jobs' pancreatic cancer, which led to his death in October 2011. Scientists don't know what causes pancreatic cancer, according to the American Cancer Society. Certain inherited DNA mutations might play a role, as well as chemicals in our environment or diet.

Even if you don't overwork your pancreas, you're probably not eating enough calories on an all-fruit diet, Moore says. That puts the body into starvation mode, which can result in serious medical conditions like osteoporosis, severe dehydration and even heart failure, according to the National Eating Disorders Association.

Here's the bottom line: Fruit is natural. It's nutritious. The government recommends eating 1 to 2 cups of it a day. Just don't go all "nutso" on it.

Annex 903

Asia Maritime Transparency Initiative, *Virtual Tour of Itu Aba*, Photo 20160123_123323 (23 Jan. 2016), *available at* https://www.flickr.com/photos/139462176@N08/25863661766/

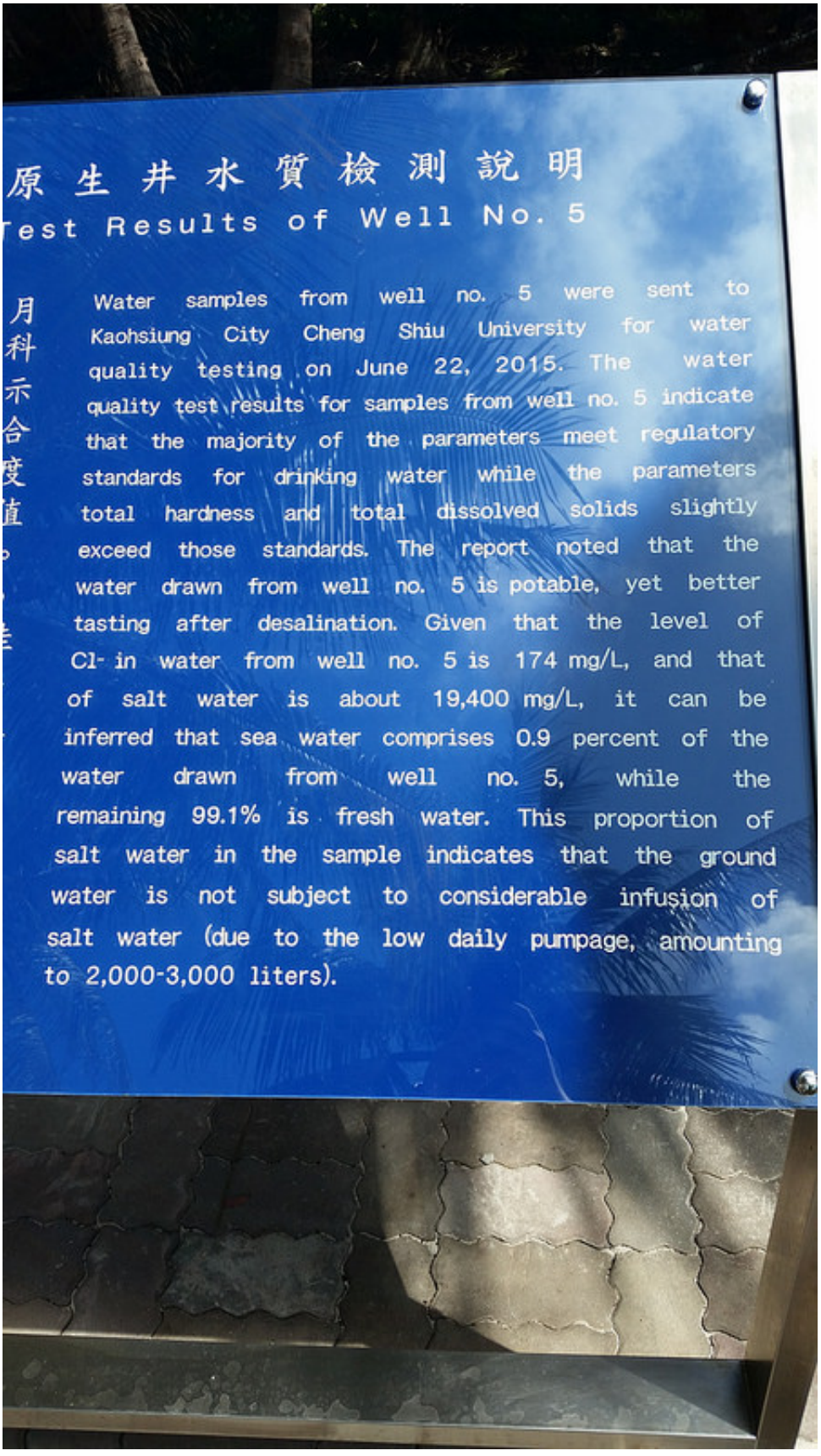
20160123_123323

In the area around the garden plots there is darker soil on top of the sand that covers most of Itu Aba. Taiwanese experts say the soil is native to this and a few other parts of the island, and was created by the breakdown of trees and other organic matter over centuries.

Annex 904

Asia Maritime Transparency Initiative, *Virtual Tour of Itu Aba*, Photo 20160123_132739 (23 Jan. 2016), *available at* https://www.flickr.com/photos/139462176@N08/25861212365/

20160123_132739



A sign beside the well notes that its quality was tested in June 2015 by experts at Kaohsiung City Chen Shiu University, who reported that it meets the majority of international regulatory standards for drinking water but its total hardness and level of dissolved solids slightly exceed those standards. The experts concluded the well produces 99.1 percent fresh water and is potable, though it tastes better

Annex 905

Debra Mao, "Tiny Island at Center of South China Sea Tussle Seeks Status", *Bloomberg* (23 Mar. 2016), *available at* http://www.bloomberg.com/news/articles/2016-03-24/tiny-island-at-center-of-south-china-sea-struggle-seeks-status

Tiny Island at Center of South China Sea Tussle Seeks Status

Debra Mao
March 23, 2016 — 8:27 PM EDT
Updated on March 23, 2016 — 11:43 PM EDT

- Taiwan says community of 200 shows Itu Aba can support life
- 'Happy to play part upholding our nation's sovereignty here'

While warships and fishing fleets jockey for dominance of the South China Sea, the 200-odd residents of Itu Aba eke out their days growing vegetables and baking pizza.

With such mundane rituals of daily life, Taiwan sustains a toehold to a strategic struggle that has drawn in the militaries of China and and the U.S. Now, six decades after establishing an outpost on this 510-square-meter (5,500-square-feet) speck of sand, the government in far-off Taipei is seeking to prove it's an island capable of supporting human life.

Taiwanese soldiers ride past a sign reading "the sovereignty" on Itu Aba

Photographer: Sam Yeh/AFP via Getty Images

"I'm really happy to play a part in upholding our nation's sovereignty here," said Lin Fang-tzu, 28, who moved the 1,600 kilometers (1,000 miles) from southern Taiwan eight months ago to serve as an anesthesiology nurse at the island's Nansha Hospital.

The legal status of islands, rocks and reefs scattered across the South China Sea has taken on new significance as the region braces for a ruling from an international tribunal that could upend a complex web of territorial disputes. The United Nation's Permanent Court of Arbitration could in the next few

months decide on claims by the Philippines that the Spratly Islands are uninhabitable rocks and thus don’t confer rights to exploit surrounding resources.

QuickTake map shows overlapping territorial claims of Brunei, China, Malaysia, Taiwan, the Philippines and Vietnam. {NSN O2OSHZ1ANZG8}

The Philippine case is aimed at China, which has embarked on a large-scale land reclamation program in the waters and built up its military presence. The U.S., which says it doesn’t take sides on individual claims, has sought to assert free navigation rights by sailing warships through the key shipping corridor, drawing protests from China.

Caught in the middle is Itu Aba, or Taiping Island, which is the largest naturally occurring feature in the chain, and Taiwan, whose claims provide the foundation for China’s. The so-called nine-dashed line that Beijing provides to assert sovereignty over more than 80 percent of the sea was drafted by the Republic of China government just before civil war forced it to retreat to Taipei in 1949.

"Legally speaking, both China and Taiwan can ignore, but politically both cannot, because of international publicity and discourse under international law," research fellow Yann-huei Song of Taiwan’s Academia Sinica said by e-mail.

Taiwan has in recent months rushed to prove to the world that Itu Aba, which is dominated by a 1,500-meter (5,000-foot) airstrip, should be considered an island under international law. On Wednesday, Taiwan for the first time allowed journalists to visit the outpost claimed by China, the Philippines and Vietnam.

Armed Taiwan coast guard members stand around a C-130 transport plane

Photographer: Sam Yeh/AFP via Getty Images

"There’s no need to declare our sovereignty over Taiping Island, we’ve been running it successfully for 60 years," President Ma Ying-jeou told reporters after the trip. "We’re just saying on the issue of whether it’s a rock or an island, at least get the facts straight." Ma, who’s leaving office in May, didn’t accompany them to the island.

Strange-Tasting Coffee

Taiwan, which isn’t recognized as a country, hasn’t been allowed to participate in the Philippine case. China has dismissed the arbitration as "unlawful, unfaithful and unreasonable" and refused to challenge it in court.

As part of his lobbying effort, Ma visited Itu Aba in February to highlight signs of life. Besides a runway and hospital, the island features a wharf, completed in December, and a small solar-power plant. The armed service personnel, health workers and others who live their grow crops such as okra, plantains and papaya. At last count, there were 14 goats.

Lin was one of three nurses who answered Ma’s call this year to move their housing registration to Itu Aba. A key issue under the law is whether the island can produce fresh water -- the food produced there was presented as evidence the sweet, clear liquid flowing from the taps was potable.

"It was amazing to see baking ovens here and we make pizzas and cakes all the time," Lin said. "Sure, the coffee has a strange and interesting flavor. The thing I miss most though is bubble tea."

Annex 906

Jeremy Page, “Taiwan Cultivates an Argument for China’s Spratlys Claim”,
Wall Street Journal (23 Mar. 2016)

THE WALL STREET JOURNAL.

http://www.wsj.com/articles/taiwan-cultivates-an-argument-for-chinas-spratlys-claim-1458753873

WORLD | ASIA | CHINA NEWS

Taiwan Cultivates an Argument for China's Spratlys Claim

Officers on disputed land mass raise crops and animals to bolster assertion it is an island and not a rock

A Taiwanese security officer feeds goats on Itu Aba on March 23. *PHOTO: EUROPEAN PRESSPHOTO AGENCY*

By **JEREMY PAGE**

Updated March 23, 2016 1:39 p.m. ET

ITU ABA, South China Sea—This tiny palm-fringed outcrop boasts a unique strategic asset in the escalating contest over the South China Sea. The Taiwanese coast-guard officers who live here call it the "Happy Farm."

While China builds artificial islands on the clumps of land it holds, and Vietnam and the Philippines look to the U.S. for help in defending their claims, the 167 Taiwanese officers on Itu Aba cultivate pumpkin, okra, corn and cabbage, and keep a handful of chickens and goats.

Their goal is to prove that Itu Aba is an inhabitable island, not a rock.

The Disputed Land Mass

Taiping/Itu Aba Island
Taiwan's spot in the Spratly Islands

That is now the subject of fierce international debate, as a tribunal in The Hague prepares to deliver a verdict this summer on the first legal challenge to China's expansive claims to the islands, rocks and reefs in the South China Sea.

A key part of the Philippines case is that no feature in the Spratlys archipelago meets a legal definition of an island, which requires it to be able to "sustain human habitation or economic life."

The outcome has broad legal implications for all six governments with claims in the area, as well as for the U.S., which worries about freedom of navigation through one of the world's busiest shipping routes.

Itu Aba, which Taiwan calls Taiping Island, is the largest Spratlys feature and the only one with a freshwater supply. That gives it the strongest case to qualify as an island under a U.N. maritime convention.

If the tribunal concludes that Itu Aba is an island, it would be entitled to an Exclusive Economic Zone, or EEZ, extending up to 200 nautical miles, and allowing construction of artificial islands in that zone.

Since Beijing claims all the Spratlys, maritime experts say that could give legal cover to its artificial islands, all of which lie within 200 nautical miles of Itu Aba.

But if the tribunal rules that Itu Aba is a rock, and thus not entitled to an EEZ, then China's efforts to justify its claims through international law would be undermined, those experts say.

"The impact would be that China would be forced to say its activities are only based on historic rights," said Peter Dutton, an expert on maritime law at the U.S. Naval War

An aerial view of the disputed land mass. *PHOTO: TAIWAN MINISTRY OF DEFENSE/ASSOCIATED PRESS*

College. "China would have very little left in terms of legitimate legal arguments. It would be exposed as simply exercising power."

Armed Taiwan soldiers stand guard around a C-130 transport plane at the airstrip on Itu Aba. *PHOTO: SAM YEH/AGENCE FRANCE-PRESSE/GETTY IMAGES*

China has refused to take part in the tribunal, saying it has no jurisdiction. Taiwan, which China claims as a wayward province, is neither a member of the U.N. nor a signatory of the relevant maritime convention.

Instead, Taiwan has been waging a publicity campaign to bolster its claims, which are roughly the same as China's. On Wednesday, the Taiwan government escorted foreign journalists to visit Itu Aba for the first time.

"Everything you eat and drink here today was produced on this island," Wang Mao-lin, commander of the coast-guard outpost on Itu Aba, told the reporters.

His staff prepared a lunch including chicken, fish, pumpkin, spinach, papaya and rice—

all produced locally except for the rice.

AN ISLAND OF ONE'S OWN

In maritime disputes, the U.N.'s law of the sea defines what's an island and why it matters.

What it is: Island

How it is defined: A natural landmass permanently above water that can sustain human habitation.

Why it matters: Islands are entitled to 12 nautical miles of territorial seas and a 200-nautical-mile exclusive economic zone.

What it is: Rock

How it is defined: Land permanently above water but unable to sustain human habitation.

Why it matters: Rocks are allowed 12 nautical miles of territorial seas, but action can be taken up to 24 nautical miles out to prevent immigration, customs and other infringements.

What it is: Low-tide elevation

How it is defined: A natural piece of land above water at low tide.

Why it matters: Low-tide elevations aren't entitled to territorial seas.

Source: U.N. Convention on the Law of the Sea

After a tour of the farm, where he showed off 12 goats and 125 chickens, he also poured out cups of fresh water drawn from one of Itu Aba's four wells.

"It's as good as Evian," he said, citing tests by Taiwanese water experts.

Lawyers for the Philippines say this is all for show. They presented their case to the judges' panel of the Permanent Court of Arbitration in The Hague in November.

Paul Reichler, an American attorney who represented the Philippines at the tribunal,

said Itu Aba had been uninhabited until it was occupied by Taiwanese forces in 1956, and has only been inhabited by government personnel since.

"They cannot survive there without supplies from the outside, including food and water," he said. "The standard is: Can it produce enough potable water to sustain a human community over an extended period of time? Itu Aba can't do that."

He also said Itu Aba wasn't suited to agriculture, and accused Taiwan authorities of bringing in topsoil to help it grow food locally, and producing much of its drinking water from desalination plants.

Taiwanese officials denied bringing in topsoil, and said they produced roughly half of Itu Aba's drinking water from desalination plants, and brought in roughly 80% of food supplies.

But they said there was more than enough locally produced water and food to sustain a human settlement.

They also pointed to other facilities including a hospital, solar generators, a temple, a lighthouse, a wharf and a newly upgraded airstrip, long enough for a C-130 military transport plane.

Later, Taiwan's President Ma Ying-jeou told a news conference in Taipei that a panel of Taiwanese experts had sent a written submission to The Hague tribunal laying out Taiwan's position.

He also invited the tribunal's five judges to visit Itu Aba.

Their verdict could go either way, said maritime experts including Greg Poling of the Center for Strategic and International Studies in Washington, who visited Itu Aba in January.

"I can say with some confidence that there is some drinkable water and arable soil to grow crops," he said.

"It appears to be enough for a small number of people to live off of, but not enough for a self-sustaining community without support from the outside. So ultimately the five judges on the arbitral tribunal will be deciding whether 'sustain...habitation' means keep a person alive, keep a long-term human settlement going, or something in between."

Write to Jeremy Page at jeremy.page@wsj.com

Interactive: The South China Sea Dispute

Annex 907

Johnson Lai, "Pushing territorial claim, Taiwan says 'rock' is an island", *Associated Press* (23 Mar. 2016), *available at* http://bigstory.ap.org/article/0c82f35028a44621a3f0fd1cf7cc78ce/taiwan-takes-media-tour-south-china-sea-island-claim

Pushing territorial claim, Taiwan says 'rock' is an island

7 photos

An aerial view of Taiwan-controlled Taiping island, also known as Itu Aba, is seen in the Spratly... Read more

TAIPING ISLAND (AP) — Taiwan flew international media to its largest island holding in the South China Sea in a bid to reinforce its territorial claims in the disputed and increasingly tense region.

Deputy Foreign Minister Bruce Linghu, who led the trip, said he wanted to show that Taiping is an island capable of sustaining human habitation, and not simply a "rock" as the Philippines claims in a case brought before the Permanent Court of Arbitration. Islands are entitled to an exclusive economic zone and other rights not enjoyed by mere rocks.

Two dozen journalists were flown to the island aboard a Taiwanese air force C-130 transport plane on Wednesday that landed on an airstrip guarded by coast guard sentries with rifles. They were shown the island's post office, its fresh water well, the harbor and a traditional Chinese temple.

The Philippines and Vietnam also claim Taiping. Critics say Manila is seeking to have Taiping designated a rock to avoid having to share an exclusive economic zone with its own nearby island of Palawan.

Speaking to reporters in Taipei following the trip, Taiwanese President Ma Ying-jeou said he would invite Philippine government representatives, lawyers, and five members of the arbitration commission to visit Taiping themselves to see that it is "an island with fresh water, capable of sustaining farm production, livestock and human life."

The Philippines "remains ignorant" of conditions on Taiping and has "misled the arbiters with absurd reasoning," Ma said.

Manila's case, which has been rejected by China, aims to challenge Beijing's blanket claim to virtually the entire South China Sea. Yet it threatens also to harm relations between the Philippines and fellow pro-U.S. democracy Taiwan, which generally enjoy friendly neighborly relations.

Taiwan, which lacks diplomatic ties to negotiate with the five other governments with territorial claims in the South China Sea, has increasingly turned to public diplomacy to reinforce its own claims.

Ma paid a visit to Taiping in late January, drawing rare criticism from the United States, Taiwan's key ally, which has urged all parties to avoid steps that might raise tensions. Although Taiwan's claim to almost the entire region overlaps with China's, Ma has sought to cast Taiwan as a peaceful, humanitarian player in the region.

Taiwan operates a 10-bed hospital, a lighthouse and a fishing industry aid station on 46-hectare (110-acre) Taiping, also known as Itu Aba, which has a population of about 200 mostly coast guard personnel. It is spending more than $100 million to upgrade the island's airstrip and build a wharf capable of allowing its 3,000-ton coast guard cutters to dock.

Roughly 2,000 kilometers (1,200 miles) south of Taiwan, Taiping is the largest naturally occurring island in the South China Sea's disputed Spratly Islands.

However, it has recently been eclipsed in size by artificial islands China has built by piling sand on top of reefs and shoals, and then constructing housing, ports, airstrips and other infrastructure. The United States and others say Beijing is exacerbating tensions in the strategically vital region, while China accuses the U.S. of militarizing the area by ordering Navy ships to cruise in defiance of Beijing's claims.

The commander of the Taiping garrison, Wang Mao-lin, said the surrounding waters remain mostly placid despite the political turbulence.

"So far we haven't discovered any provocative movements. Vietnamese and Chinese fishing boats try to approach Taiping from time to time. We just follow our regulations and standard procedures to disperse them," Wang said.

Malaysia and Brunei also say parts of the strategically vital sea belong to them and the dispute now threatens to draw in Indonesia, whose sea border abuts China's vague, unilaterally declared boundary around the South China Sea known as the nine-dash line.

Indonesia this week detained the eight crew members of a Chinese vessel it said was fishing illegally in its waters, while China says the ship was being "harassed" by an armed Indonesian government boat.

China has demanded the crewmembers' release.

Asked to comment on the Taiwanese media trip, Chinese Foreign Ministry spokeswoman Hua Chunying said China and Taiwan have a common responsibility to "maintain the ancestral property of

the Chinese nation," a reference to Beijing's insistence that the two remain part of a single Chinese nation despite separating amid civil war in 1949.

While construction work is still underway, China would consider allowing journalists to visit its own Spratly island holdings "when the condition is ripe," Hua said.

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Associated Press writer Christopher Bodeen and researcher Yu Bing in Beijing contributed to this report.

Annex 908

Adrian Brown, "Taiwan shows off Taiping Island in the South China Sea", *al-Jazeera* (24 Mar. 2016), *available at* http://www.aljazeera.com/blogs/asia/2016/03/taiwan-taiping-island-south-china-sea-160324062533491.html

Taiwan shows off Taiping Island in the South China Sea

Taipei invites journalists to tour disputed island, which is also subject to claims by the Philippines and Vietnam.

24 Mar 2016 14:36 GMT | Taiwan, South China Sea, China, Politics, Asia Pacific

Adrian Brown

@ajabrown

Taiping - Taiwan had waited 60 years for this moment.

Our C130 military transport plane had just landed on the tiny island of Taiping, also known as Itu Aba.

Actually it is more a runway than island. Taiping is less than a kilometre long. It had been a four-and-a-half hour, 1,600km journey from the capital Taipei to this distant Taiwanese outpost in the heart of the South China Sea.

But it was worth it.

As I walked down the ramp on to the tarmac I was making history, albeit history with a small "h". I had become one of the first foreign journalists to set foot on the island since Taiwan began its occupation at the end of World War II.

Sixty years on, Taiwan has been busy cementing its sovereignty. The government had invited this select group to prove that Taiping island was "more than just a rock".

And in these waters there is an important distinction between rock and island.

Under the outgoing President Ma Ying-jeou, we were told that more than a $100m had been spent on upgrading the runway and port.

A hospital, lighthouse and post office have also been added. We were shown evidence of sustainable life: a small farm with goats and chicks. Some of the chickens were sacrificed for our lunch, washed down with juice from locally-grown coconuts. Falling coconuts and sea snakes pose some of the few dangers to life here - along with boredom.

Power comes from a bank of solar panels and scientists have found a way to produce fresh water.

The tour group included several government officials, including Bruce Linghu, a deputy foreign minister, who was formerly Taiwan's ambassador to the Marshall Islands, one of handful of countries to recognise Taiwan.

"I am used to remote islands, which I guess is why I am on this trip," he joked. But he also had a serious point.

"Taiping is a naturally formed island. It's' sustainable, good for the living of the people...It is not a rock," he said.

It's a phrase we heard time and again during our visit.

The population is now almost 200: Coastguard personnel mostly, as well as a handful of scientists and medical staff.

Dr Ni Yinghui volunteered to come here for eight weeks.

"[It's] lonely," he laughs. "But that is okay. I think two months is a great period. Not too long and not too short."

Taiping is also claimed by China - which, of course, claims Taiwan - along with Vietnam and the Philippines.

And it's the latter that has begun making waves in this complex sovereignty battle.

Manila has sought to play down Taiwan's claim by referring to Taiping island as a rock. Owners of rocks can't claim rights to surrounding islands, in the way that owners of islands can.

At the moment Taiwan has yet to begin enforcing those rights, but if it does it would effectively be laying claim to waters within Manila's maritime borders.

Why does any of this matter?

Well, this region is supposedly rich in oil and gas reserves. It also contains some of the world’s busiest shipping lanes. Last year some $5 trillion of trade passed through these waters.

President Ma, who leaves office in two months, has an eye on his legacy, and pushing Taiwan's maritime claims is part of that.

At a news conference following our visit, the president focused on what he sees as the factual evidence of Taiwan's case.

"Taiping is an island as defined by the United Nations Convention on the Law of the Sea," he said.

"In addition to 12 nautical miles of territorial waters, the Republic of China is entitled to claim a 200-nautical-mile exclusive economic zone and a continental shelf."

China's leaders are hyper-sensitive about sovereignty issues. But oddly enough they have raised no objections to the build-up on Taiping island.

One analyst has suggested there is a simple reason for this. Taiping would become China's if it ever took Taiwan back.

Also, it is fair to assume that China would rather its Taiwanese compatriots occupy Taiping than the Philippines or Vietnam.

But things could come to a head in a few months - which was another reason for the visit.

The Permanent Court of Arbitration in the Hague is shortly to rule on a challenge by the Philippines that disputes China's sovereignty claims. (China has created seven artificial islands, complete with runways in another part of the archipelago.)

That challenge could potentially bring things to a head over Taiping.

The gentle waves lapping the shores of this peaceful place belie the murky politics of an intensifying battle over who really owns these waters.

Source: Al Jazeera

Annex 909

I. Watson & M. Philipps, “South China Sea: Taiwan enters power struggle”, *CNN* (27 Mar. 2016), *available at* http://www.cnn.com/2016/03/26/asia/taiwan-south-china-sea/index.html

South China Sea: Taiwan enters power struggle

By **Ivan Watson** and Mark Phillips, CNN

Updated 7:31 PM ET, Sun March 27, 2016

Story highlights

- Taiwan occupies Taiping island in the disputed waters of the South China Sea
- China's massive land reclamation projects have made neighbors nervous
- Taiwan challenges a maritime arbitration case brought by the Philippines

Taiping island, South China Sea (CNN) — Taiwan claims to have continuously occupied this postage stamp-sized island in the azure waters of the South China Sea for 60 years.

But it wasn't until this week, that the government invited journalists to see the tiny place firsthand.

Also known as Itu Aba, Taiping island consists of little more than a 1,360 meter long airstrip bordered on two sides by palm trees and white sandy beaches.

But that is enough for Taiwan to make its case in the growing struggle for control of this hotly disputed body of water -- where $5 trillion in ship-borne trade passes through annually.

Showdown in the South China Sea: How did we get here?

Island, not a rock

Taiping Island "is entitled to an exclusive economic zone of 200 nautical miles," outgoing Taiwan president Ma Ying-jeou told journalists on Wednesday -- which gives a country special rights over the seabed, and marine resources like fish.

Related Video: Taiwan President on China, disputed islands 08:12

However, there at least six countries laying competing claims to different parts of the South China Sea, including Vietnam, Taiwan, Indonesia, Philippines, Malaysia and Brunei.

China, with a large U shape on its maps, lays claim to virtually all of the contested waters.

To cement its stance, Beijing has been building man-made islands atop seven reefs it controls in the Spratly archipelago, a series of atolls far closer to the Philippines and Malaysia than mainland China.

These massive land reclamation projects have made the neighbors nervous.

"Like most countries we are opposed to militarization or military expansionism in the area," said Bruce Linghu, deputy foreign minister of Taiwan.

The diplomat expressed concern that China's ambitious island-building could trigger "possible confrontations or conflicts."

A lighthouse is pictured on Taiping Island, also known as Itu Aba, in the South China Sea.

Warnings

In fact, the U.S. and Chinese navies have already engaged in several rounds of shadow-boxing here.

Last May, CNN's Jim Sciutto accompanied a U.S. Navy spy plane on a flight over several of the man-made islands.

"This is the Chinese navy, this is the Chinese navy. Please go away," a Chinese radio operator announced in one of at least eight warnings to the aircraft.

In October, the Chinese government summoned the U.S. ambassador to Beijing to issue a formal protest after the destroyer USS Lassen sailed within 12 nautical miles of the Chinese-controlled Subi Reef in the Spratlys.

The destroyer's voyage was "a very serious provocation, politically and militarily" China's ambassador to the U.S. told CNN's Christiane Amanpour in an interview.

One of the military bunkers and anti-aircraft batteries defending Taiping Island. Taiwan officials say they replaced the Marines who used to defend this island with coast guard personnel more than a decade ago.

But the U.S. Navy continues to carry out what Washington calls "freedom of navigation" operations in the South China Sea.

"Just being there in the South China Sea shows that we believe we have the right to operate in international waters," said Rear Admiral Ronald Boxall.

He spoke to CNN aboard the U.S. aircraft carrier John C. Stennis, two weeks after he led a carrier strike group conducting operations in the South China Sea.

During that journey, the U.S. Navy reported seeing far more Chinese navy ships around the strike group than on previous deployments.

"It's a growing navy -- there's no question," said Admiral Boxall, as F-18 fighters catapulted off the deck of the aircraft carrier into the sky.

"As you see a navy get larger, and you see a lot of activity in the South China Sea, you always wonder at what point what exactly that's going to mean to our navy and our presence there," he added.

High stakes surveillance over the South China Sea 03:47

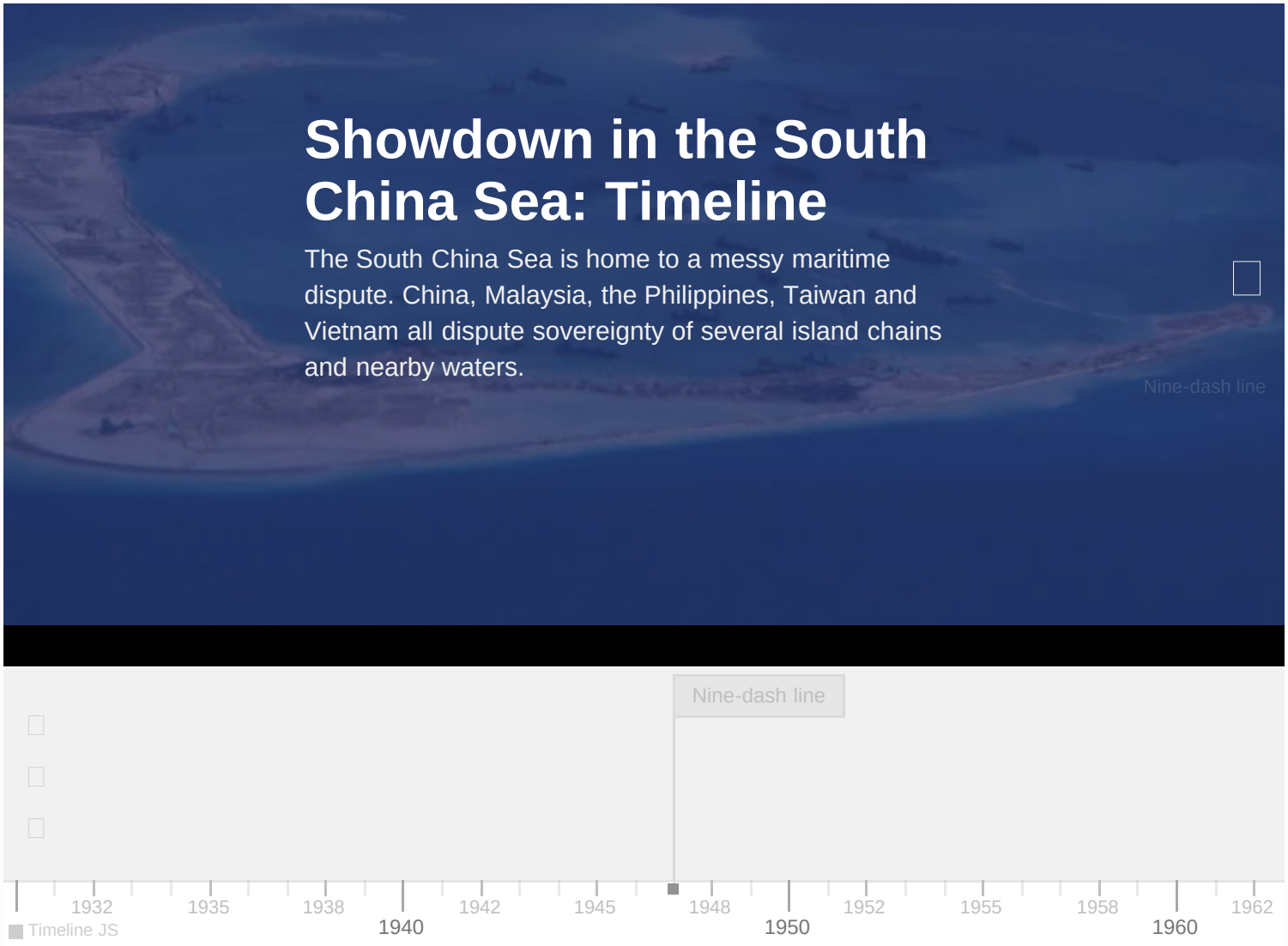
Shifting alliances

Beijing's forceful maritime moves have prompted some smaller countries in the region to welcome the U.S. Navy's presence here.

In recent months, former U.S. enemy Vietnam publicly called on the U.S. to play a bigger role in the South China Sea.

And nearly a quarter century after the U.S. closed its military bases on the Philippines, both governments announced last week a new agreement for U.S. troops to make use of five bases on the island nation.

"It's certainly leading to a bit of an arms race in the region. Chinese behavior in the South China Sea is creating incentives for different countries in the region...to bolster their defense budgets," said J. Michael Cole, a Taiwan-based analyst with the University of Nottingham's China Policy Institute.



Legal challenge

The Philippines, whose military is dramatically out-gunned and out-resourced by China, is also attempting to use international law to challenge Beijing.

It has taken China to the Permanent Court of Arbitration at The Hague, arguing that China's occupation of the Spratly Islands violates the United Nations Convention on the Law of the Sea (UNCLOS). A ruling is expected in May.

China refuses to participate and doesn't recognize the court's jurisdiction.

"I think this can backfire on China," warned Daniel Pinkston, a South Korea-based lecturer on international relations with Troy University.

"If you act opportunistically in the short run, using your power capabilities to grab benefits without restraint, then other states will start forming a coalition against you."

But the Philippines-China arbitration case led to an unforeseen consequence: a challenge from Taiwan.

The government of Taiwan, officially known as the Republic of China, rejects claims by the Philippines' legal team at the Hague that Taiping does not deserve to be called an island, according to international maritime law.

To prove this point, officials invited journalists on a three hour, 1577 km (980 mile) military flight from an airforce base in southern Taiwan to Taiping Island.

Such a public relations exercise is particularly important for Taiwan, which isn't a member of the U.N. and thus not a signatory to UNCLOS -- China considers Taiwan a breakaway province and blocks its membership of most international organizations.

During the first ever visit for journalists to Taiping Island, officials showed off vegetable gardens, fresh water wells, a chicken coop and a pen full of goats.

Azure waters

From the air, we could see the coral reefs and atolls that speckle the azure waters of the South China Sea in the Spratly archipelago.

On Taiping, officials showed off small vegetable gardens, chicken coops and a pen full of goats that help feed the 167 coast guard officers based on the island.

They also invited visitors to sample the water drawn from one of the island's fresh water wells.

Taiping "is blessed with an abundance of high-quality freshwater," President Ma later explained. He invited representatives from the Philippines and judges from the Court of Arbitration to visit the island.

The leader argued that if Taiping officially won the designation of being an island, Taiwan could theoretically argue for fishing rights as well as permission to explore for minerals in the seabed in a huge 200 nautical mile [230 mile, 370 km] economic exclusion zone surrounding it.

Taiwan's goal, Ma said, is to transform Taiping into "an island for peace and rescue operations."

But the tiny island's palm tree-lined beaches also bristle with concrete military bunkers, anti-aircraft guns and helmeted, uniformed guards.

What should be a remote tropical paradise is instead part of a much larger power struggle over the future of the South China Sea.

CNN's KJ Kwon, Yuli Yang, Bex Wright, Katie Hunt and Felicia Wong contributed to this report

Annex 910

Republic of China (Taiwan), Coast Guard Administration, “Historical Background”, *available at* http://www.cga.gov.tw/GipOpen/wSite/ct?xItem=10574&ctNode=1306&mp=999 (accessed 10 Apr. 2016)

[Maritime Strategy – Service – Affairs – Enforcement]

[…] […]

[…]

Historical Background

Source: Coast Guard Administration Date: 98/11/22

Origin of the Name

There were historical records of the Nansha Islands during the Qin and Han eras. The *Guangdong-Vietnam First National Borders Treaty* under the Qing Legal Code, signed during the reign of Guangxu of the Qing Empire, recognized that the islands to the east of latitude East 108 degrees would fall within the territory of the Qing Empire, which would include the Nansha Islands. The Taiwanese military vessel *S. S. Taiping* was responsible for receiving a territory marker from the Japanese military and placing it on this island. It also built a broadcast station and weather station. It declared sovereignty on behalf of the Republic of China, and thus gave the island its maritime name. On 5 June 1956, the *S. S. Taiping* sailed to Taiping Island, erected a monument, and raised the flag *Nansha Defense Zone*, and deployed a garrison. Additionally, according to tradition the fishing communities in the area called this island Huang Shan Ma Peak, where "peak" refers to its "lofty" appearance. The fishing communities at sea for a long time have viewed this as *Taiping Island*, but now foreign maritime maps all refer to this as Yi Tu A-ba or "Itu Aba Island", and Yi Tu A-ba is Malaysian for "what is that?"

Historical Developments

- In April 1929, because the island's phosphorous mine was exhausted, and due to the effect of the world economic crisis, Japanese merchants declared that they would stop production, and all of the workers returned to Japan.
- On 10 April 1933, the French military occupied Taiping Island, and dispersed the Japanese merchants and Taiwanese laborers on the island.
- At the start of 1935, the Japanese citizen Sueji Harata brought the navy and the Taiwanese governor to establish the Hiroshi Investment Corporation, and in April of the same year, France dispatched its navy to bring 30 Vietnamese persons to live on the island.
- In December 1936, the Horishi Investment Corporation owned by Japanese citizen Sueji Harata illegally sent employees to explore the phosphorous mine.
- On 9 August 1938, Japan sent a military ship to build a market to establish that the Japanese had developed the island; on October 30 of the same year, Japan sent a military ship, soldiers and Taiwanese laborers onto the island; on December 7, more people landed on the island.
- In April 1939, the Japanese army attacked Taiping Island, and changed its name to Changdao, annexing it to the Kaohsiung administrative jurisdiction. During this time, Japan had deployed a combat unit, weather monitors, telecommunications dispatchers and surveillance aircraft to the island.
- In 1944, Japan built a submarine base on the island.
- On 12 December 1945, the Government of the Republic of China established the *Nansha Administrative Office* under the jurisdiction of the Guangdong Government, and built a broadcast station and weather station on the island.
- On 5 October 1946, the French ship Chevreud invaded and landed on the Nansha Islands, the Nanwei Island and Taiping Island. It built a monument on the island, which at the time was protested by the Government of the Republic of China, and used legal methods to make a resolution to negotiate the matter on January 4 of the following year, but due to the tensions of the Vietnam War, France unilaterally abandoned the negotiations.
- On 24 November 1946, the Government of the Republic of China dispatched four ships: the *S. S. Zhong Ye*, *S. S. Yong Xing*, *S. S. Taiping*, and the *S. S. Zhong Jian*. Commander Lin Yu and Yao Ruyu led them to the Nansha Islands, along with representatives from the ministry of the interior, army, navy, and air force for a visual inspection. They assembled in and departed from Guangzhou, setting sail for Xisha and Nansha where they would be stationed. On December 12, after receiving command of the Taiping and Zhongye, Lin Zun arrived at Taiping Island. To commemorate the receipt of the *S. S. Taiping*, the name of the island was changed to Taping. A Taiping Island monument was erected at the wave breakers on the southern tip of the island. At the eastern tip of the island, another

monument inscribed with “Nansha Islands Taiping Island” was erected. After these monuments were built, a receiving ceremony and flag raising ceremony were held. An administrative office was built on Taiping Island under the jurisdiction of the Guangdong Province Government.

- In 1950, people from the Philippines landed on Taiping Island and other islands, wantonly stealing from the phosphorous mines.
- In the 1952 Japan Treaty, Japan relinquished all of its rights, claims, and titles to the Nansha Islands.
- On 5 June 1956, the *S. S. Taiping* again navigated to the island, erected a monument, and raised a flag, changing its name to the “Nansha Defense Zone” and diverting a garrison of naval and land forces to defend this land.
- In 1959, the military officials on the island received a thousand-armed Guanyin Boddhisatva statue from Taiwan for purposes of making sacrifices, and erected a Guanyin Temple.
- On 31 October 1960, the original weather station was expanded into a full weather office. In the same year on September 9, a postal service office was added under the jurisdiction of the Kaohsiung postal administration, and in July 1963, it was added to the administration of the Taipei City postal service.
- In 1963, the Executive Yuan executive affairs council established a Nansha Development Group at Taiping Island, to conduct waste iron removal and phosphorous mining, and in 1968 it was expanded to being the Nansha Resource Development Office.
- In October 1967, the China Youth Anti-Communist Patriots Group “Summer Music Activity at the Southern Territory Garrison” crafted a “Southern Territory Screen.”
- In 1975, the Government of the Republic of China issued the one and only valid legal warning regarding the Nansha Islands in response to incursions by the Philippines, Vietnam, and Malaysia.
- In 1987, the “Taipeng Regional Fisherman Service Station” expanded various kinds of services to the local fishermen.
- On 12 January 1990, Ministry of the Interior department head Wang Xingquan represented Minister Xu Shuide in erecting a monument inscribed with the words “Lock and Key to the Southern Territory,” and reiterated the Republic of China’s claim to the sovereignty of the South China Sea; in the same year on February 16, the Executive Yuan ratified the establishment of an administrative committee from Kaohsiung City to accept jurisdiction over Taiping Island, as part of the Kaohsiung City Qijin District, and establishing a “Fishery Industry Station.”
- On 16 February 1990, the Executive Yuan ratified the establishment of the Kaohsiung City Administrative Council, which took over the Taiping Island administration.
- On 12 June 1992, the Ministry of the Interior undertook the reorganization of the *Nansha Group*.
- On 28 January 2000 the Executive Yuan established the *Coast Guard Administration*, and renamed the existing coast guard units as the *Directorate General of the Coast Guard*, and administered the Nansha Taiping Island, and in peace time conducted legal inspections for smuggling, illegal border crossing, and fishery safety missions; during wartime the *National Defense Law* in Section 4 Item 2 and the *Coast Guard Administration Organizational Law* in Section 24 provides: “During time of war or conflict, the Executive Yuan shall be empowered to combine it with the combat organization,” and execute missions.
- On 16 August 2003, the Republic of China Minister of the Interior Yu Zhengxian led the Executive Yuan’s Council for Economic Planning and Development Deputy Chair Zhang Jingsen, Research, Development and Evaluation Commission Deputy Chair Cai Dinggui, and Coast Guard Administration Deputy Director You Ganci, Gaoxiong City Deputy Mayor Lin Yongjian, among other high level administrators to the island to conduct a visual inspection, and held a first-class satellite control point construction ground-breaking ceremony.
- In the middle of December 2005, the Ministry of Defense started work on its *Pacific Defense Papers*, and at this time of the *Projects Budget* stopped work projects in July of 2006. In 2007 the *Taiping Project* was reinstated by the Executive Yuan, and in December 2007 was completed. Its airport runway’s total length is 1,250 meters, and can accommodate C-130H transport planes, and in the future it is planned to be extended to 1,500 meters.
- In 2006, the Government of the Republic of China built a 1,150 meter airport runway on the island to support supply and medical rescue operations between it and Taiwan, but resulted in a dispute as to whether it would lead to destruction of the island ecosystem, and its strategic import led to dissatisfaction among neighboring countries; when the Executive Yuan later passed its budget, work was temporarily stopped in July, and the work team returned to Taiwan.
- In 3 March 2007, the Kaohsiung City Government Maritime Office considered the local activities of sea turtles and the importance international society places on the protection of sea turtles, and relied upon Section 45 of the Fisheries Law to designate a Taiping Island sea turtle reproduction area, centered around Taiping Island, and nesting enclosures were placed on the beach and near trees. The sea habitat extends from the intertidal and low tide line out to 12 nautical miles.
- In 2007, the “Executive Building and Battlement Projects” were issued from the military administration to shape designs for cannons, and authority was given to the southern coastguard administration and Nansha coast guard command. Additionally, on 7 December 2007 a groundbreaking ceremony was held, and work started on 10 December 2007, with 125 designated work days; due to an extension, as of 23 November 2008 it is currently registering for work completion. On December 14 of the same year, the re-inspection was completed, and on 25 January 2009, the moving was completed.
- From 2008 to 2010, a pressed brick road will be built on 25 sections along Taiping Island, with an estimated length of 6,945.3 square meters.

歷史背景

歷史背景

資料來源：南巡局 日期：98/11/22

名稱由來

遠在秦漢年間即已有南沙歷史相關紀錄，而於清光緒年間清法所簽訂《廣東越南第一國界約》中，承認東經108度以東諸島歸屬清國領土，其中應包括南沙群島。太平島的名稱是有歷史淵源的，那是因為二戰結束之後，這座島嶼由台灣國軍「太平艦」負責自日軍手中接收並豎立國疆碑石，修建電台、氣象站；宣誓主權，因而以此艦來命名。民國45年6月5日太平艦駛抵太平島立碑升旗編成「南沙守備區」，派駐陸戰隊擔任守備。另從前傳統的漁民都稱呼這座島嶼為「黃山馬峙」，而「峙」是「高聳」的樣子，漁民們在海上老遠 就看得到「太平島」，現在的外國海上地圖均稱太平島為伊圖阿巴「Itu Aba Island」，而「伊圖阿巴」正是馬來語「那是什麼」。

歷史沿革

- 民國18年4月，因島上蘊藏的磷礦已開採殆盡，而且受到世界經濟危機的影響，日商宣告停止開採，全部人員撤返日本。
- 民國22年4月10日，法軍佔領太平島，趕走島上日商與台灣勞工。
- 民國24年初，日本人平田末治勾結海軍省和台灣總督府設立開發太平島的開洋興行株式會社，同年4月，法國以軍艦派遣30名越南人長住太平島。
- 民國25年12月，日本人平田末治開發的開洋興業公司非法派員探查磷礦。
- 民國27年8月9日，日本派遣軍艦，建立石碑記載日本人開發經過；同年10月30日，日本派遣軍艦，士兵和台灣勞工登陸；12月7日則有更多人登陸。
- 民國28年4月，日軍攻佔太平島，並將其更名為長島，納入高雄市管理。在這期間，日本曾在島上駐紮過陸戰隊、氣象情報隊、通信派遣隊和偵察機部隊。
- 民國33年，日本在島上建立了潛艇基地。
- 民國34年12月12日，中華民國政府設立「南沙管理處」隸屬廣東省政府管轄，並修建電台、氣象台。
- 民國35年10月5日，法國Chevreud號侵入並登陸南沙群島南威島和太平島，在島上建立石碑，當時中華民國政府提出抗議，並與法方決定於該月及翌年1月4日進行談判，但因越南戰爭緊張，法國自動放棄談判。
- 民國35年11月24日，中華民國政府派出「中業號」、「永興號」、「太平號」、「中建號」等四艘軍艦，由指揮官林遵、姚汝鈺率領南下，並有內政及陸海空各部代表隨往視察，會同海軍在廣州出發，前往西沙、南沙進駐接收。12月12日，接收南沙群島的「太平」、「中業」兩艦由林遵率領，抵達太平島。為了紀念「太平」艦接收該島，即以「太平」為該島命名。在島西南方的防波堤末

端豎立起「太平島」石碑，並在島之東端，另立「南沙群島太平島」石碑。立碑完後，乃於碑旁舉行接收和升旗典禮。在太平島設立南沙群島管理處，隸屬於廣東省政府管轄。

- 民國39年，菲律賓民間人士進佔南沙太平島及其他諸島，大肆盜採磷礦。
- 民國41年對日合約中，日本放棄對南沙群島之一切權利，權利名義與要求。
- 民國45年6月5日，太平艦再次駛抵太平島立碑並升旗，改編為「南沙守備區」，改派海軍陸戰隊守備此地。
- 民國48年，島上官兵自台灣迎奉千手觀世音菩薩來此祭祀，修建觀音堂。
- 民國49年10月31日，將原有之氣象站擴充為氣象台，同年9月9日設立郵政代辦所一處，歸高雄郵局管轄，迄1963年7月，改隸台北市郵局管轄。
- 民國52年，行政院退輔會於太平島設立「南海開發小組」，從事廢鐵打撈與磷礦開採，迄1968年擴編為「南海資源開發所」。
- 民國56年10月，中國青年反共救國團「暑期育樂活動南疆遠航隊」設立「南疆屏障」石碑1座。
- 民國64年，中華民國政府針對菲律賓、越南、馬來西亞相繼侵佔南沙群島，發表對南沙群島唯一合法主權之嚴正聲明。
- 民國76年，設立「台澎地區漁民服務站」，推展各項漁民服務工作。
- 民國79年1月12日，由內政部地政司司長王杏泉代表部長許水德，登島設立「南疆鎖鑰」石碑1座，並重申中華民國對南海之主權；同年2月16日行政院核定高雄市成立管理委員會，接管太平島，隸屬高雄市旗津區，設立「漁業工作站」。
- 民國79年2月16日行政院核定高雄市成立管理委員會，接管南沙太平島。
- 民國81年6月12日，由內政部負責籌組「南沙小組」。
- 民國89年1月28日行政院成立「海岸巡防署」，將原隸屬國防部之海岸巡防部隊改編為「海岸巡防總局」隸屬「行政院海岸巡防署」，並接管南沙太平島，平時依法執行查緝走私、偷渡及商（漁）船安檢任務；戰時依「國防法」第4條第2項及「海岸巡防署組織法」第24條之規定：「戰爭或事變發生時，依行政院命令納入國防軍事作戰體系」，遂行作戰任務。
- 民國92年8月16日，中華民國內政部長余政憲率領行政院經建會副主委張景森、研考會副主委蔡丁貴、海巡署副署長游乾賜、高雄市副市長林永堅等一行人前往視察，並舉行一等衛星控制點設置動土典禮。
- 民國94年12月中旬，國防部「太平專案」動工，期間因「工程預算」因素而於95年7月暫停施工，96年「太平專案」經行政院核予復工，並於96年12月完工。其機場跑道全長1250公尺，可供空軍C-130H運輸機起降，未來將規劃延長至1500公尺。
- 民國95年，中華民國政府為便利由台灣本島運輸補給和醫療救護，在島上興建一條1150公尺的飛機跑道，但卻引發了破壞生態的爭議。而由於此舉的戰略意義，也引起鄰近國家的不滿；之後因立法院未通過此預算，於同年7月暫停施工，該施工部隊已返回台灣。
- 民國96年3月3日，高雄市政府海洋局為保護當地活動之海龜及響應國際間對海龜保育工作的重視，依漁業法第45條規定公告劃設太平島海龜繁殖保育區，範圍以太平島為中心，陸域產卵棲地從沙灘至樹林外側，海域重要棲息環境自潮間帶和低潮線至12浬處。
- 民國96年，「行政大樓暨砲陣地新建工程」係由軍備局規劃設計及發包，委由南巡局及南沙巡防指揮部負責監造，並於96年12月7日辦理動土典禮，96年12月10日開工，預定工期125工作天；因故延期，目前已於97年11月23日申報完工，同年12月14日複驗完畢，98 01月25日完成搬遷。
- 97年至99年完成南沙太平島高壓磚鋪設路段計有25處，約6945.3平方公尺。

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Annex 911

Dr. Ryan T. Bailey, *Supplemental Report on Groundwater Resources Analysis of Itu Aba*
(20 Apr. 2016)

Supplemental Report on Groundwater Resources Analysis of Itu Aba

By Dr. Ryan T. Bailey
Department of Civil & Environmental Engineering
Colorado State University
20 April 2016

On 9 March 2016, I submitted a report assessing Itu Aba's potential groundwater resources. Subsequently, I received, among other materials, the *Amicus Curiae* Submission by the Chinese (Taiwan) Society of International Law dated 23 March 2016 and three expert reports: *Water Quality and Agricultural Environment Survey – Groundwater Quality and Hydrology Survey Report* by Ta-Wei Chang; *Water Quality and Agricultural Environment Survey of Taiping Island ─ The Flora and Vegetation Survey Report* by Chien-Fan Chen; and *Preliminary Studies on the Holocene Geology of Taiping Island* by Shou-Yeh Gong and Kuo-Yen Wei.

I have carefully examined these materials. They contain no information that causes me to question the conclusion stated in my original report that any naturally occurring fresh groundwater resources on Itu Aba likely are virtually non-existent.[1] If anything, these materials suggest that my previous modeling results of Itu Aba's groundwater resources were too optimistic.

In this Supplemental Report, I address points made in these materials concerning the existence and extent of any fresh groundwater on Itu Aba, and the quality and quantity of the groundwater.

[1] Dr. Ryan T. Bailey, *Expert Report on Groundwater Resources Analysis of Itu Aba*, 9 March 2016, pp. 9-10.

1. The Existence of a Freshwater Lens on Itu Aba

The authors of *Preliminary Studies on the Holocene Geology of Taiping Island* state that Itu Aba has a "permanent" freshwater lens.[2] They do not, however, provide any evidence for this statement. The report therefore provides no scientific basis for concluding that Itu Aba has a permanent freshwater lens.

There is ample scientific reason for doubting that a freshwater lens within the subsurface of Itu Aba is in fact permanent. As I indicated in my previous report, there are a number of important variables that affect the size and permanence of freshwater lenses beneath small coral islands like Itu Aba, including rainfall patterns. Itu Aba reportedly experiences distinct wet and dry seasons.[3] According to the new report, *Water Quality and Agricultural Environment Survey – Groundwater Quality and Hydrology Survey Report* (discussed further below), the rainy season on Itu Aba lasts from June to January, and the dry season from February to May.[4] This is significant because, as explained in my earlier report, periods of little or no rainfall can cause the rapid depletion of the lens as fresh groundwater that is not replenished by recharge discharges to the ocean. Complete lens depletion for islands like Itu Aba can occur in as little as 2-3 months with little or no rainfall.[5]

Given that Itu Aba has a dry season that lasts at least four months, it is reasonable to conclude to a high degree of scientific certainty that even during normal climactic cycles Itu Aba will experience periods during which any freshwater lens beneath it is completely depleted. Moreover, given that Itu Aba is subject to periodic El Niño, La Niña cycles during which more extended dry periods are likely, it is also reasonable to conclude to a high degree of certainty that Itu Aba experiences more prolonged periods during which the freshwater lens would be expected to disappear entirely.

The authors of *Preliminary Studies on the Holocene Geology of Taiping Island* also postulate that "if the freshwater surface is 1 meter above sea level, there will be 40 meters of

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[2] Shou-Yeh Gong and Kuo-Yen Wei, *Preliminary Studies on the Holocene Geology of Taiping Island,* p. 1.

[3] Dr. Ryan T. Bailey, *Expert Report on Groundwater Resources Analysis of Itu Aba*, 9 March 2016, p. 9.

[4] Shou-Yeh Gong and Kuo-Yen Wei, *Preliminary Studies on the Holocene Geology of Taiping Island,* p. 3.

[5] Dr. Ryan T. Bailey, Expert Report on Groundwater Resources Analysis of Itu Aba, 9 March 2016, p. 9.

freshwater below". This might be read to suggest that any freshwater lens on Itu Aba is thick.[6] However, there is no basis for this suggestion. The authors present no measurements of either the height above sea level of the freshwater surface or the thickness of the freshwater lens, and therefore the statement regarding the 1:40 ratio does not have any bearing on the existence or permanence of a freshwater lens.

Moreover, the authors of the report fail to state that the freshwater surface on small coral islands like Itu Aba is typically only centimeters above sea level. The vast majority of coral islands in the Pacific and Indian Oceans have a freshwater lens thickness of less than 20 m, with thickness of greater than 10 m occurring only for islands with widths substantially larger than that of Itu Aba[7]. For islands with widths of 300-500 m, the maximum lens thickness is typically on the order of 2-4 m, which is based on a freshwater surface of approximately 5-10 cm above mean sea level. Even if the "1:40 rule" held true in the case of Itu Aba, the freshwater lens thickness would be only a meter or two thick at best. In my original report, I estimated that the average thickness of Itu Aba's freshwater lens is 1.6 m. This suggests that the water level above sea level is about 4 cm (0.04 m).

It also bears note that the "1:40 rule" does not always apply. This occurs, for example, when tidal influence causes a thick transition ("mixing") zone between the freshwater lens and the underlying seawater, with a ratio of 1:35 to 1:30 more likely.

3. The Quality of Itu Aba's Groundwater

The *Groundwater Quality and Hydrology Survey Report* confirms that, at best, only one out of four wells on Itu Aba (Well No. 5) has potable freshwater.[8] According to the report, the measured salt concentration of water drawn from Well No. 5 varied between 418 and 427 mg/L.[9]

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[6] Shou-Yeh Gong and Kuo-Yen Wei, *Preliminary Studies on the Holocene Geology of Taiping Island,* p. 3.

[7] Bailey, R.T., Jenson, J.W., and A. Olsen (2009) Numerical Modeling of Atoll Island Hydrogeology. Groundwater 47(2) 184-196.

[8] Ta-Wei Chang, *Water Quality and Agricultural Environment Survey – Groundwater Quality and Hydrology Survey Report*, pp. 2, 3.

[9] Ta-Wei Chang, *Water Quality and Agricultural Environment Survey – Groundwater Quality and Hydrology Survey Report*, p. 2.

In my opinion, this measurement of the salt concentration of water drawn from Well No. 5 is methodologically flawed in at least two respects. According to the report, the water quality testing was based on samples drawn on January 22-23.[10] This is at the end of the local rainy season which reportedly "occurs from June each year to next January".[11] This difference between testing the water at the end of the rainy season and at the end of the dry season is significant. For objective results, the testing should have been done during the dry season, when the salt concentration in the groundwater is certain to be higher (due to the absence of rainwater to replenish any freshwater lens). Measuring the salt concentration in the water drawn from Well No. 5 during, or at the end of, the dry season would provide a more meaningful indication of whether potable freshwater is available on Itu Aba year-round.

In addition, the report indicates that two samples of the water from Well No. 5 were tested. The first sample was tested after the water had been in the well "for some time"; the second sample was tested after some undetermined amount of water had been siphoned off and the freshwater allowed to "recharge" overnight.[12] The tests thus appear to have been performed on the "freshest" water available on Itu Aba (and then at the end of the rainy season). A more scientifically appropriate way to test water quality would have been to test the water immediately after extracting a designated amount of water, e.g. about 2,000 liters, which is the reported volume of water extracted daily from the well.

Moreover, it is significant that even the reported salt concentration of Well No. 5 (418-427 mg/L) taken under the controlled conditions described above are comparatively high. By way of example, water with a chloride content greater than 250 mg/L, which corresponds to approximately 455 mg/L of total salt, is designated by the United States Environmental Protection Agency as having a "salty taste" (EPA Secondary Drinking Water Standards), and the maximum recommended salt concentration in potable water is about 850 mg/L. This may explain

[10] Ta-Wei Chang, *Water Quality and Agricultural Environment Survey – Groundwater Quality and Hydrology Survey Report*, p. 1.

[11] Ta-Wei Chang, *Water Quality and Agricultural Environment Survey – Groundwater Quality and Hydrology Survey Report*, pp. 2, 3.

[12] Ta-Wei Chang, *Water Quality and Agricultural Environment Survey – Groundwater Quality and Hydrology Survey Report*, p. 1.

why a sign posted near Well No. 5 states that "the water drawn from well no. 5 is potable, yet better tasting after desalination."[13]

Further, the reported salt concentrations are inconsistent with an earlier 1994 report entitled "*Policy Guiding Principles: The Report for the Ecological Environment Survey on South Sea*" that was referenced in but not attached to the *amicus curiae* brief. According to the translation of that report provided to me, salt concentrations of the groundwater were measured at two sites. The results indicated that the salt concentration at the "better" of the two sites (which it seems reasonable to conclude corresponds to the location of Well No. 5) was 1.1 ppt, while the other was 2.0 ppt. As stated in the last paragraph, the highest limit of freshwater is a salt content equal to 850 mg/L, which is 0.85 ppt. Thus, both sites were above the maximum allowable salt concentration for potable water, with the second site more than two times the limit.

As regards the water resources in the remaining three wells, the report confirms that they are significantly affected by seawater.[14] This is predictable because small insular features composed of porous sand and coral debris like Itu Aba[15] are highly vulnerable to seawater infiltration. Because the areas where the other three wells are located contain brackish water, Well No. 5 is vulnerable to salinization if too much groundwater is pumped from this well.

The *Groundwater Quality and Hydrology Survey Report* states that the average salinity of the four operational wells on Itu Aba is "lower than 3%, far below the average salinity of 33% to 35% of seawater."[16] In the first place, averaging the salinity of four wells is methodologically inappropriate. This has the effect of enhancing the apparent overall quality of the groundwater. Best scientific practice dictates that each site be measured and reported separately.

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[13] Center for Strategic and International Studies, *Asia Maritime Transparency Initiative*, http://amti.csis.org/exploring-itu-aba-virtual-tour-south-china-sea-islet/#18742B6F-9FDC-6796-708C-81616F0B542C.

[14] Ta-Wei Chang, *Water Quality and Agricultural Environment Survey – Groundwater Quality and Hydrology Survey Report*, p. 2.

[15] Shou-Yeh Gong and Kuo-Yen Wei, *Preliminary Studies on the Holocene Geology of Taiping Island*, p. 3.

[16] Ta-Wei Chang, *Water Quality and Agricultural Environment Survey – Groundwater Quality and Hydrology Survey Report*, p. 2.

The way in which reported average is presented is also scientifically inappropriate. Salinity must be compared to allowable salt concentration in potable water, not to the salt concentration of seawater. The report thus compares apples to oranges. Salinity of about 10% that of seawater reflects significant salt content that renders water unpotable and unusable for most other purposes. Water with such high salt concentration cannot, for example, be used even for cooking, cleaning or irrigation.

4. The Quantity of Itu Aba's Groundwater

The *Groundwater Quality and Hydrology Survey Report* states that Well No. 5 "can provide 2 to 3 tons daily" of freshwater.[17] Again, no evidence is provided to support this statement. There are several factors that indicate that the stated daily amount of freshwater would be unsustainable.

As indicated above, the report explains that water from Well No. 5 was tested only after (1) the water had been in the well "for some time", and (2) the freshwater was allowed to "recharge" overnight.[18] A meaningful test of the well's capacity would require testing only after the asserted amount (2-3,000 liters) had been pumped from the well. This would indicate whether the well could sustain the pumping rate without rendering the water unpotable or otherwise unfit for human use. The test should also be conducted during or at the end of the dry season, not the rainy season.

Also, it appears that Well No. 5 is surrounded by Wells Nos. 7, 9 and 10,[19] which contain only brackish/saline water.[20] This suggests that, at best, Itu Aba has only a small pocket of freshwater beneath the center of the island (near where Well No. 5 is located) that is surrounded by larger pockets of brackish/saline water.

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[17] Ta-Wei Chang, *Water Quality and Agricultural Environment Survey – Groundwater Quality and Hydrology Survey Report*, p. 2.

[18] Ta-Wei Chang, *Water Quality and Agricultural Environment Survey – Groundwater Quality and Hydrology Survey Report*, p. 1.

[19] See Map 5 of the Flora and Vegetation Survey Report.

[20] Ta-Wei Chang, *Water Quality and Agricultural Environment Survey – Groundwater Quality and Hydrology Survey Report*, p. 2.

In this respect, Itu Aba appears to contrast with most coral islands that typically have a fresh water lens that extends beneath most of the land surface. In fact, the modeling approach I used in my first report assumed that any freshwater lens extended across the whole area of Itu Aba. As such, my original calculations on Itu Aba's fresh groundwater resources (average lens thickness of 1.6 m under the center of the island) were too optimistic, over-estimating the amount of available fresh groundwater on the island, and a more conservative estimate is warranted. As a full freshwater lens does not seem to exist on the island, available modeling tools can only provide over-estimates of the amount of fresh groundwater, and a more conservative estimate is warranted.

The *Groundwater Quality and Hydrology Survey Report* also asserts that "rainwater infiltration to the aquifer storage should be sufficient to provide the island population with about 0.237 million M^3 of groundwater."[21] This is not correct. The amount of infiltration cannot be equated with the amount of available freshwater. The report ignores the fact, stated in my first report, that a large portion of groundwater discharges to the ocean, and does not stay in the aquifer. Moreover, the fact that three out of four wells on Itu Aba contain brackish/saline groundwater indicates that infiltration is not uniform across the feature.

4. Conclusion

It is my opinion that a sustainable quantity of fresh groundwater does not exist on Itu Aba. Based on the field data reported by Taiwan, only a small pocket of fresh groundwater exists, and even this water is at the limit of "fresh" (418 mg/L – 427 mg/L, compared to the limit of 450 mg/L at which water tastes salty). As this data is based on water quality sampling during the rainy season, I conclude that groundwater on Itu Aba during the dry season or drought periods most likely contains a salt concentration above that of the freshwater limit, and as such groundwater is not a sustainable resource for the island.

Ryan T. Bailey, 20 April 2016

[21] Ta-Wei Chang, *Water Quality and Agricultural Environment Survey – Groundwater Quality and Hydrology Survey Report*, p. 3.

Annex 912

Dr. Peter P. Motavalli, Ph.D., *Supplemental Expert Report on Soil Resources and Potential Self-Sustaining Agricultural Production on Itu Aba* (24 Apr. 2016)

Supplemental Expert Report on Soil Resources and Potential Self-Sustaining Agricultural Production on Itu Aba

Dr. Peter P. Motavalli, Ph.D.

24 April 2016

I. Introduction

My name is Dr. Peter P. Motavalli and I have been a Professor in Soil Nutrient Management at the University of Missouri in Columbia, Missouri (U.S.A.) since 1999.[1] From 1994 to 1999, I taught and conducted research on soil nutrient management of Pacific Island soils, especially in the region of Micronesia, at the University of Guam. I previously provided a report, dated 9 March 2016, analyzing the soil resources and potential for agricultural production on Itu Aba. My CV is attached in an appendix to that report.

I provide this supplemental report to address two documents exhibited to the *amicus curiae* submission by the Chinese (Taiwan) Society of International Law (CSIL), dated 23 March 2016. In addition to the information I reviewed in the preparation of my first report,[2] I have reviewed the following additional documents:

a) Zueng-Sang Chen, *Brief Report of Soil Resources Survey of Taiping Island* (Exhibit 31) ("the Soil Report")
b) Office of the President of the Taiwan Authority of China, "Remarks by President Ma on Taiping Island" (28 Jan. 2016) (Exhibit 2) ("President Ma's remarks")

In this supplemental report, I provide an updated overview of the soil resources on Itu Aba, taking into account the new information provided in the documents above. Then, I explain some methodological irregularities in the Soil Report presented with the CSIL *amicus curiae* submission. Finally, I conclude with a rebuttal of the claims made regarding the feature's ability to support self-sustaining agricultural production.

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[1] The content of this supplemental report does not reflect the official opinion or views of the University of Missouri. Responsibility for the information and views expressed in the report lies entirely with the author.

[2] *See* Annex 879, p. 3.

II. Supplemental Assessment of the Soil Resources on Itu Aba

Overall, the underlying soil information provided in the Soil Report is consistent with my first report. As I predicted, the Soil Report identifies all three reported soil samples taken on Itu Aba as "Entisols." Entisols are weakly-developed soils of recent origin. The distinguishing characteristic of Entisols is that they exhibit little or no evidence of the development of pedogenic horizons, or soil layers.

Because they lack pedogenic horizons, Entisols are typically dominated by the characteristics of the parent material. In this case, the Soil Report states that the parent material is primarily coral reef rock composed of coralline limestone. As I explained in my first report, these types of soils typically exhibit a high pH that poses a constraint for plant nutrition because of deficiencies in phosphorus and micronutrients such as copper, iron, manganese and zinc. Also, nitrogen loss from ammonia volatilization is also greater in high pH soils.

Entisols are also inhospitable soils for root and plant growth because of their shallow nature. (According to the Soil Report, the coral bedrock it located at depths of between 40 and 60 cm, which is quite shallow in terms of affording medium for substantial plant growth.) With fertilization and controlled water supply, some Entisols may be used for some types of agriculture, such as rangeland or grazing, but their lack of depth, clay content, and water balance limit intensive use of these soils. It is unlikely that roots of any meaningful length exist on Itu Aba, given the characteristics of Entisols, despite what the Soil Report appears to state.[3] In this

[3] CSIL *amicus brief*, Exhibit 31, pp. 1-2. The report references "different sizes plant roots" and "high amounts of roots" in both types of soil identified.

case, the shallow nature of the soil could allow for growth of some non-agricultural native and introduced species that are adapted for this type of environment.

The constraints Entisols typically present for plant growth generally results in low litterfall amounts which slows the accumulation of organic matter in the topsoil. The accumulation of organic matter on small coral islands like Itu Aba is further limited by the continual deposition and removal of sand and other marine sediments due to wave and tidal action and strong winds.

Because the Soil Report does not provide any laboratory analysis or information on procedures and inputs for their estimates of litterfall (discussed further below), it is difficult to ascertain the possible contribution of the soil organic matter in the described pedons to soil fertility in this case. Estimating the amount of soil organic matter based merely on a visual inspection of soil color, as the Soil Report does, may not be an accurate procedure since soil color is affected by several factors other than organic matter content.

Entisols generally are found to have what are known as ochric or anthropic epipedons, a superficial soil layer near the surface. According to the Soil Report, all three soil pedons examined are classified as having an “ochric epipedon.” This type of epipedon is deemed too light, too thin, or too low in organic matter to be classified as any other type of epipedon. Essentially, if a soil’s epipedon fails to meet the criteria for any other type of epipedon, it is “ochric.”

In the Soil Report, the soil pedons examined are further classified as belonging to the "Udipsamments" or "Quartzipsamments" Great Groups.[4] Entisol "Psamments" are dominated by unconsolidated sand deposits. As such, they are extremely low in all essential nutrients, particularly phosphorus. These types of soils also often have very poor water-holding capacity and low nutrient retention which can limit crop growth without supplemental water and nutrient amendments.

The fact that coconut may grow wildly on the feature does not change my conclusions about the general characteristics of the soil on Itu Aba or the feature's likely inability to support significant agricultural production. Coconut grows well in shallow, sandy soil. Unlike most other food plants, it has adapted well to the suboptimal conditions common to limestone islands.

With respect to President Ma's remarks about the vegetables growing on Itu Aba's farm, I would expect that this is done using soil amendments (such as imported soil and/or fertilizers). The Soil Report's description of Pedon No. 3, taken from "[f]arm land for different vegetables and crops," identifies that soil as an Entisol with a sandy loam soil texture. Continual agricultural production of the types of vegetables identified by President Ma in such soil is not possible with soil amendments. The fact that soil in the vegetable beds is of a perceptibly different color than other locations on Itu Aba supports the hypothesis that extensive soil amendments have been used.

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[4] The classification of Quartzipsamment and Udipsamment within the Psamment suborder provides further information on specific diagnostic features, base status, soil temperature, and soil moisture regimes. Udipsamments have a humid soil moisture regime, meaning they are found in humid or subhumid climates, while Quartzipsamments have a high quartz content.

III. Critique of the Soil Report's Methodology

In my opinion, there are at least two significant methodological difficulties with the approach adopted in the Soil Report that render inconsistent with scientific best practice. One is that the Soil Report does not indicate the precise area on Itu Aba that each pedon represents. The report simply states that pedons in the "grass land, coconut field, agricultural field, tropical natural forest, and shrubs area" were investigated. Information on the rationale for selecting each sampling site would be important for determining how representative each pedon description is for an assessment of the overall soil resources on Itu Aba. Moreover, the report references five soil pedons but only provides information for three of them, and it is unclear from which area they were taken, and whether the photographs included in the report align with the samples described above them.

Also, in this field, common procedure for soil surveys is to assess the presence of carbonates in the soil, which is important to determine how calcareous the soil is. The Soil Report does not provide the results of this test (if it was conducted), and the only reference to the calcareous nature of the soil is provided in captions for Pictures 1, 6 and 9. Similarly, it is unusual to only perform visual inspection of soil samples. Standard procedure calls for laboratory tests that would include soil organic matter content, pH, exchangeable acidity, and cation exchange capacity, among others.[5] These analyses are important for classification and critical to determine potential constraints for plant growth.

[5] As my first report states, "an in-depth inventory of the soil resources on Itu Aba Island would be required for a more thorough assessment of the suitability of the soil for sustainable agricultural production. This would include a detailed soil survey and physical, chemical and biological analysis of soil properties, especially soil properties that are important to assess soil fertility for plant growth to produce food." Annex 879, pp. 3-4 (emphasis added).

IV. Response to Claims Made Regarding Self-Sustaining Agricultural Production

President Ma's claims regarding self-sustaining agricultural production on Itu Aba are not consistent with my first report but they do not change my conclusions. As mentioned above, the Soil Report does not provide sufficiently detailed information, including chemical analyses of the soil, to determine potential constraints for plant growth with precision..

Even without this information, however, we know that generally low limestone features with the climate, soil characteristics, and soil distribution of Itu Aba present multiple constraints for self-sustaining agricultural production. In my first report, I identified at least five such constraints: (1) the dominance of sand in the soil profile, which reduces the capacity of the soil to retain water and nutrients; (2) the high pH, calcareous nature of the soils (indicated in a study reviewed for my first report); (3) high winds; (4) soil degradation due to intensive cultivation of a small area; and (5) the small proportion of land available for any type of agricultural production, and even then only with the use of extensive external inputs.[6] Additionally, it is important to note that soil pedogenic processes occur very slowly and are not likely to affect near future agricultural production.

The Soil Report's description of the soil on Itu Aba as Entisols of the Udipsamments or Quartzipsamments Great Groups with the diagnostic epipedon ochric epipedon are all entirely consistent with the conclusion that Itu Aba, like other low coral islands exhibits all these constraints for self-sustaining agricultural production.

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[6] Annex 879, pp. 6-8. Note that litterfall decomposition is not likely sufficient to sustain intensive agricultural production without external nutrient inputs.

In conclusion, I affirm the opinion I gave in my first report: that the Entisol soil on Itu Aba is calcareous, dominated by sand and coral, with limited soil development, and exhibiting a relatively high pH—all of which makes it generally inhospitable to many types of vegetation. Other factors present in the soil and on the feature present serious constraints for self-sustaining agricultural production.

Dr. Peter P. Motavalli, Ph.D.
24 April 2016
Columbia, MO, USA

Annex 913

"Spratly Islands Initial Stage Installation and Estimated Income & Expenditure Statement", *Japanese Ministry of Foreign Affairs Archives*, A.4.1.0.2-1-1 Vol. 1, No. 8 (undated)

Spratly Islands Initial Stage Installation and Estimated Income & Expenditure Statement			
I. Installation			
1. Facilities			
AMOUNT		CATEGORY	BREAKDOWN
K	Yen		
2,	400	Wireless Telegraph Room	Building: 24 tsubo @ 100 yen per tsubo
1,	500	Sailors Housing	Building: 30 tsubo @ 50 yen per tsubo
4,	900	Office Staff Housing	Building (2 buildings): 42 tsubo @ 116.66 seen per tsubo
1,	680	Fishermen Dining Room and Kitchen	Building: 21 tsubo @ 80 yen per tsubo
1,	000	Infirmary	Building: 20 tsubo, 100 yen per tsubo
3,	000	Pier (width: about 10 shaku; length: 30 ken) [Translator's note: 1 shaku = approx. 0.99 feet; 1 ken = 5.96 feet]	150 yen per 1 ken
	800	Food Storage	Building: 10 tsubo @ 80 yen per tsubo
2,	400	Product Storage	Building: 30 tsubo @ 80 yen per tsubo
	500	Drying Area	Building: 100 tsubo @ 5 yen per tsubo

1,000		Tank (height: about 4 feet 3 tsubo)	
250		Water Storage Tank	50 yen for one unit
25,000		Wireless Telegraph Equipment	
4,000		Machine Gun Stands and Firearms Storage	Height: about 28 shaku 6 tsubo
3,000		Heavy Machine Guns x 2	1500 yen for one unit
3,250		Light Machine Guns x 5	650 yen for one unit
2,100		Rifles x 30	70 yen for one unit
Sub-Total 56,	780		
2. Vessels			
AMOUNT		CATEGORY	BREAKDOWN
K	Yen		
12,000		80 h.p. Fishing Boat x 1	Including hull
9,250		60 h.p. Fishing Boat x 1	
4,500		Tub Boat Motor Boat x 1	
Total 82,	280		

Total 82,	280		
II. Estimated Income & expenditure *			
1. Operating Expenses (Annual Amount)			
AMOUNT		CATEGORY	BREAKDOWN
K	Yen		
60,	000	Salaries and Food Expenses	Office Staff: 5 members; Fishing Boat Crew: 20 members; Contracted Fishermen: 50 members
15,	000	Fuel Expenses	For Fishing Boats and Tug Boats
2,	400	Medical Expenses and Those for Consumable Goods	
6,	000	Repair Expenses	
7,	000	Wireless Telegraph Expenses	
6,	000	Miscellaneous Expenses	
Total 96,	400		

2. Business Income			
AMOUNT		CATEGORY	BREAKDOWN
K	Yen		
37,	000	Trocas Shell: 47,000 kin at 64 yen per 100 kin [Translator's note: 1 kin = approx. 0.6 kg]	10 kin collected per fishermen per day. The work lasted for 9 months.
35,	500	Hirose Shell: 142,000 kin at 25 yen per 100 kin	# of Workers: 70 workers. 189,000 kin collected in on year.
Total 72,	500		
Net Loss	900		
200K yen is to be reserved as the capital, and 100K yen is to be paid, as a result, the fixed capital is to be ~~82,680 yen~~ 82,280 yen and the working capital is to be 17,720 yen. For the 2nd phase, it is planned to procure refrigeration equipment to catch tunas and other fishes as well.			

CONFIDENTIAL
Original Domicile Address, Professional History
Original Domicile: <illegible>

新南群島第一期設備及收支概算書

一、設備

一ノ施設

金額	種類	内訳
二、四〇〇円	事務所及無線電信室	建物二十四坪 坪当一〇〇円
一、五〇〇	船員宿舎	〃 三十坪 〃 五〇円
四、九〇〇	事務員宿舎	又（三棟）四十九坪 〃 [illegible]
六、六八〇	鑛夫食堂及炊事場	〃 二十一坪 〃 [illegible]〇円
六、〇〇〇	病室	建物六十坪 坪当一〇〇円
三、〇〇〇	棧橋 長サ廿尺 幅 間	間当 [illegible]五〇円
一、八〇〇	食料倉庫	建物十坪 坪当八〇円
二、四〇〇	商品倉庫	〃 三十坪 〃 八〇円
一、五〇〇	乾燥場	百坪 坪当 五円

数量	金額	品名	摘要
一	一〇〇〇	タンク高サ四尺三坪	四年前造 廿円
[illegible]	二五〇	貯水槽五ケ	二ケ 三千五〇円 八〇円
二五	一〇〇〇	無線電信設備	[illegible] 十年前造 八〇円
四	〇〇〇〇	機関銃及銃器倉	高サ二十尺 [illegible]坪
三	〇〇〇〇	重機関銃二台	[illegible] 十五年前造 一〇円
三	三五〇〇	軽機関銃五挺	一台 二十[illegible] 一〇円
[illegible]	九〇〇〇	小銃三十挺	十(挺)四十七挺 二円
[illegible]	[illegible]	[illegible]	二十挺 廿〇円
三六	七八〇〇	[illegible]	[illegible] 廿四年前造 一〇〇円
小計			
2 船	二船		
金	額	種類	内訳
一		八十馬力漁船一隻 / 六十馬力漁船一隻 / 一隻 モーターボート一隻	船体共
[illegible]	四九三千 五〇〇〇〇		

合計 八二二二八〇円

合計　八二、二八〇円

二、収支概算（年額）

（イ）経常経費

金額	種類	内容
六〇、〇〇〇円	給料及食料費	事務員五名 常雇漁夫二〇名 乗込漁夫五〇名
五、〇〇〇	燃料費	漁船及発艇用
二、四〇〇	医療及消耗品費	
六、〇〇〇	修繕費	
七、〇〇〇	無線電信経費	
六、〇〇〇	雑費	
計 九六、四〇〇		

乙、事業收入

金額	種類	内訳
二七、〇〇〇	高瀬貝四七、〇〇〇斤 百斤当六四円	漁夫一日又十斤採取 作業期間九ヶ月 従業人七十人 一ヶ年採取六八、〇〇〇斤
三五、五〇〇	廣瀬貝一四〇、〇〇〇斤 〃二五円	
計 七六、五〇〇		

差引不足金六三、九〇〇円

資本金五十万円内 拾万円拂込ニシテ固定資金八二、二八〇円 運轉資金一七、七二〇円ニシテ第一期計画ニ於テ冷凍設備ヲ為シ鮪其ノ他ノ魚獲ヲモ営業トス計畫

一、漁夫人件費(年額)