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PRECAMBRIAN CYCLIC CARBONATE FACIES, WESTERN MONTANA

At least 5 main carbonate facies are recognizable in the Helena Formation (of the Precambrian Belt Supergroup) and its equivalents of western Montana: (1) stromatolite-"ribbon limestone" beds dominate the shallow-water shelf carbonate facies; (2) dark-gray to black argillaceous "pod carbonate" facies, of slightly deeper water origin; (3) green-gray and green argillite-dolomite and tan dolomite facies; (4) dark shale and platy dolomite facies of the central basin; and (5) a more highly clastic facies derived from a probable western source.

The Helena carbonate facies are markedly cyclic, with individual cycles expressed in several ways depending on horizontal and vertical stratigraphic position in the overall depositional complex of the basin. A characteristic cycle in the shelf carbonate belt includes, from base upward, (1) a stromatolitic dark limestone overlying an eroded, scour surface at the top of a dark, brown-weathering massive silty dolomite; (2) a massive "ribbon limestone" bed; (3) a dark argillite or argillaceous "pod carbonate" thinly bedded unit that may be green gray or green in some cycles; and (4) a black or dark-gray, brown-weathering massive dolomite unit, in places containing scattered "ribbon" organic structures. The brown-weathering dolomite in almost all places shows a prominent scour surface of varied relief at the top and overlain by a prominent stromatolitic structure.

Reasonable interpretations for each of these rocks and facies can be made to fit the environmental provinces of a normal epicontinental basin. However, a complete analysis of cycle and basin facies genesis must face the question of marine versus nonmarine origin of Belt sediments. Most, if not all, of the "marine" sedimentary features of the Helena carbonate beds can fit the broad sedimentary patterns of an extensive lacustrine basin. This possibility needs further study, and conceivably could help to explain problems related to Early Cambrian stratigraphy and faunas.

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DIFFERENTIATION OF LACUSTRINE AND FLUVIAL SANDSTONE BY ANALYSIS OF PALEOCURRENT PATTERNS

Oil-impregnated intervals, up to 75 ft thick within a stratigraphic interval of about 250 ft in the Garden Gulch and Parachute Creek Members of the Green River Formation (Eocene), are exposed in beds that dip gently northward in the P. R. Spring area of the southeast Uinta basin, Utah. Reserve estimates indicate that there may be about 3.7 billion bbl of oil in place.

It is necessary to distinguish lacustrine from fluvial sandstone in these intertonguing beds because most of the oil is in lacustrine sandstone. Paleocurrent study indicates that paleocurrent patterns can be used for these distinctions. A total of 308 paleocurrent measurements was made at 13 localities in the P. R. Spring area; 123 from sandstone beds of fluvial origin and 185 from lacustrine sandstone bodies.

Of 9 fluvial paleocurrent patterns, 7 indicate that streams flowed northward into Lake Uinta in the P. R. Spring area. The considerable scatter in the paleocurrent measurements suggests that the streams had low gradients and were meandering. Many of the fluvial sandstone bodies are oriented approximately north-south and contain northward-inclined foreset laminae.

Of 10 lacustrine paleocurrent patterns, 9 have significant intervals in the south half of the compass. These directions are interpreted to be dominantly the result of onshore lake currents. The shorelines of Lake Uinta probably trended northeast through much of the P. R. Spring area, but on the northeast, shorelines were oriented northwest-southeast.

The paleocurrent patterns of fluvial and lacustrine sandstone are both unimodal. The environments can be differentiated, however, on the basis of paleocurrent orientations; the fluvial currents flowed northward; the lacustrine currents were southerly.

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GEOLOGY OF FELDER URANIUM DEPOSIT, LIVE OAK COUNTY, TEXAS

(No abstract submitted)

REISHUS, MARK, Hunt Oil Co., Dallas, Tex.

NEWCASTLE FORMATION IN WILLISTON BASIN

(No abstract submitted)

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ENVIRONMENTAL RESTRICTIONS ON MINERAL RESOURCE DEVELOPMENT IN ROCKIES

Exploration geologists, though by nature unbounded optimists, might profit by a realistic investigation of the factors which may constrict future mineral resource development in the Rockies. The two major factors which adversely affect present and future development of each mineral in a different manner are land availability and the additional cost factors for environmental protection.

The amount of land available for mineral exploration and development will be curtailed substantially by present and future land withdrawals, highways, and growing urbanization. In Montana, Idaho, Wyoming, Utah, Colorado, New Mexico, and Arizona, specific land withdrawals prohibit or seriously curtail mineral development. The present wilderness area encompasses 9,996,000 acres with more being proposed at each hearing. National Park and Monument lands contain 6,446,000 acres with significant additions proposed at several places. The Department of Defense controls 10,066,000 acres. Additional scenic and other mineral withdrawals are being proposed with increasing frequency. Highway right-of-ways have little effect on oil exploration, but prohibit all open pit mineral extraction and can seriously affect underground mining. In Colorado, for example, 787,000 acres are covered by public roads. Each mile of interstate highway system utilizes approximately 40 acres of land surface. Growing urbanization, though not a problem everywhere, definitely curtails mineral development in some areas. It specifically affects sand and gravel, stone aggregate, and industrial minerals.

The mounting concern for the mineral industries' real and fancied degradation of our environment is creating a proliferation of new laws and regulations. Each of