generation of accurate computer-enhanced images or maps. Problems related to diurnal variations and solar storms at high magnetic latitude are largely overcome because changes in the total magnetic field do not significantly affect the magnetic gradient. Analysis of an experimental survey, covering 4,418 line km (2,745 line mi), suggests that the Marsh Creek anticline in the Arctic National Wildlife Refuge is prospective for oil and/or gas. Additional magnetic anomalies were also identified. Although the effect of permafrost on epigenetic processes has not been investigated, the data suggest that special purpose aeromagnetic surveying may be a useful and relatively inexpensive way to explore for oil and gas in this hostile environment.

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Applied Biostratigraphy in Paleozoic Exploration

Integration of data from the palynological analysis of acritarchs and chitinozoa, together with conodont data, provides biostratigraphic results in all environments from wide carbonate platform, inner and outer shelf, basin margin, to deep basin sediments.

This integrated data is of great value in Paleozoic exploration biostratigraphy, in particular where miospore and calcareous microfossil data are inadequate. The acritarch data are of prime importance as the numerous, diverse assemblages provide a refined biostratigraphy of shelf and basin margin sediments worldwide; the chitinozoa are of particular value in deep basin areas, whereas the conodonts are of value in carbonate platform areas.

Identification of basin margins and basin subsidence can be gained by the preservation and known environmental distribution of selected acritarchs and chitinozoa. Sediment source areas can be identified using recycled palynomorphs. Thermal maturation based on vitrinite reflectance cannot be applied to pre-Silurian rocks; in the Paleozoic visual kerogen analysis including acritarch and chitinozoa colors, together with conodont coloration and organic pyrolysis provides the data on organic thermal maturation and source rock oil and gas potential.

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Regional Cathodoluminescent Cement Zonation Related to Upland-Sourced Paleoaquifers: Devonian Helderberg Carbonates and Clastics, Central Appalachians

Cathodoluminescent zonation in shallow burial calcite cements of the Keyser and New Creek Limestones (lower Helderberg Group, Upper Silurian–Lower Devonian) in Virginia, West Virginia, and Maryland can be mapped regionally. Regional distribution of cement zones coincides with the distribution of easterly derived sandstone tongues within the carbonate sequence. In southwestern Virginia, calcite cements in limestones subjacent and laterally equivalent to the Clifton Forge and Healing Springs Sandstones show cathodoluminescent zonation of nonluminescent (earliest cement) to bright to dull or subzoned dull (last shallow burial cement). Noneluminescent cements are Mn^{2+} and Fe^{2+} poor and precipitated from oxidizing meteoric pore fluids; bright cement (Mn^{2+}-rich) reflects more reducing pore fluids; dull cement (Fe^{2+}-rich) precipitated from most reducing shallow to deeper burial pore fluids. Nonluminescent-bright-dull zonation grades abruptly into correlative subzoned dull cement downdip from sandstone tongues. Further downdip, subzoned dull cement grades into dull (nonzoned) cement. Limestone adjacent to the Elbow Ridge Sandstone (West Virginia and Maryland) lacks nonluminescent and bright cement but has subzoned dull cement that grades into dull cement westward. Clear rim cement on scattered pelmatozoan grains in the Clifton Forge, Healing Springs, and Elbow Ridge Sandstones have complexly zoned nonluminescent and bright cements. Quartz grains have pressure-solved contacts and are cemented by dully luminescent, deep burial cement. Predominance of deep burial Fe-rich cement in sandstone indicates that they remained "open" during shallow burial diagenesis and that sandstone tongues acted as conduits for oxidizing meteoric ground waters recharged from tectonic highlands. Downdip from sandstone tongues, subzoned dull and nonzoned dull cements precipitated from reducing meteoric ground waters distant from subareal recharge areas. Precipitation of shallow burial zoned cements ceased when recharge areas were buried by thick Devonian clastics (Ridgeley Sandstone, Huntersville Chert, Millboro Shale) or when burial removed the sediments from the effects of upland sourced meteoric ground waters. Final porosity occlusion in the limestone is by deep burial, clear, Fe-rich calcite cement (dull luminescence), Fe-rich "saddle dolomite," silica cement, and rare fluorite. This study emphasizes the importance of (1) tectonic uplands as recharge areas for aquifers involved in cementation; (2) potential of interlayered sandstones in carbonate sequences to act as permeable conduits for meteoric ground waters because they are less susceptible to calcite cementation than associated lime grainstones; and (3) documenting regional cathodoluminescent zonation of porosity-occluding shallow burial calcite cements in potential reservoir facies prior to hydrocarbon migration.

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A Petrologic Examination of Some Resedimented, Coarse-Grained, Clastic Intervals in Ouachita Mountains, Arkansas

Several resedimented, coarse-grained clastic intervals exist in the strata of the Ouachita Mountains. A petrologic examination of selected units in the basal Stanley Shale, the Arkansas Novaculite, and the Missouri Mountain Shale yields information pertaining to provenance, transportation, and deposition.

Twenty-five coarse-grained units sampled are categorized as massive sandstone, pebbly sandstone, clast-supported conglomerate, and matrix-supported conglomerate. Samples exhibit grading, imbrication, and stratification indicative of mass flow and fluidal flow-transport processes. Sedimentary rock fragments are the predominant clasts, with chert being the primary constituent. Other major constituents are detrital quartz, rip-up clasts, and shale fragments, of which the latter show signs of soft-sediment deformation. A metasedimentary source area is inferred. Paleoflow direction, estimated to be to the south and southwest, was ascertained by orientation of imbricated clasts and channel cuts.

A vertical sequence change from a matrix-supported conglomerate to a bimodal, clast-supported conglomerate, both of which exhibit channeling, to a massive sandstone occurs at one locality. This fining-upward sequence is due to a change in source area, which may be the result of tectonism and/or glacio-eustatic sea-level fluctuations.

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Foraminifera as Paleobathymetric Indicators

Benthic foraminifera are one of the principal means of inter-