

appropriate now to consider its use in mineral prospecting. Its applications can include indirect ore-detection methods such as: tracing intrabasement horizons; qualitative interpretation of zones, using or adapting ideas of seismic stratigraphy; mapping structural features such as faults or folds; interpolating between or extrapolating from existing drill holes.

Direct detection may also be possible by using "bright" or "dim spot" techniques, or because some orebodies have characteristic reflection and diffraction responses.

In contrast with petroleum exploration, where variations in velocity are taken as a guide to reflection response, the evidence indicates that density contrast is more likely to be the governing factor. Thus, for example, increasing substitution of pyrrhotitic ore into a country rock consisting of siltstone does not substantially alter an intrinsic rock velocity of 5.5 km/s. The density, on the other hand, may change from 2.7 to 4.5 t/m³. This is in agreement with the known relationship between velocity, density and mean atomic weight. Therefore, in metamorphic, igneous or mineral-bearing rocks, where porosity is low and exists mostly as microcracks, it is the variations in density which occur in predominantly monomineralic layers which may contribute to a significant reflection response. The thicknesses of such bands, the relative sizes of the targets and the degree of resolution sought of structural features requires the use of high resolution techniques and the recording of frequencies in excess of 200 Hz.

Modeling of the responses of known orebodies confirms the notion that some may have characteristic seismic response. It is a useful approach which assists in the design of field surveys, particularly when one seeks to avoid spatial aliasing problems in areas of steep dip and structural complexity. Processing techniques suitable for a particular area may also be examined using modeling techniques.

The use of common-depth-point stacking is inappropriate in structurally complex areas. However, as some form of stacking is necessary to yield adequate levels of signal above noise, the application of so-called slant-stacking techniques should be considered. These also alleviate problems associated with offset-dependent waveforms and reflection coefficients. Examples from various areas in Australia illustrate these concepts.

NEWCOMBE, KENNETH, STEPHEN MEYERS, WM. SAM PINTZ, and KIRK R. SMITH, East-West Resource Systems Inst., Honolulu, Hawaii

Energy Requirements of South Pacific and the Role of Renewables

During early 1982, a survey of the energy situation in ten countries of the South Pacific was undertaken to determine future energy policy options.

The ten survey countries fall into two natural size groups with larger countries (Papua New Guinea, Fiji, Solomons, Vanuatu) using 20 to 30% of export revenue to purchase imported oil. Western Samoa, however, showed an exceptionally high jump from 38% in 1979 to 60% in 1980. The smaller nations showed even greater balance of payment vulnerability with the most dramatic examples being Niue (where oil imports cost more than twice total exports) and the Cook Islands (where oil consumed 107% of export revenues). For all island nations, copra and other coconut products represent a substantial export earner which is relatively insensitive to energy costs so the possibility of a flow through of oil price increases to export revenues is considered to be unlikely.

Only in the region's largest countries do indigenous energy resources presently play a significant role with PNG and Samoa generating a significant (but declining) fraction of electricity from hydropower and Fiji utilizing bagasse for thermal genera-

tion. Many of the larger countries have hydropower schemes under construction or advanced study but the smaller and flatter nations have little hydro potential. For these nations, biomass potential will also be constrained by the limited land area and by competition with food export crops.

The energy survey concluded that feasible oil substitution strategies for South Pacific Island nations might focus on the generation of electricity and the provision of domestic fuels from biomass although a wide range of other options will play a part. One resource which has substantial potential throughout the Pacific are senile coconut trees well past their productive economic lifetimes which could be developed through gasification or directly to generate island electricity. Beyond special circumstances favoring ethanol in PNG and Fiji, little potential for liquid fuel production is anticipated for the transportation sector over the next 10 to 15 years for most Pacific countries. Identified, as well, are policy changes leading to more efficient use, more rational mixes of fuel supplies, and increases in security of existing petroleum imports.

NISHIWAKI, CHIKAO, Inst. International Minerals Development, Tokyo, Japan

Tectonic Stress and Metallogenesis—Southwest Pacific Island Arc Region

In 1980, the author expressed a hypothesis that the extensional tectonic stress environment is favorable for volcanogenic massive sulfide mineralization, while the compressional stress environment is conducive to porphyry-type copper concentration. The genetic control of tectonic stress on major porphyry copper mines and prospects, with more than 3×10^5 tons of metallic copper in the Southwest Pacific, has been investigated.

(1) The distribution of these deposits is generally confined to the island arcs formed by collision/accretion tectonics.

(2) Highly compressional tectonic stress environments of collision tectonics, if active at the time of porphyry intrusions and the ore emplacement, seem to be one of the most favorable controlling factors for copper concentration of this type.

(3) Highly compressive tectonic stresses produce higher confining pressures in the porphyry intrusive body than those produced under extensional deviatoric stress conditions. When intrusive stocks solidify by cooling, high confining pressures retard second boiling of the stage of lower temperature and higher crystal ratio. The fluid phase, separated by the second boiling, will be more saline and may have a higher partitioning ratio of chalcophile metals. When inner pressure overcomes the outer strength, brittle failure causes myriads of minute cracks, in the surrounding solid rock, which the metal-laden fluid will permeate. Copper sulfides will be disseminated as a stockwork deposit.

(4) Physico-chemical processes, governed by tectonic dynamics, seem to be very favorable for rich concentration of porphyry-type metal deposits.

Metal concentration of the extensional stress environment, such as they produced by exhalation of hot metallic solutions at ocean rifts, can be compared to that of the compressive type.

NISHIWAKI, CHIKAO, Inst. International Minerals Development, Tokyo, Japan, and TAMOTSU NOZAWA and YOSHIHIKO SHIMAZAKI, Geol. Survey Japan, Tsukuba, Japan

Status of Geologic and Resource Mapping, Northwest Quadrant, Circum-Pacific Map Project

A draft of the Geologic Map was completed in 1978 with the