studies. Natural remnant directions from 21 units at five sites (24 to 29° north lat.) suggest an average northward translation of roughly 10° since late Miocene time, and a probable 45° clockwise rotation (post 6 m.y.B.P.) of the San Ignacio flows.

The Paleomagnetically indicated rate of absolute motion of the peninsula is 11 cm per year since 5 m.y.B.P. and 3.5 cm per year prior to 5 m.y.B.P., assuming an offset axial dipole. Absolute northward motion, assuming a geocentric axial dipole, is 18 cm per year from 0 to 5 m.y.B.P., and 3.5 cm per year from 5 to 19 m.y.B.P. The rates of northward motion described by Atwater and Molnar, and Dickinson for the same time spans are 3.5 cm per year and 1.5 cm per year, respectively.

Possible solutions to this discrepancy are: (1) Baja California is part of a broad shear zone of the plate margin, and has had more movement along faults within the proto-gulf and the present margin of western Mexico than previously deduced, (2) the North American plate has no northward motion, or (3) the North American plate has had northward motion since the Miocene, with the amount of motion of the plate margin being equal to that described by T. Atwater and P. Molnar; thus, the paleomagnetic data show both motions.

Studies by M. J. Kamerling and B. P. Luyendyk, and continued paleomagnetic studies at San Diego State University, show a comparable amount of northward motion for southern California and northwestern Mexico during the Miocene. Paleomagnetic results would imply that the present palinspastic reconstructions have not completely resolved the tectonic framework of the Pacific–North American plate boundary.

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Resolution of Reefs, Overthrusts, and Pre-Volcanic Sediments by Electrical Geophysics

Today's explorationist is generally unfamiliar with the potential and success of surface-based electrical resistivity methods as geophysical tools useful in reducing exploration and reserve-areas definition costs, as well as drilling costs. Two major reasons for this are: (1) the promise of direct detection of hydrocarbons where surface-based electrical methods have been used to delineate shallow subsurface anomalies; and (2) the geophysical data from electrical methods are more complex than simple anomaly profiles and require a specifically educated and costly consultant to do the interpretation.

In spite of the above, the electrical methods may be used directly as a resistivity-defining tool which not only delineates structure but also provides information necessary to resolve lithologic and stratigraphic problems, such as rock type, fluid content, and porosity. In areas where seismic data quality is poor because of adverse conditions, such as volcanics, electrical techniques are unaffected and, in many instances, the data quality is actually improved.

To help meet the challenge of today's petroleum exploration problems, a multi-methodology electrical resistivity system has been developed. This system is used to great advantage in exploring reef, overthrust, and pre-volcanic sediment prospects. Case histories in Nevada and west Texas show resolution of these problems by electrical methods.

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Aggregate-Resources Evaluation of Lund Nevada Mapsheet

As a result of preliminary research and development work performed in support of a large proposed construction project in Nevada, an aggregate-resource evaluation was completed for 12 major valley areas within the Lund 1° by 2° mapsheet. Construction would require a total of from 95 to 124 million tons of aggregate for production of concrete and base-grade materials in over 40 valley areas where current production is 1 million tons/year.

Within the Lund mapsheet a three-phase program was initiated to assess the relatively unknown aggregate potential of the area. Each phase became more detailed than the preceding one. The phases went from regional-overview to valley-specific analyses. Results of the initial regional aggregate-resources evaluation indicated that sufficient acceptable coarse aggregate could be obtained from Quaternary alluvial-fan and lacustrine basin-fill deposits and Precambrian and Paleozoic carbonate and quartzitic rock sources. Sufficient acceptable fine-aggregate sources were not readily available in the area. During the two subsequent valley-wide studies, geomorphologic division of basin-fill deposits, based on interpretation of aerial photography and ground reconnaissance in conjunction with the results of exploratory drilling and trenching, seismic refraction and laboratory testing, established the extent, composition, and quality of these units. These data refined and confirmed initial aggregate results. Additionally, limited trial concrete-mix test results indicate that high-strength concrete (6,500 psi compressive strength at age 28 days) can be made from selected basin fill and rock sources using standard mix designs and admixtures.

RAUP, OMER B., U.S. Geol. Survey, Denver, CO

Evaporite Mineral Cycles, Paradox Basin, Utah and Colorado

The evaporites of the Paradox Member of the Hermosa Formation of Pennsylvanian age in southeast Utah and southwest Colorado are direct precipitates from marine brines and have been changed only slightly by subsequent events. Geophysical logs of deep wells indicate that the Paradox Member is composed of 29 evaporite cycles. Lithologies that make up the cycles, in order of increasing salinity, are: black calcareous shale, dolomite, anhydrite, and halite (with or without potash). Studies of cores from two wells in the central part of the basin show that some of the cycles in the upper part of the Paradox Member are remarkably symmetrical above and below the black shale, indicating regular changes in salinity. Lithic texture, crystal morphology, and bromine distribution are suggestive of primary sedimentation with only minor early diagenesis related to burial dehydration.

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Physical Evidence for Saline Cycles of Deposition in Eocene Lake Gosiute in Southwest Wyoming

The Wilkins Peak Member, the saline unit of the Green River Formation in southwest Wyoming, is more than 985 ft (300 m) thick and contains more than 35 beds of trona or trona with halite. The trona and halite were deposited in the deepest part of the basin of Lake Gosiute, during arid periods of the Eocene Epoch, by the periodic evaporation and contraction of the lake waters. Alternating with the arid periods were more humid periods, when the lake expanded and less saline sediments were deposited across and beyond the previously deposited salt beds. The water-level fluctuations resulted in a concentric pattern of