

complex is restricted to western North America and the *P. roveloi* and *P. endoi* complexes are known from both North America and Asia.

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LOWER PERMIAN BRYOZOA, CARNARVON BASIN, WESTERN AUSTRALIA

The early Permian (Asselian-Sakmarian) Lyons Group consisting of tillite, greywacke, sandstone, siltstone, and conglomerate rests unconformably on the Precambrian basement and is conformably overlain by the Permian (Artinskian) Callytharra Formation. Bryozoa occur in thin, local, calcareous lenses in the Lyons Group, 4,600 feet thick in its type section, whereas they form rich bryozoan calcarenites and bryozoan calcirudites in the overlying Callytharra Formation, 765 feet thick. The stenoporid species in the Lyons Group display similarities to certain Eastern Australian forms from the early Permian, and a well distributed fenestellid species of *Polypora* has close affinities with species from the Lower Permian in Eastern Australia and from the Bituani Beds (equivalent to the Asselian Series of Russia) from Timor. These species of *Polypora* appear to be primitive members of a well-defined phylogenetic group of species including *P. tuberculifera*, *P. punctata*, *P. subovaticellata*, and *P. nadiniae* from the upper part of the Sakmarian Series of the Ural Mountains. The geographic and stratigraphic distributions of such early Permian bryozoan lineages appear useful tools in the correlation of different stratigraphic units.

The generic and specific composition of the bryozoans in the overlying Callytharra Formation is vastly different and the bryozoan faunal break between these two stratigraphic units is very distinctive. Genera such as *Hexagonella*, *Evactinopora*, *Protoretepora*, *Ramipora*, *Streblotrypa*, *Rhombocladia*, and *Streblocladia* which are prominent in the Callytharra bryozoan faunas are not found in the Lyons Group.

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HOW TO EVALUATE EXPLORATION PROSPECTS

The problems of exploration evaluation are occupying an ever-increasing importance in the petroleum industry. Recent developments in exploration trends and in the field of data handling stress the need and desire to minimize risk in business decisions.

Geologic-geographic preference has long been an excellent criterion to determine where to concentrate exploration efforts. This becomes very obvious when the exploration efforts and results in areas such as the Gulf Coast and West Texas are carefully analyzed and compared with other areas. Exploring for oil in certain foreign countries, too, has paid off munificently, particularly when the oil finding costs are compared in dollars per barrel with similar costs in the United States.

All exploration programs have one common goal: To find and exploit oil and gas reserves at a profit. However, economic factors are playing an ever-increasingly important role. The problem of arriving at what appears to be the optimum route to follow in petroleum exploration can be facilitated by a statistical approach, particularly with the recent advent and utilization of data processing techniques. This approach is not a substitute for intelligence or judgment but it is a new advance in the solution of problems of all kinds. The theo-

ries of probability provide a method of measuring uncertainty that may lead to better exploration decisions.

Innumerable factors affect exploration decisions but these can be placed in four broad categories—geophysical, geological, economic and engineering aspects. Since the primary goal of any exploration problem is to find and exploit reserves efficiently, a realistic approach for exploration decisions is needed. The various factors must be considered and an attempt made to translate them into a desired return on investment. The resultant solution can be accepted or rejected, depending on good judgment and the particular company's criteria and policies.

Analytical evaluations bring oil exploration from the realm of educated guessing to a quantitative approach that fits into modern businesses' techniques. Management and explorationists can thus appraise the merits of a prospect or exploration program and expect to derive optimum results with minimum risk.

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MODERN TURBIDITES: TERRIGENOUS ABYSSAL PLAIN VERSUS BIOCLASTIC BASIN*

Many of the fundamental characteristics of abyssal plain turbidites may be traced in the modern calcareous turbidites of the Tongue of the Ocean. However, less broad areas of coverage and greater diversity of the constituents are evident from the Tongue of the Ocean than would be expected in abyssal plain deposits. This difference reflects a narrower depositional basin and several localized sources, each with its own materials.

The abyssal plain deposits are laterally transported cyclic-graded beds of terrigenous sand, silt, and clay alternating with possibly minor layers of true pelagic sediment consisting of the vertically (particle by particle) settled clay components characteristic of red clays. The cyclic units are monotonously similar, with no outstanding distinctions between them except for thickness and maximum grain size, and are of broad areal extent.

The Tongue of the Ocean deposits are also cyclic, but the turbidites consist of bioclastics, pteropods, foraminiferal sands, and calcareous silts and clays; the pelagic beds between are homogeneous calcareous clayey silts (calcilutites) with varying amounts of Foraminifera and pteropods. The sediments are primarily calcareous silts in contrast to the terrigenous clays of the abyssal plain. Cyclic units vary in composition and are only locally distributed.

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TECTONIC HISTORY OF THE GLASFORD CRYPTOEXPLORATION STRUCTURE

Exploration sponsored by the Central Illinois Light Company has delineated a structural high, 12 miles southwest of Peoria, near the village of Glasford, Illinois. The structure is nearly circular and consists of a normal sequence of Paleozoic strata down to the Ordovician Maquoketa Shale. The Maquoketa is abnormally thick over the dome, and the underlying 1,500 feet of rocks are faulted and severely brecciated. The structure appears

* Contribution from the Marine Laboratory, University of Miami.