lated in the practice of their "black arts" from the lay public. Most contacts were with corporate clients or sophisticated investors. The dramatic increase in use of geologic maps and written opinion occasioned by the drilling fund, environmental impact statements, and the expansion of business in general, coupled with the developing sense of professionalism among earth scientists and a litigation-conscious public combine into "malpractice exposure." The geologist who understands this trend can minimize this exposure and afford himself, his employer, and his family a measure of protection as the times change.

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EFFECT OF PETROGRAPHIC COMPOSITION ON HEATING VALUE OF LIGNITE

Heating value of borehole samples of lignite ranges from 500 to 1,000 Btu/lb within short distances. Much of this variation is caused by (1) weathering at shallow depth, resulting in a decrease in heat value, and (2) loss of moisture because of improper handling of the sample, resulting in an increase in heating value. Aside from these factors, the petrographic composition of lignite is the most important parameter that ultimately controls its heating values (assuming geologic history is the same after the peat stage). Chemical analyses of hand-picked pure maceral material exhibit considerable variation in elemental composition and heating values. On an as-received basis, the heating values of resinite and huminite (vitrinite) are 16,000 Btu/lb and 7,500 Btu/lb, respectively. The hydrogen and carbon contents are 10 % and 80 %, respectively, for resinite and 5 % and 70 % for huminite, calculated on a dry, ash-free basis.

Lignite mined near Larson, Burke County, North Dakota, contains resinite particles with a diameter up to 0.5 in. Published data (212 samples) indicate that the average heating value of this lignite is 460 Btu/lb more than the average value for all lignite in North Dakota (7,280 versus 6,820 Btu/lb). A presence of 5 % resinite could account for this difference in heating values.

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FLUVIAL CYCLES AND THEIR INTERPRETATION, DAKOTA FORMATION (CRETACEOUS), UINTA MOUNTAINS, NORTHEAST UTAH

The Dakota Formation provides excellent exposures of cyclically deposited fluvial channel sandstones. Each successive channel sequence represents a cycle that commonly decreases in thickness upward. A general fining-upward sequence is typical within each cycle. Rarely, however, are cycles topped with material smaller than very fine-grained sandstone. Outcrops of the cyclic deposits range in thickness from 65 to 115 ft.

The base of each cycle is the basal erosional surface of each channel. The basal sandstones contain the coarsest sediment, which ranges in size from medium grain sand to pebbles. Boulder size fragments of bank material are commonly incorporated in the basal sandstone. Sorting is very poor to moderate. Almost all basal sandstones are nonresistant to erosion and moderate to dark reddish-brown in color. Sandstones above the basal unit are well to very well sorted and range in color from light brown to white.

The cementing agent of the sandstone is mainly clay, which apparently is kaolinite altered from potassium feldspar. Only minor amounts of calcite and silica cement are present. Virtually all samples contain various amounts of subangular to subrounded, frosted quartz grains.

Sedimentary structures are primarily trough and planar cross-stratification and parallel stratification. Thicker cycles commonly have medium- and small-scale trough and planar cross-stratification overlain by parallel stratification. Thinner cycles may contain exclusively trough and/or planar cross-stratification. Ripple marks are uncommon, but where present are situated at or near the top of cycles.

Most cycles probably were deposited in sinuous streams. Thicker sections of the Dakota apparently were deposited in streams of higher sinuosity than thinner sections.

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DEPOSITIONAL ENVIRONMENTS OF WHEELER FORMATION, DRUM MOUNTAINS, MILLARD COUNTY, UTAH

The Wheeler Formation in the Drum Mountains represents the transition between shoal and deeper open-shelf environments. Lithologic evidence suggests continuous deposition and frequent oscillation of lithotopes. The following facies can be recognized: (1) intra-shoal basin with mottled and thin-bedded intrasparites; (2) shoal with trilobite biosparites; (3) deeper open-shelf rhythmite consisting of thin-bedded pelsparite interbedded with fissile calcareous shale or argillaceous partings; and (4) deeper open-shelf shale.

Faunal assemblages and types of fossil preservation further support the interpretation of a transition between shoal and open-shelf environments. Shallower facies are dominated by assemblages of diverse, probably benthic, nonagnostid trilobites, whereas the deeper facies are dominated by pelagic agnostid trilobites. In the shoal facies, trilobites are commonly disarticulated and are found in a sparry matrix, whereas rhythmites of the open-shelf facies commonly contain articulated specimens.

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GEOLOGIC CYCLES OF EARTH, MOON, AND MARS

The geologic cycle of a planet depicts the interaction of impact, surface, and internal tectonic processes on the planetary surface. The earth has a "closed-loop" geologic cycle in which source rocks are eroded but are continuously recycled. In contrast, the moon apparently has an "open-loop" geologic cycle in which the primitive crust is irreversibly destroyed. On the earth, impact plays a minor role and surface and tectonic processes are approximately equally active; that is, if averaged over the globe throughout geologic history, the rate of uplift equals the rate of erosion. On the moon, impact processes are dominant and there are only minor surface and tectonic effects. Preliminary interpretations of the rock cycle and the "ice cycle" of Mars are presented as sources of questions for future analysis. Apparently, the geologic cycle of Mars involves surface and tectonic phenomena as well as impact phenomena.

Surface processes active on Mars include eolian erosion and deposition. The "channels" in the equatorial regions are evidence of intermittent stream erosion. The tectonic processes of Mars have been investigated by mapping regional stress patterns from analysis of observed lineament (fracture) systems.