small area near McCoy, Colorado, and in a large region in east-central Nevada indicate that at least eight major marine and paralic faunal assemblages occur in rocks of Pennsylvanian and Permian age. The eight recognized major faunal groups are: textulariid, fusulinid, coral, productid-*Composita*, chonetid, *Heteralosia*, *Nuculana*, and *Euphemites* faunas. The textulariid, fusulinid, coral, productid-*Composita*, and chonetid faunas required a salinity close to 35°/₀₀. The textulariid fauna probably lived at a depth of 50–70 m. and perhaps deeper; fusulinid fauna, 20–50 m.; and coral fauna, 10–30 m. The productid-*Composita* and chonetid faunas both may have lived at a depth of 4–10 m., but they had different energy requirements. The *Heteralosia*, *Nuculana*, and *Euphemites* faunas occupied very shallow-water environments with salinities different from 35°/₀₀.

Overlap of faunas appears to have been a more common occurrence in the Colorado area than in Nevada because a greater inclination of the sea floor in Colorado allowed maximum development of different faunas to take place in areas close enough together to permit considerable faunal mixing. Geographic distribution of contemporaneous faunas indicates that inclination of the Colorado sea floor generally was about 10 m./km., whereas the inclination of the Nevada sea floor generally was about 1 m./km.

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GEOCHEMICAL PROSPECTING—A CRITICAL REVIEW

A recent visit to the Soviet Union confirms impressions from the literature that Soviet geochemists continue to be the most active in geochemical prospecting technology. The All Union Scientific Institute of Nuclear Geophysics and Geochemistry in Moscow has the prime responsibility for research and development of near-surface geochemical prospecting for practical application as a rapid reconnaissance tool, especially in new areas and for stratigraphic traps, in support of geophysics and geology exploration. The major topics of investigation include: vertical migration mechanisms, radiometry, geomicrobiology, soil gas analysis, and gas logging.

In the United States, geochemical prospecting has had an erratic history of research and application, and although credited in whole or in part with some discoveries, it is not generally accepted as a commercially useful tool.

Successful application of near-surface geochemical prospecting requires (1) migration of hydrocarbons from the accumulation to the near-surface zone, (2) detection and identification of these migrated hydrocarbons in micro quantities, and (3) correlation of the observed near-surface distribution of these hydrocarbons with their subsurface source. Modern analytical methods for detecting micro quantities of hydrocarbons in rocks, soil, or soil gas samples are accurate and definitive. Factors complicating the use of geochemical prospecting involve the vertical migration process with the associated complex environmental productive zones, non-commercial occurrences, and intervening source rocks. Field tests indicate that where hydrocarbons succeed in reaching the near-surface zones, they usually do so in the form of seeps of restricted areal extent even at the micro concentration level.

From the initial work of United States and Soviet geochemical investigators 25 years ago, there has developed a sophisticated geochemical technology now making important contributions to petroleum exploration through source bed evaluation, crude oil correlation, formation water analyses, and origin and migration investigations.

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STRUCTURAL FEATURES OF THE CANADIAN SHIELD

The paper is accompanied by a sketch map showing the main structural and orogenic features of the Canadian Shield. Three main types of structural patterns are distinguished. Regions characterized by high-grade metamorphism or granitic intrusions present swirling and circular structures of extremely complex pattern and relatively little topographic relief. Areas of low grade, folded Proterozoic rocks form linear belts of generally more pronounced relief. Areas of flat or gently folded cover rocks of Proterozoic age form broad sheets of low relief except where cut by diabase sills. The various types of structures found in the exposed Shield may be expected to continue beneath the Phanerozoic cover.

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DEPOSITIONAL ENVIRONMENTS OF SOME CRETACEOUS SEDIMENTS, ROCKY MOUNTAIN FOOTHILLS, CANADA*

Excellent exposures of Upper Cretaceous rocks in the central Foothills of Alberta reveal a lateral and vertical succession of marine shale, littoral and near-shore sandstones, and lagoonal to deltaic sediments. The interpretation of the depositional environments is based on comparisons with Recent sediments and on various physical criteria such as areal patterns, structures, and textures. In addition, paleontological data also provide useful information. The intertonguing of deposits records shifting shorelines related to the slowly regressing sea. Delineation of the ancient shorelines suggests areas in which potential reservoir rock may have formed and is important in future petroleum exploration.

Several units are interpreted as having formed in the transitional environment. Some of the sandstones, particularly those of the Cardium formation, are similar to those associated with barrier islands and represent the littoral and upper part of the epineritic environments. The sandstones are finely laminated, show reworking by organisms, and generally are well sorted. They have a linear distribution, extending for hundreds of miles along the Foothills. Associated with those sand bodies are carbonaceous sediments believed to represent lagoonal and marsh deposits. They include coarse-grained sandstone that presumably formed in stream channels, suggesting the presence of a deltaic complex. The abundance of carbonaceous debris and thin coal seams attest to widespread and recurring swamp conditions.

The marine shales are separated into several types, each characterizing a specific zone of deposition. Those formed in an oxidizing environment, presumably above wave base, contain glauconite and siderite. Shales formed below wave base were in a reducing environment that favored the development of pyrite and the diagenetic alternation of calcite to dolomite.

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IDENTIFICATION OF CLINOPYROXENES BY X-RAY DIFFRACTION AND OPTICAL METHODS

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