dissolution associated with hydrocarbon maturation-migration.

The understanding of these subsurface cements helps decipher the diagenetic history of carbonate rock sequences during progressive burial and can be particularly helpful in timing hydrocarbon migration.

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Development and Infilling of the South Pass Shelf-Edge Failure Bowl, Offshore Mississippi Delta

The South Pass shelf-edge failure complex, which extends from the continental shelf edge to the Mississippi fan, is one of several expressions of late Pleistocene seafloor failure identified off the Mississippi River delta. The headward portion of this feature lies within a 240 km² (93 mi²) study area located 22 km (14 mi) south of South Pass. Water depths within the area range from 50 to 400 m (165 to 1,300 ft). High-resolution sparker and Acoustipulse seismic data have been correlated with borehole information and radiocarbon dates to document the failure and subsequent infilling of the headward bowl of this massive feature.

Radiocarbon dating of the sediments cut by the failure feature suggest that it was formed 25,000 to 20,000 years ago. The buried failure surface represents the evacuation of a slab of sediments approximately 200 m (660 ft) thick with a volume of 40 km³ (9.5 mi³) from within the study area. Dating of the post-failure sediments indicates that the infilling process was essentially complete by 15,000 y.B.P.

Seismic stratigraphic techniques, and lithologic and geotechnical borehole data were used to subdivide the evacuation and infilling into seven stages. These stages are represented by four surfaces of unconformity and the sediment packages they enclose. Sea level, morphology of the depositional surface, contemporaneous structure, sediment accumulation rate, depositional source, and erosion controlled the duration and development of these stages.

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Lake-Margin Deposition in Ensialic Rift Basins—The Miocene Chalk Hills Formation of the Southwestern Snake River Plain

Over 120 m (400 ft) of terrigenous sediment within the Miocene Chalk Hills Formation was deposited in proximal to distal fluvial to lacustrine settings during extensional tectonism along the southwestern Snake River Plain. spectacular exposures of basin-fill facies along deep tributary gorges allow for detailed reconstruction of major sedimentary environments along this extensional basin margin.

Vertically, Chalk Hills sediments comprise a transgressive sequence of fluvial-floodplain, marginal lacustrine, and deep lake systems which progressively onlap basin-margin silicic volcanics. Fluvial-floodplain facies, deposited in and along large, slightly sinuous rivers, consist of trough-cross-bedded boulder gravel to coarse sand paleochannels which incise floodplain fine sands and muddy silts. These pass basinward and vertically into coarse, marginal lake facies, commonly exhibiting tabular cross-sets in excess of 18 m (60 ft) in thickness, with individual inclined units reaching 1 m (3.3 ft) in thickness. These constructional units are characterized by dips to the northeast of 15 to 22°. Closely spaced sections demonstrate that most well-developed foreset-topset couplets have great extent along the basin margin, and were probably deposited as lateral benches which repeatedly developed along interfluvial headlands. Coarse sediment supplied from one or more fluvial sources along the lake margin was winnowed by waves on shallow bench platforms prior to deposition on steep basinward-dipping bench slopes. In addition, localized Gilbert-type deltas may have been responsible for lobate cross-set sequences which are laterally restricted in comparison to the tabular cross-sets which characterize bench sequences. Marginal lake facies in turn grade basinward and upward vertically into deep lake silts and muds which were deposited during continued lake transgression over steep lake margin volcanics. These units are commonly horizontally bedded or massive.

Unlike lacustrine systems deposited in broad compressional intermontaine basins, facies within the Chalk Hills Formation of the southwestern Snake River Plain exhibit abrupt lateral and vertical changes, recording both spatial narrowness and temporal instability of fluvial-lacustrine transitional environments in extensional rift basin settings. The unique relationships exhibited by these sediments, resulting from tectonic instability, may be characteristic of many rift-valley lacustrine systems.

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Radiolarians in Plankton Samples from Ice-Covered Antarctic Waters

Plankton tows taken within the Antarctic sea ice in late October through November 1981, as part of the US–USSR Weddell Polynya Expedition contain numerous varieties of polycystine and tripylean radiolarians. Fifteen tows at nine sites sampled the zooplankton at specific intervals within the water column along a north-south transect extending over 300 km (190 mi) within the ice.

Although chlorophyll A levels were relatively low (≤ 0.1 mg/m³) in samples taken under the ice, the total number of polycystine and tripylean radiolarians per cubic meter of filtered seawater ranged from 20 to 50% of that reported from open-ocean sites. At several of the ice stations, the number of radiolarians per cubic meter of filtered seawater was similar to that recorded at the ice edge, even though ice-edge chlorophyll levels were 100% higher than levels at sites in the ice. The relatively high number of radiolarians found under the ice is even more unusual considering that the region has been completely ice-covered for a minimum of 4 months prior to sampling.

Although most species were found living above and below the thermocline/halocline, specific species such as *Spongotrochus glacialis* Popofsky and *Lithelius nautiloides* Popofsky were most abundant in tows which sampled the water column above this oceanographic boundary. Comparison of this plankton-tow data with that from Antarctic surface-sediment samples shows, that with few exceptions, the relative abundances of specific polycystine species in the water column are comparable to those found in the surface sediments.

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Extending Present Coal Reserves with Self-Bursting Coal Pellets

A new scheme is proposed which would extend our present reserves of coal by making use of what is now a waste product.

Studies show that up to 25% of the volume of coal is lost as fine coal particles in the coal mining and handling process. These fines, considered to be nontransportable and useless may be concentrated as thick "deposits' in tailings ponds.

Actually, if the fines can be transported (as in the case of local slurry pipelines directly to the user), they are preferred, for most coal-burning electrical power plants inject the coal into their boilers as dust (−200 mesh). This allows for greater burning efficiency. Unfortunately, since fines are rarely available, utility companies must grind all coal received. Such grinding is very expensive, frequently costing as much as the coal itself.

At present, the concept of agglomeration of coal fines into coherent pellets strong and stable enough to allow transportation is being considered, and several pilot-scale operations have been undertaken. These have shown that while pelletization can be done with relative ease, the economics of the process is at best marginal. The binders considered to date include bentonite, various oils and asphalts, and organic waste. Obviously a binder which burns is preferable to one which contributes to the ash. Unfortunately, in each case, the coal pellets must be reground to dust to be injected into the furnace.

If, however, a binder is employed which is both combustible and contains a small amount of water, the expensive grinding stage can be eliminated. When a pellet held together by a water-soluble polymer or other water-based binder is introduced into a hot environment (a pre-heating chamber or the boiler itself), the vapor contained in the binder vaporizes and undergoes a rapid volume increase, causing a dramatic pressure increase inside the pellet. Meanwhile, the tensile strength of the pellet is being lowered by the degradation of the binder. Once the internal pressure exceeds the ability of the pellet to contain it, the pellet bursts. This "explosion" reduces the pellet once again to dust, since any pellet fragments would likewise burst. No grinding is necessary, and the economic picture of the process improves dramatically.

Application of this process finds breadth when one considers the potential sources of coal fines. As environmental regulations tighten, coal-cleaning standards rise. To effectively remove organic sulfur from coal, the coal must first be crushed, and conceivably large supplies of coal dust would be available. Pelletizing might also find application between the end of a slurry pipeline and the ultimate user. Another potential source is in-situ comminution of thin, deep coal seams, which reduces the coal to small fragments before pumping it to the surface.

To be sure, coal agglomeration will find widespread use in the near future, and the use of a water-based binder will make the process economically feasible. Indeed, the self-bursting concept may revolutionize the burning industry.

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Chemical Diagenesis of Pennsylvanian Brush Creek (Pennsylvania) Carbonate Components: Trace Elements

The various (low-Mg calcite, intermediate-Mg calcite, high-Mg calcite, and aragonite) carbonate components from the Pennsylvanian Brush Creek Formation of Pennsylvania are preserved in different stages of diagenetic alteration. In general, these components follow the predicted diagenetic changes in structure, mineralogy, and chemistry deduced from theoretical considerations for progressively altered carbonates.

The low-Mg calcite brachiopods show no signs of either structural or chemical alteration. The shell material is preserved as low-Mg calcite fibers with no apparent dissolution and/or infilling by diagenetic calcite. Also, the average Sr^{2+} content of the brachiopods is 820 ppm, which is in agreement with the chemical content of their Holocene counterparts. In contrast, the intermediate-Mg calcite rugose corals show signs of structural aggrading neomorphism. The trabecular fibers are in part recrystallized to small mosaic calcite grains. This structural alteration is concomitant with chemical changes in the Brush Creek rugose corals. The least-altered components contain about 1,770 ppm Sr^{2+}, whereas the most altered components contain only about 1,030 ppm Sr^{2+}. For the high-Mg calcite crinoids, diagenetic alteration is mostly a cementation process with minor mineralogical alteration. The open meshwork structure typical of the Echinodermata is infilled in the Brush Creek crinoids by diagenetic cement. This infilling cement has decreased the average Sr^{2+} content of 2,140 ppm of unaltered crinoids to that of 1,090 ppm Sr^{2+} for the most-altered Brush Creek crinoids. Scanning electron microscope analysis of the originally aragonitic mollusks (gastropods, pelecypods, and cephalopods) shows a complete structural diagenetic transition series. The original and least-altered mollusk material is preserved as nacre, which is always aragonite. The second phase of the transition series in the mollusks is represented by the aggrading neomorphism of the nacreous tablets into small, coarse mosaic calcite crystals. The structural transition is completed by the replacement of the mosaic calcite by coarse calcite spar. Mineralogically, the mollusk material changes from aragonite to aragonite-calcite to calcite, relative to the least- and to the most-altered specimens, respectively. The structural and mineralogical changes of the originally aragonitic mollusks are also confirmed by changes in their overall chemical composition. Average Sr^{2+} values measured for the least-altered Brush Creek mollusk material is 4,470 ppm. Mollusk material of the second phase of the diagenetic transition series contains on average about 2,170 ppm Sr^{2+}. The most-altered mollusks, which are calcite, contain on average about 1,110 ppm Sr^{2+}. Similarily, the Na^{+} values follow the diagenetic trend of strontium. The least-altered material contains 750 ppm Na^{+}, the intermediate-altered material contains 420 ppm Na^{+}, and the most-altered material contains 250 ppm Na^{+}.

Thus the diagenetic alteration process and rate proceed in accordance with mineralogical stability. This sequence is aragonite, high-Mg calcite, intermediate-Mg calcite, and low-Mg calcite relative to fastest to slowest reaction, respectively. The diagenetic alteration and preservation process of the Brush Creek carbonate components is probably a two-stage event. The first stage occurs in the marine phreatic zone, and the second stage occurs in the meteoric phreatic zone.

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Age of Clay Diagenesis in Oligocene Frio Formation

The Rb-Sr isotopic dating method can be applied to sedimentary rocks to determine the time of formation of diagenetic illite. In the Pleasant Bayou 1 geothermal test well in Brazoria County on the Texas Gulf Coast, the interval from 9,300 to 16,500 ft (2,800 to 5,000 m) consists mainly of overpressured shale and sand of the upper Oligocene Frio Formation. Rb-Sr isotopic analyses of the less than 0.06 μ fraction indicate that clays within the zone of "hard" geopressure, which extends downward from 11,000 ft (3,400 m), formed in equilibrium with pore water and record an age of diagenesis at 23.6 ± 0.8 m.y. This sharply defined age is in contrast to the result that would be expected if burial diagenesis had been a gradual, continuing process, in which clays at different depths would have accumulated various amount of Rb at different times in the past. If this were true, the ages of diagenesis would have varied continuously from older in the deeply buried part of the stratigraphic section to younger in the upper part of the section.