

30 m below land surface. The anomaly forms an ellipse with the major axis oriented northeastward, along the fault that controls the position of the hot springs. Comparison of the temperature pattern with the configuration of the water table indicates that transport of heat by lateral flow of thermal ground water is not significant at shallow depths. Total discharge of heat from the system is about  $1.8 \times 10^6$  cal  $s^{-1}$ , of which  $1.0 \times 10^6$  cal  $s^{-1}$  is conduction through near-surface materials within the area of the thermal anomaly and the remainder is the heat carried by the spring discharge.

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GEOHERMAL RESOURCE CHARACTERISTICS,  
EXPLORATION CONSIDERATIONS AND PROPERTY ACQUISITION TECHNIQUES

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World wide experience demonstrates rather conclusively that geothermal reservoirs are more closely related as far as geological occurrence, and exploration and development techniques are concerned to conditions encountered by the mining industry than those encountered by the petroleum industry. To date, however, the majority of geothermal activity in the United States has been undertaken by the petroleum industry or related organizations not only because of the energy relationship but also because property acquisition practices and overall exploration costs have a more direct bearing to the oil and gas experience.

Due to high land acquisition and evaluation costs, and because of long developmental lead time, complex marketing problems and the necessity to develop a technical capability to handle a wide range of geothermal fluids, the high degree of inherent risk in geothermal ventures requires that costs related to the discovery and definition of the resource be held to a minimum. This can be accomplished by avoiding large lease bonuses and rentals for unevaluated and untested properties, by joint venture arrangements whereby a degree of the risk is spread, and by exploration agreements that permit a timely evaluation of the geothermal potential without a commitment to large capital expenditures.

CHEMICAL INTERACTIONS DUE TO SUBSURFACE MIXING OF METEORIC AND MARINE WATERS IN A PLEISTOCENE REEF COMPLEX, RIO BUENO, JAMAICA

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An investigation was made of geochemical processes occurring during subsurface mixing of meteoric and marine waters within a Pleistocene reef complex along the north coast of Jamaica. Water samples from local sea water, four shallow wells along a transect normal to the strand line, and a fresh water spring were monitored over a four-week period for Na, Mg, Ca, K, Sr, Cl,  $SO_4$ , pH, and alkalinity.

Na, K, Cl, and  $SO_4$  behave conservatively during mixing and decrease in concentration inland toward fresh water recharge zones. Variations in Ca, Mg, Sr, pH, and alkalinity, however, reflect variations occurring between water and sediment in the zone of mixing. Thermodynamic calculations indicate that meteoric water is saturated with respect to magnesian calcite and slightly undersaturated to aragonite and dolomite. Waters in the zone of mixing are slightly undersaturated with respect to magnesian calcite and aragonite, but supersaturated to dolomite. Solution cavities in sediments of the mixed zone reflect dissolution by waters undersaturated in magnesian calcite

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and aragonite. Further sampling of dolomite cements.

Decreased saturation of the carbonate solid phases result from coefficients and degree of complex changes in ionic strength.

THE MAGNETIC POLARITY STRATIGRAPHIC SEQUENCE AT ANZA-BORREGO STATE PARK

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One hundred and twenty sites with through a stratigraphically continuous mammal bearing poorly indurated clays and fine silts. The magnetically oriented samples of the clays and fine silts. A.f. deposits and it was found that a high is present in most samples requiring 500 oersteds peak field for its reversal.

Eleven complete reversals of section which contains fossils ranging from the Pliocene to the Pleistocene. On the basis of the correlation of this section with the previously studied section in the Anza-Borrego State Park, the observed magnetic polarity sequence represents the time from the middle of the upper Matuyama reversed polarity to the present, a period represented by 4500 feet of section for this part of the sequence of 1

PALEOHYDROLOGY OF A CARBONIFEROUS POINT BAR MOROCCO

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Point bar accretion scars exposed in the southern Morocco offer an excellent paleohydrological record. Gently dipping point bars are capped by siltstone and shale for several kilometers. The point bars are partially eroded, removing the highly indurated point bar ridge. Radii of curvature were measured from aerial photographs of the meander discharge, drainage area, meander wavelength thus generated, meander wavelength observed and measured in the field, and overall thickness of the point bar. Mean velocity was calculated. The measurements were repeated at several locations. A geographic plot of the results shows a clear trend. A geographic plot of the results is basic for this late paleozoic sedi