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## TWO STUDIES OF MARINE ENVIRONMENT IN AUSTRALIA

A controversy arose in the late 1960s regarding the effect of the crown-of-thorns starfish *Acanthaster planci* (Lamarck) on the Great Barrier Reef. At that time of public concern, oil exploration was announced in the vicinity of the reef. In response to public outcry, government created the Great Barrier Reef Petroleum Drilling Royal Commission to consider: (1) what risk there is of an oil or gas leak during drilling; (2) what the effects would be of such a leak and the subsequent remedial measures; (3) whether there are localities where drilling might be permitted; (4) what safety conditions should be imposed before drilling; and (5) what are the probable benefits accruing from drilling.

Westernport Bay is close to petroleum reserves and consumer markets, and is an obvious place for industrial development. It is also an untouched body of water suitable for holiday homes, and recreation for Melbourne's 2.6 million people. The catchment of Westernport Bay offers undeveloped land for expansion of the city's residential areas.

To resolve the conflicts, represented by the possible uses of Westernport Bay, the Victorian Government, in conjunction with industry, created the Westernport Bay Environment Study. This interdisciplinary scientific program comprises: (1) collection of information on the characteristics of bay waters, and distribution of living organisms; (2) laboratory studies on tolerance to pollutants of selected species; (3) preparation of a land-use model for forecasting potential inputs to the bay from any planned development in the catchment area; and (5) preparation of a water-quality model of the bay describing intensity, areal extent, and duration of contamination arising from a given input.

The Barrier Reef Royal Commission will provide government with recommendations on the policy to be adopted regarding oil-industry activities in the Barrier Reef area, based on the Commission's careful testing, according to the rules of evidence, of the available knowledge. The Westernport Study will provide government with new knowledge and a numerical tool for predicting the impact of change; it will not recommend a policy for the future development of the Westernport area.

Here are two contrasting methods of handling a complex environmental problem. Each will cost some US \$2 million, and each will take several years to complete.

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## MARINE PETROLEUM EXPLORATION OF KOREAN PLATFORM

Geophysical surveys performed over the southeastern part of the Yellow Sea indicate the presence of a broad area of shallow basement called the Korean platform. A veneer of Pliocene-Pleistocene sedimentary rocks on this platform covers a regional unconformity. Sedimentary basins and subcrop patterns below this unconformity demonstrate a positive structural trend far west and south of the Korean Peninsula.

Two deep exploratory wells drilled on the north edge of the study area are of significance to a better understanding of the stratigraphy west of Korea. Because of the presence of charophytes and freshwater ostracods and the total absence of nanofossils, most of the sedimentary rocks were deposited in continental environments. Limited fossil data indicate shallow-marine tongues that enter the upper part of the section below the regional unconformity. High matrix carbonate in the clastic rocks throughout the section may account for the high interval velocities observed. Although no hydrocarbons were found in the rocks penetrated by the wells, additional drilling will be required before this large area can be fully evaluated.

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## METALLOGENIC BELT AND TECTONIC EVOLUTION OF CHILEAN CIRCUM-PACIFIC CONTINENTAL BORDER

This paper accompanies a mineral and geothermal resources map of the continental part of Chile. The mineral deposits, including coal- and petroleum-bearing basins, and geothermal fields, are associated in belts and represented as fringes on a tectonic base map at a scale 1:2,500,000.

The tectonic-metallogenic scheme shows the relations between the geologic evolution of the region from the Precambrian to the Pleistocene and the genesis of the mineral deposits. Of special interest is the relation of the mineralization of iron, apatite, copper, gold, and silver which are associated with Subhercynian (Cenomanian) plutonism, and the belt of superimposition of the Tithonian-Neocomian marine basin over the folded and eroded Jurassic volcanic formations. Also of interest is the relation of the porphyry copper and polymetallic deposits with paleogeographic factors (especially some Jurassic paleogeographic features), magmatic factors (Tertiary volcanism), and tectonic factors (large normal, reverse, and transcurrent faults).

Although Chilean metallic minerals include deposits of iron, manganese, silver, gold, mercury, etc., its huge copper reserves define it as a highly specialized copper-bearing metallogenic province. Copper production is about 700,000 tons per year, and is chiefly from porphyry copper mines (85%), which also produce associated molybdenum.

Among the industrial minerals, nitrate in the north of Chile is of particular interest, and a revival of its importance is probably due to the present world's shortage of petroleum (required to produce synthetic ammonium nitrate).

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## ENVIRONMENTS OF CORDILLERAN DEPOSITIONAL BASINS

The stratigraphy of the cordillera can be interpreted in terms of stratigraphic assemblages that are unique in distribution, gross lithology, and lateral facies variations. Models of depositional basins in which these assemblages accumulated are essential in exploration for mineral deposits whose distribution is controlled by stratigraphy.

Proterozoic and lower Paleozoic strata in the cordillera comprise an assemblage of clastic and carbonate with minor volcanic rocks that appears to represent a continental-terrace wedge built along the margin of an earlier Precambrian continent. All units show a distinct polarity of facies distribution and thickness relative to the source area. This assemblage contains most of the known stratiform mineral deposits of gypsum, iron, copper, zinc, and lead in the cordillera.

The distinctive elements of a Late Devonian and Early Mississippian assemblage suggest, at least in the northern cordillera, the presence of a foredeep and related source areas in the west and northwest. In the southern and eastern parts of the cordillera, however, the rocks reflect a continuing shelf-platform environment linked to the craton. The mineral potential of these rocks has been considered low but needs further study in view of an important zinc-lead deposit in eastern Selwyn basin.

Distinctive rocks of oceanic character ranging in age from Mississippian to Middle Triassic underlie parts of the cordilleran intermontane belt. The important mineral deposits in these rocks include asbestos deposits in ultramafic rocks in the northern cordillera. Generally, however, mineral discoveries, other than those in ultramafic rocks have been few. In the eastern cordillera a shelf environment prevailed.

The association of copper with volcanic rocks of Late Triassic and Early Jurassic ages is well known. The volcanic rocks, together with spatially and temporally associated plutons, are thought to outline a system of evolving island arcs probably roughly coincident with the mapped distribution of these rocks. Between the arcs and the craton, strata were deposited in a marginal basin with little or no evidence of the volcanism that occurred farther west.

The remaining stratigraphic units, ranging in age from Early Jurassic to the Cenozoic, are described as successor-basin and foredeep assemblages whose distribution and lithology reflect a close relation to bounding uplifts of metamorphic and plutonic terrains. Because they are a late-stage phenomenon in the evolution of the cordillera these assemblages have potential for a variety of placer deposits. They also contain all of the known coal reserves of the region.

GANESHIN, G. S., *et al.*

#### CLASSIFICATION OF SHELVES AROUND PACIFIC

No abstract available.

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#### EXPLOITATION OF MANGANESE NODULES IN SOUTH PACIFIC

Manganese nodules in the South Pacific are mainly in the following regions: an elongate belt approximately 1,000 km wide beneath the Antarctic Circumpolar Current; the Southwest Pacific basin; the Peru basin; the Chile basin; and the mountain region bounded by the Cook Islands and Tuamotu Islands. Metalliferous sediments are present dominantly along the crest of the East Pacific Rise where nodules are largely absent. The distribution patterns suggest that the formations of manganese nodules and metalliferous sediments are

mutually exclusive. Modes of origin of the nodules are suggested and the possibility of economic exploitation of the nodules discussed.

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#### BACKGROUND TO PRESENT MINERAL SEARCH IN BRITISH SOLOMON ISLANDS AND FIJI

The effects of earlier mining policy have inhibited exploration. In both countries government geological surveys were established amid hopes that geologists might supplant prospecting activity by private enterprise, a view that matured over the years in the face of reality. Long-range ground exploration, with continued support and technical collaboration from London, produced geologic maps. Modest finances demanded a basic philosophy differing from the advice from the private sector, but outstanding results were produced which even better complemented and supported the role of private enterprise in resources development.

In the Solomons, the situation demanded the evolution of a dynamic role for government. Unprecedented support, from many sources, and international collaboration in a series of ventures led to a buildup in fundamental exploration which deployed scientists, engineers, army personnel, research vessels, and ships of the Royal Navy. Nickel and other minerals were found and drilled. Activity culminated in a regional reinvestment airborne geophysical survey with shipborne and ground follow-up teams of competent indigenous staff and bearers, each team led by a scientist, and involving an expenditure in excess of a million dollars. There were successes and shortcomings. Copper and bauxite were the main discoveries. The knowledge was applied later to Fiji where a different approach was needed.

Fiji's mapping progress and observations suggested the need for complementary activity by the private sector. Copper mineralization suggesting porphyry-type potential was described in an official letter to more than 80 major mining companies of the world and was supported by press advertisements. The mining companies were not interested. Three replies were received in 11 months. The government decision led to the discovery of anomalies and large deposits now being test drilled. Other mineral occurrences are also mentioned.

The remaining 5,000 sq mi of the main Fiji Islands was the subject of a decision in the same year. Within well-informed mining policy guidelines, agreement was reached with a highly skilled research group for the expenditure of \$2,000,000. The methods and the outcome are described.

Hopes of financial independence now are held where there had been none. The need for a well-informed governmental role in resources development is emphasized as a means to national self realization. Mention also is made of the adjoining New Hebrides and the unusual petroleum potential of the Kingdom of Tonga.

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#### GEOTHERMAL POTENTIALS IN INDONESIA

Since 1969, beginning with the first year of the First Five-Year Development Program, prospecting for geothermal resources has been carried out by the Geo-