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Limitations of Rock-Eval Pyrolysis for Typing Organic Matter

Laboratory experimentation on whole-rock Rock-Eval pyrolysis has shown that the characterization of organic matter through the use of a modified van Krevelen-type diagram, where the hydrogen and oxygen indices are substituted for the H/C and O/C ratios, is questionable. The hydrogen and oxygen indices are strongly affected by the matrix mineralogy and by organic enrichment.

Others have assumed that the S_3 peak on the Rock-Eval represents CO_2 liberated solely from the organic matter because the pyrolysis temperature of 390°C, at which trapping of CO_2 ceases, is significantly below the decomposition temperatures for the principal matrix minerals. However, Rock-Eval pyrolysis of pure mineral specimens with decomposition temperatures in excess of 800°C has produced CO_2. Published data suggest that this yield of inorganic CO_2 may be partly a consequence of crystallographic imperfections. Because the oxygen index is calculated relative to the organic carbon content, the leaner the rocks the greater the error will be resulting from interference of inorganic CO_2.

The hydrocarbon yield (S_2) was found also to be dependent on the mineral matrix. Each kerogen type produced greater hydrocarbon yields when associated with a carbonate matrix as compared to an argillaceous matrix. These differences were found to be greater in leaner rocks. In addition, the hydrocarbon yield did not appear to increase proportionately with increasing organic carbon content. Hydrocarbon yields relative to organic carbon content were found to be greater in richer rocks than in leaner ones. Thus, the hydrogen index for a given rock appears to depend not only on the type of organic matter, but also on concentration of the organic matter and the character of the mineral matrix.

It appears, therefore, that although there are advantages to the van Krevelen diagram for tracing evolution pathways as organic matter matures, the complications discussed above require that an alternative method be developed for evaluating pyrolysis data.

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Regional Disconformities and Eustatic History: Cretaceous Trans-Atlantic Test Case

Increasing refinement in contemporary biostratigraphic and geochronologic correlation allows critical testing of space-time relations of regional disconformities within and between large marine sedimentary basins. This is especially true in the Cretaceous Period, where global correlation is possible within 0.5 m.y. or less time/biostratigraphic units. The most critical questions posed by regional disconformities are: (1) their mode of origin, and especially whether or not they reflect regional tectonic/sedimentologic or global eustatic controls; and, (2) their temporal relations—are they regionally diachronous, with minimal correlation value, or synchronous, reflecting global factors?

Regional Cretaceous disconformities are numerous, well studied, and precisely dated in both Europe and North America, providing an opportunity to test various hypotheses concerning their origins. They are most commonly reflected by: (1) mature hardgrounds; (2) broadly erosional disconformities; (3) lag deposits and calcarenites, in some places overlying hardgrounds or erosion surfaces; (4) paraconformities and sediment bypass surfaces identifiable by biostratigraphic/geochronologic gaps; and (5) sharp, flat erosional surfaces truncating the tops of large progradational sequences in areas of highly active sedimentation. An intercontinental test shows precise correlation of many Cretaceous disconformities regardless of type (1 to 5 above) between the Western Interior and coastal plains of North America, and the carbonate platform/shelf facies of central and western Europe, proving a eustatic origin (stillstand events). Most such regional disconformities occur during punctuated eustatic rise (transgression).

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Characteristics of Some Oil Shale, East-Central Uinta Basin, Utah

Oil-yield, lithologic, and mineral-distribution data were determined for cores taken from a 152-m drill hole in the upper part of the Parachute Creek Member of the Eocene Green River Formation. The drill hole, in Sec. 3, T12S, R24E, started just below the contact between the Uinta Formation and the underlying Green River Formation, and ended 10 m below the Mahogany oil shale bed (the richest oil shale bed in the interval examined) in the lower part of the Mahogany zone. Most of the interval studied is composed of kerogen- and carbonate-rich, very fine-grained sediments.

Several thin (less than 1 m) oil shale beds which yield as much as 25 gal of oil per ton (104.3 l per metric ton) are above the Mahogany zone, but are probably not of economic interest. The studied sequence contains several tuff beds; the maximum thickness of these beds is about 0.6 m, but the average thickness rarely exceeds 0.2 m. Two oil-saturated tuff beds occur approximately 20 m above the Mahogany oil-shale bed. Although these two tuffs are exposed in nearby surface outcrops, they do not contain oil in these outcrops. The Mahogany zone is approximately 21 m thick at the drill site; the lowermost few feet were not penetrated. The Mahogany zone is covered by 132.6 m of overburden. Fischer assays indicate that 12.9 m of oil shale within the Mahogany zone could yield at least 25 gal of oil per ton (104.3 l per metric ton) from beds at least 3 m thick.

Although analcime is a common accessory mineral in the upper 50 m of the core hole, it was not identified in the Mahogany zone. Illite and mixed-layer clay minerals occur together above the Mahogany zone. The mixed-layer clays decrease in quantity as the Mahogany zone is approached, and no mixed-layer clays are detected in the Mahogany zone. Illite was detected in all samples examined from the Mahogany zone. Examination of X-ray diffraction patterns obtained from bulk rock samples from cores did not reveal the presence of any potentially valuable accessory minerals in the stratigraphic interval studied.

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Geotechnical Properties and Stability Characteristics of Continental Slope Deposits Influenced by Coastal Upwelling

Studies to date on continental slope deposits of Peru and Oregon indicate that coastal upwelling indirectly contributes to the alteration of sediment mass physical properties and stability characteristics by concentrating organic matter in the underlying and nearby sediments. Those sediments in close proximity to areas of intense upwelling display distinctly different geotechnical properties than do those of comparable sediment type some distance away. The ability of organic matter to adsorb water and to aggregate clay-size particles to form an open fabric appears to result in exceptionally high water