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Location and Chronology of Tertiary Sedimentary Deposits in Arizona

Isotopic and paleontologic dates published for 41 Tertiary sedimentary units in Arizona provide a basis for statewide correlation and interpretation for the Tertiary tectonic history of the state. Locations of the units and depositional basins are mapped, and their absolute and relative ages are plotted in a correlation chart, based primarily on isotopic dates of intercalated volcanic units.

The general stratigraphic and structural relationships of the sedimentary units provide evidence of the Tertiary evolution of structure and drainage systems in Arizona. Early Tertiary sedimentary rocks of southern Arizona are predominantly well-rounded, coarse-grained stream gravels that were derived from nearby uplands formed during the Laramide and mid-Tertiary orogenies. In northern Arizona, comparable sediments were deposited in drainage systems flowing northward from central Arizona, across the present Colorado Plateau. Local ponding occurred in both areas, wherein fine clastics and carbonates were deposited.

Extensional tectonics of the Basin and Range disturbance resulted in volcanic activity and normal faulting, creating deeply subsiding basins in which thick sequences of fluvial, lacustrine, and evaporite sediments were deposited. Sedimentation continued until Pliocene time when tectonism and volcanism abated, allowing the establishment of through-flowing drainage and downcutting of the more elevated basins. The fossil record in these basins contributes valuable information relative to their depositional history and is used for preliminary interpretations of Tertiary paleoclimates, land elevations, and paleodrainages.

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Pisoliths of Fairview Valley Formation, San Bernardino County, California

The metamorphosed Fairview Valley Formation (Permian-Triassic?) crops out beneath the Sidewinder Volcanics in the Mojave block, southern California. Abundant spherical grains occurring in its upper portions are questionably known as ooliths. However, results of field and mineralogical analyses lead to the conclusion that the majority of the grains are not ooliths but pisoliths originally formed in a sandy vadose zone. Their accretionary growth process began around siliceous nuclei in a similar manner to that of pisolith growth in caliche soil. Most of them commonly occur fused together or form unusual fitted polygonal structure.

Locally, the grains crop out as conspicuous graded, inverse graded, and lensoid or wavy beds. These are commonly separated by thin laminae composed of finely crystalline aggregates originally deposited as carbonate mud. This bedding suggests periodic accumulation under uniform, quiet-water conditions. No cross-beds or fossils were found in these deposits.

The average grain size of 466 pisoliths measured in the field ranges from 0.2 to 0.5 cm in diameter. The average size decreases vertically toward the upper (north) stratigraphic zones, which implies that either the pisoliths in the source area became smaller in size with time or they were brought from farther away. The bulk of the pisoliths is interpreted as having been carried a short distance from the source area by running water, and redeposited from waning currents similar to turbidity flows. The site of deposition was probably a nearby broad barred lagoon in proximity to a shallow marine environment, which would allow dolomitization to take place after burial of sediments.

The matrix of rock samples analyzed both by X-ray diffraction and staining contains iron-free calcite, tremolite, and forsterite. Prior to metamorphism, the matrix was possibly composed primarily of dolomite; presently, the pisoliths are formed mainly by diopside, iron-free calcite, wollastonite, dolomite, forsterite, and periclase. The calcite content in most pisoliths, especially the larger ones, seems to increase outward from the core.

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Uranium Deposits in Channel Curves of Salt Wash Sandstone Member of Morrison Formation (Late Jurassic), Utah

The Salt Wash Member of the Morrison Formation in southeastern Utah is characterized by fluvial sandstone in distinct paleochannels. The deposits are part of a large delta-fan with an apex in the vicinity of the western Grand Canyon. The exhumed channel fills, which excellently expose directional sedimentary structures, were deposited by streams of slight to moderate sinuosity, with occasional sharp bends. Such curves were loci of more conspicuous entrapment and burial of carbonaceous material. Later these areas became highly reducing environments where uranium ores precipitated from ground water percolating through permeable interconnecting channels. Major uranium deposits are more likely to occur in areas where such conditions existed.

To determine areas with strong randomness of paleocurrent directions, the vector summation method was applied to the analysis of 2,638 paleocurrent measurements. Because this method is a sensitive measure of dispersion, it was possible to outline areas displaying high and low vector strength values. Areas of high scatter commonly yield low values and polymodal distribution, and areas with low scatter are characterized by high values and unimodal distribution. Thus, areas of high channel sinuosity were successfully outlined. Major known uranium deposits occur most commonly in areas of low vector strength values. Such areas were compared with those containing known ore deposits and those considered favorable for future discoveries, and the results support the conclusion. Although the vector method has been used in many paleocurrent studies, this is the first time it has been applied in conjunction with other geologic criteria to delineate and select areas favorable for uranium exploration in sandstone deposits.

The results show an important relationship among low paleocurrent vector strength values, carbonaceous material, channel curves, and uranium occurrences in the sandstone channels.

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Palynology of Barstow Formation (Miocene), Rainbow Basin, Southern California

The Barstow Formation, a deposit of alluvial-fan, fluvial, and lacustrine sediments 3,280 to 3,940 ft (1,000 to 1,200 m) thick, was deposited in the Barstow basin during Neogene time. The formation is well exposed in the Barstow syncline about 9 mi (14 km) north of Barstow. The palynomorphs of the Bar-