ing the Delaware basin or an excess of mass under the Central Basin platform. The West Platform fault zone is basement controlled. The seismic activity recently recorded in the area may be related to these deep-seated basement structures. The geophysical and geologic similarities between the southern Oklahoma aulacogen and the Permian basin suggest that the latter may be related to a late Precambrian aulacogen.

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Evidence for Deltaic Environment of Deposition for Aguja Formation (Upper Cretaceous), Southwest Texas

The Aguja Formation consists of approximately 650 ft (200 m) of claystones, calcareous concretions, sandstones, ironstone concretions, humate-bearing shales, and seams of humate material, in an area 8 mi (13 km) northwest of Big Bend National Park, Texas.

Three informal members of the Aguja Formation are based on the varied lithology. The lower member is gradational with the underlying Pen Formation and is composed of approximately 200 ft (60 m) of yellow and light to dark-brown massively bedded claystones, lenticular beds of calcareous concretions, and thin to massive-bedded and cross-bedded channel sandstones. The lenticular beds of calcareous concretions and cross-bedded channel sandstones occur near the top of this member. Massive claystones dominate the lower member and contain a wide variety of forams, and a restricted fauna of gastropods and pelecypods. The relation of claystone to sandstone, within the lower member, reflects a coarsening-upward sequence and suggests a gradational change from a prodeltaic to a lower delta-plain environment.

The middle member of the Aguja Formation is gradational with the underlying lower member. The middle member is composed of approximately 300 ft (90 m) of lenticular, thin to massive-bedded, and cross-bedded sandstones, dark-gray massive claystones, and interbedded claystones and sandstones. Lenticular beds of ironstone and ironstone concretions, humate-bearing shales, and seams of humate material also are present in this member. The wide variety of gastropods and pelecypods within the channel sandstones and vertebrate and wood remains in the massive claystones in the middle member suggest both marine- and brackish-water conditions typical of a delta-plain environment.

The upper member of the Aguja Formation unconformably overlies the middle member and is composed of approximately 150 ft (45 m) of cross-bedded and massive-bedded sandstones, lenticular beds of limestone-pebble conglomerate, and minor amounts of claystone. Marine fossils are associated with some lenticular sandstones and include cephalopods, pelecypods, and gastropods. Vertebrate remains and petrified wood are present throughout the upper member. The upper member probably reflects a prograding upper delta-plain environment. Marine fossils associated with the lenticular sandstones may represent intermittent destructive phases during progradation.

The Aguja Formation was deposited within a deltaic environment as is indicated by the geometry of the claystones, channel sandstones, and humate-bearing units. The lower member represents a prodeltaic to lower delta-plain environment. The source area for the Aguja was probably on the west, northwest, and southwest as is suggested by paleocurrent indicators in the channel deposits.

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Volcanogenic Uranium Deposits and Associated Gold-Bearing Mineralization in U.S.S.R.

No abstract available.

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Shallow-Seated Dissolution of Bedded Evaporites in Northern Delaware Basin

Studies of boreholes penetrating the Dewey Lake, Rustler, and uppermost Salado Formations in the northern Delaware basin (southeastern New Mexico) have investigated subsurface dissolution of bedded evaporites in the vicinity of Nash Draw, a depression 5 to 10 mi (8 to 16 km) wide and about 250 ft (75 m) deep. The thickness of the section between the top of the Salado Formation and the base of marker bed 103 ranges from an intact 210 ft (64 m, east of Nash Draw) to a residual 45 ft (14 m in the Draw), where gypsification of Rustler anhydrite and removal of Rustler halite are virtually complete. The uppermost Permian halite has been previously described as a dissolution zone (the "brine aquifer"). Within 130 ft (40 m) below this zone are halite-filled fractures, cubic-shaped cavities, and gypsum after anhydrite. Above are remnant "islets" of halite and anhydrite, gypsum replacing anhydrite and polyhalite, and dissolution breccia. The mineralogy and stratigraphy suggest that the shallow-seated "dissolution front" is a series of "fingers" moving laterally along bedding planes, rather than a single surface migrating downward. The sequence of alterations appears to be: (1) fracture of brittle rock, (2) dissolution of halite adjacent to the fracture rock, (3) gypsification of interbedded polyhalite and then anhydrite, and (4) dissolution of gypsum. Waters of higher salinity and lower flow rate in the "brine aquifer" east of Nash Draw show an oxygen isotope enrichment with respect to meteoric waters, indicating that the low fluid-to-rock ratio there has thus far precluded significant alteration of rock by water.

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Magnetostratigraphy of Upper Cretaceous Deposits in Southwestern Arkansas and Northeastern Texas

Interpretation of preliminary paleomagnetic (a.f. demagnetized) and biostratigraphic data from Upper Cretaceous deposits suggests that the Nacatoch Sand (Navarroan) and the Brownstown Marl (Austinian) of southwestern Arkansas correlate with Guffio (Italy) reversed polarity zones E- and A-, respectively. Other Austinian, Tayloran, and Navarroan Upper Cretaceous deposits (Tokio Formation, Ozan Formation, Annona Chalk, Marlbrook Marl, Saratoga Chalk, Arkadelphia Marl, Gober Chalk, Sprinkle Formation) possess a weak remanent magnetization of normal paleomagnetic polarity. We assume the normal polarity to be primary magnetization, and interpret deposition of the Tokio Formation during the Gubbio long normal zone (Santonian and older), and that of the other units in Gubbio normal polarity zone B+ (Campanian to early Maestrichtian); this is consistent with previous assignments of the units to stages on the basis of biostratigraphic data.

We conclude that the boundary between the Austinian and Tayloran provincial stages approximates the boundary between the Gubbio reverse polarity zone A and the Gubbio normal polarity zone B+. The Tayloran-Navarroan boundary is probably within the upper part of Gubbio normal polarity zone B+.

The magnetostratigraphic approach for refinement of the

geochronology for Upper Cretaceous deposits in Arkansas and Texas offers another method of dating geologic events in these areas and relating them to events elsewhere.

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Chemical Changes Associated with Propylitic Alteration of Two Ash-Flow Tuffs, Datil-Mogollon Volcanic Field, New Mexico

Large-scale propylitic alteration of two texturally distinct, Oligocene ash-flow tuffs has been investigated: the crystal-poor, one-feldspar, rhyolitic A-L Peak Tuff and the crystal-rich, two-feldspar, rhyolitic to quartz latitic Hells Mesa Tuff. Initial development of a petrographic criterion with which to separate samples into groups experiencing varying degrees of alteration was followed by univariate and multivariate statistical analyses of major and trace element data, including U and Th, to identify chemical trends accompanying alteration. The extent of alteration a sample displays can be petrographically characterized by several variables including the amount of replacement of the groundmass and feldspar phenocrysts with secondary minerals, the degree of bleaching of the groundmass and the appearance of the mafic minerals.

Both the A-L Peak Tuff and the Hells Mesa Tuff showed increases in K_2O, Rb, and FeO, increases in the Fe^{+2}/Fe^{+3} ratio, decreases in Th, and no systematic trend in U, Nb, or Zr with alteration. The two units displayed opposite behavior with alteration for MnO, Y, and Sr. Total iron, Al_2O_3, Fe_2O_3, TiO_2, MgO, CaO, and Na_2O content showed a trend in one unit but not in the other. The mobility with alteration of Th, considered to be immobile in most geologic processes, may have been caused by the reducing environment of the prophylitic process. Such a reducing system might also explain the immobility of U during propylitization.

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Volcanism and Uranium Mineralization at Spor Mountain, Utah

Uranium-beryllium-fluorine mineralization at Spor Mountain in western Utah accompanied basin-range faulting and alkali rhyolite volcanism after major episodes of caldera-related volcanism had ended. Volcanism began about 42 m.y. ago with eruption of intermediate-composition flows, breccias, and tuffs from small central volcanoes, and culminated with eruption of intermediate-composition ash flows and subsidence of the Thomas caldera about 39 m.y. ago. Intermediate-composition volcanism was accompanied by base- and precious-metal mineralization. Eruption of rhyolitic ash flows 38 to 32 m.y. ago largely filled the Thomas caldera; some of these eruptions caused subsidence of the Dugway Valley cauldron. Alkali-rhyolite volcanism, basin-range faulting, and uranium-beryllium-fluorine mineralization began at Spor Mountain about 21 m.y. ago, at least 11 m.y. after the last cauldron subsidence. Most faulting and mineralization had ended by 6 to 7 m.y. ago, when voluminous alkali rhyolite was erupted in the Thomas Range.

Extensional tectonism was the probable cause of both alkali-rhyolite volcanism and uranium-beryllium-fluorine mineralization at Spor Mountain. Vents developed along basin-range faults and fault intersections at 21 m.y. and 6 to 7 m.y. ago, and mineralizing fluids rose through a plumbing system of vents and faults after eruption of tuff and alkali rhyolite 21 m.y. ago. Mineralizing fluids invaded faults in Paleozoic rocks and deposited uraniferous fluorite; they pervaded dolomite clast-rich tuff, which is interleaved between relatively impermeable strata, and deposited uranium in the structures of fluorite and opal and beryllium in bertrandite. Precipitation of uranium and beryllium occurred in response to breakdown to beryllium fluoride, uranium fluoride, and uranium-silica complexes as fluorite and silica were precipitated from cooling fluids. Uranium of magmatic origin in glassy tuff and that added by hydrothermal fluids was remobilized by ground water to form secondary concentrations in tuff and tuffaceous sandstone; such concentrations comprise minable deposits at the Yellow Chief mine.

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Eocene Erosional "Surface" and Its Relation to Onset of Basin-Range Faulting

The widespread (2×10^5 km^2) infravolcanic, Eocene, allegedly planar "surface" in the Basin-Range (B/R) province is universally considered to indicate long-lasting erosion ("peneplanation"?) on vertically immobile crust deformed during the Laramide orogeny. This allegedly manifests secular tectonic stability between Laramide and B/R orogenies. Faults cutting this "surface" and the volcanic rocks overlying it are widely believed to demonstrate the onset of B/R faulting. I doubt this because: (1) the "surface" is not everywhere planar; its intrarange topographic relief exceeds 0.1 km; (2) its observed remnants lie on modern B/R range blocks; planar remnants of this surface may be parts of pediments formed on adjacent Eocene B/R ranges as regionally temporal but not necessarily widespread interrange hypsometric correlatives; (3) its unobserved alleged remnants in buried basin blocks may be depositional; (4) the pediments formed in warm, humid climates which possibly produced pedimentation rates high with respect to Eocene B/R range uplift rates, and few pediment gravels because of intense chemical weathering of mostly Paleozoic limestones; (5) in at least four B/R basins, the deeply buried (depositional) surfaces lie on drilled Eocene continental deposits over 2 km thick, but no Eocene deposits occur on adjacent B/R ranges between the Oligocene ignimbrites and the deeply eroded Paleozoic strata, thus indicating contemporaneity of B/R range uplift and adjacent B/R basin sinking in Eocene; and (6) the "surface" had been and was being formed up to the time of Oligocene volcanism. I conclude that the alleged Eocene "surface" was not one widespread static surface, but many local dynamic surfaces, formed in equilibrium with major Eocene B/R tectonism; throws of this "surface" are not necessarily manifestations of the onset time of B/R faulting.

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Geology and Volcanic Rocks Calera–Del Nido Block, Chihuahua, Mexico: Uranium Potential of Region

The Calera-del Nido block extends north from Chihuahua City for 140 km and from Highway 45 west to the next major valley. The block has a steep east-facing scarp and more gentle west-facing slopes. In Majalca Canyon, a rhyolite flow dome (oldest), rhyolite tuff, boulder conglomerates, and a felsic lava flow (Almireces volcanics, next oldest), and andesite-basaltic andesite flows (4+ km thick, Penas Azules volcanics) underlie a basal 45-m.y. old rhyolite tuff of the Rancheria volcanics. Above this, the Rancheria includes the Picos Gemelos andesite