proportions of fossils (planktonic and benthonic forams, bryozoans, echinoderm debris, mollusk debris, brachiopod fragments, calcareous algae, sponge spicules), glauconite, tuff fragments, quartz, feldspar, rare pyroboles, clay minerals, intraclasts (probably mostly from older dike layers), and rare pellets.

The polyphase dikes are interpreted as infillings of fissures that repeatedly opened on the flanks of volcanic mounds. Infillings appear to be more varied than the possible source rocks and probably record transient sedimentation.

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PETROLEUM EXPLORATION WITH RADAR—EASTERN PANAMA AND NORTHWESTERN COLOMBIA

Petroleum exploration in eastern Panama and northwestern Colombia has gained impetus from recent side-looking radar mapping. Radar-derived geologic information is now available for approximately 40,000 sq km where previous reconnaissance investigations have been extremely limited because of inaccessibility and perpetual cloud cover.

With radar imagery as the sole source of remote sensing data, the distribution, continuity, and structural grain of key strata provide evidence that the eastern Panamanian Isthmus can be divided into 3 main physiographic-structural parts. Two composite coastal mountain ranges are separated by the Medial Basin which trends southeastward from the mouth of the Bayano River to the Atrato River valley of northwestern Colombia. Within the Medial Basin, the most obvious site for petroleum exploration, the majority of clearly exposed surface structures are not particularly attractive prospects because prime reservoir strata have been stripped from their crests. However, several large geomorphic anomalies which have been mapped in the Medial Basin may be reflections of subsurface structures having a complete stratigraphic section. The possibilities of gravity-type entrapment in fractured organic shales, siltstones, and carbonates have been suggested along the southern synclinal trends of the Medial Basin. The southwestward extension of the Medial Basin trend, coincident with unique beach ridges from a possible granitic source, provides an attractive petroleum prospect in the western part of the Gulf of Panama. The occurrence of active shell bars in the Bay of San Miguel and present reef trends on the northern Caribbean coast suggest possible offshore sites for geophysical surveying.

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GYPIDULID BRACHIOPODS: THEIR LIFE POSITION AND PALEOENVIRONMENT

Life assemblages of 2 species of gypidulid brachiopods, preserved in their original positions of growth, have been collected from Upper Silurian and Lower Devonian limestones of the Appalachian basin. The 2 assemblages inhabited the same environmental locus at different times in a transgressing carbonate sea. The earlier *G. prognostica* is in the Keyser Formation in Pennsylvania, Maryland, Virginia, and West Virginia, and the later *G. coeymanensis* is found in the Coeymans Formation of New York state.

The gypidulids, in both cases, lived clustered in a beak-down position on poorly sorted skeletal sand substrates in association with a diverse faunal assemblage of brachiopods, bryozoans, crinoids, and trilobites. The specimens appear to have no pedical openings, indicating lack of pedical development in mature forms. The inner prismatic shell layer in the pedical umbo is many times thicker than the total shell elsewhere on the organism. The resulting weighting of the pedical umbo and lateral contact with other individuals in the cluster promoted an upright, posterior down orientation.

Gypidulids are restricted to shallow (near, but above wave base) shelf environments. Onshore skeletal barrier sands and skeletal lagoonal muds, as well as offshore fossiliferous muds, are barren of gypidulids. The gypidulid environmental position occurs only in transgressive stratigraphic sequences.

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TOWARD A MORPHOLOGICAL CLASSIFICATION OF ORGANIC REEFS AND REEF COMPLEXES

Most of the literature concerning the definition of organic reefs (bioherms and biostromes) and of similar carbonate accumulations emphasizes the genetic and biostratigraphic classification of these features. To the writer's knowledge, no previous attempt has been made at a purely morphological classification. "Reef complexes" have in recent years been called "bank atolls," "reef-fringed carbonate banks," and "biohermal flanked biostromes." Such hybrid names appear to impose a dualistic origin on a reef complex, although it is obviously a genetic unit, and they should therefore be avoided. Henson's "reef complex" included the sediments genetically associated with the reef *sensu stricto;* these are not "banks" or "biostromes" within the generally accepted meaning of these terms. The writer therefore has introduced the term "cycloherms" (circular reefs) for the gigantic shelf atolls such as those in the Devonian of western Canada, in the Permo-Pennsylvanian of West Texas, and in the Cretaceous of Mexico. In addition, the term "phragmoherms" (wall reefs) was introduced for fringing reefs and barrier reefs such as those in the Triassic of the Alps.

In recent years bioherms proper have been called "pinnacle reefs," "haystack reefs," and other such terms which bear little relation to their actual morphologic proportions. Such names are based on the reef shapes commonly seen in cross sections of exaggerated vertical scale, and create erroneous impressions of their true relative dimensions. The new, unequivocal names proposed for these bioherms are "aspiherms" (shield reefs) for the pinnacle type and "trapeziherms" (table reefs) for the flat-topped haystack type.

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EXPLORATION ON CONTINENTAL SHELF OFF NORTHWEST AUSTRALIA

Exploration of a 144,000-sq mi rank wildcat area in offshore northwestern Australia began in 1964 with analog seismic surveys. Each year additional surveys have been carried out with a steady improvement in data quality due to advantage being taken of technological advances of the industry.

Interpretation of these data and incorporation of available drilling results have permitted structural and depositional models to be rationalized for post-Paleozoic time-rock sequences. Improvements in drilling technology have allowed locations to be sited in greater water depths confirming depositional and structural models.