

PALEONTOLOGY OF THE WHITE RIVER FORMATION SOUTHEAST OF DOUGLAS, WYOMING
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Vertebrate fossils were collected from the White River Formation south of the North Platte River southwest of Orin Junction, Converse County, Wyoming. Over 200 m of Upper Chadronian and Lower Orellian rocks are exposed. They are dominantly grey silts grading upward into sandy tan silts and finally to tan sands. Stream channels are common throughout and there are several ash layers useful as stratigraphic markers. Most vertebrate remains were found in the middle third of the section and almost all recovered material came from two sandy concretionary beds, one of Chadronian and the other of Orellian age. The age boundary is within the upper part of the 16 m of rocks separating the two concretionary beds. Noteworthy finds from Chadronian rocks include the skull, jaws, and associated postcranial material of Xenocranium (Epoicotheriidae, Pholidota) and similarly complete material of a large individual of Apternodus (Apternodontidae, Insectivora). A latest Chadronian age is indicated by the joint occurrence of *Palaeolagus burkei* (Leporidae, Lagomorpha) and brontothere scrap. Fossils from Orellian rocks include a snake (unprepared and unidentified) and a small lizard in similar condition. Most small mammals found show sign of death by predation, probably by owls. Owls may have preyed selectively upon *Apternodus*.

A PROPOSED SPELEOGENESIS FOR LEWIS AND CLARK CAVERNS, MONTANA

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A speleogenesis for Lewis and Clark Caverns was arrived at by laboratory and field observations of speleothems and their stratigraphic relationships. The solution of the Mission Canyon limestone (Miss.) began about three million years ago during the late Pleistocene before the Jefferson River had cut the canyon in which the caverns are found. Drainage of the caverns probably occurred shortly after the Pleistocene. Speleothem development began as the caverns were draining but was later interrupted by three events. Early in the caverns history a period of unusual dryness occurred as suggested by rock which was a thoroughly desiccated mud. Following this was a period of major ceiling collapse which stabilized some of the roof. Minor flooding occurred later and deposited as much as four feet of sediment in certain areas of the caverns. Large stalagmites and other formations that cover the ceiling rubble probably grew at this time. Globulite formations, some of which may have pisolitic origins, may be associated with this period of flooding. Presently the lower two thirds of the caverns are still active, but the amount of deposition is not great.

EXTENSIONAL FAULTING AND VOLCANISM ALONG THE ARCO RIFT ZONE, EASTERN SNAKE RIVER PLAIN, IDAHO

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The 15-km-wide Arco Rift Zone (ARZ) extends 50 km southeastward from the north margin of the Snake River Plain (SRP) at Arco to its longitu-

dinal axis near Atomic City. The ARZ is the locus of extensional faults, graben structures, numerous basalt volcanoes, a rhyolite dome, and an andesitic(?) volcano. The youngest basalt flows, Cerro Grande and North Robbers, are 10,500 and 12,000 ^{14}C yrs old, respectively. At least 10 other basalt flows in the ARZ are judged to be <50,000 yrs old. All young basalts erupted from vents elongated N. 45° W. 15°; these vents are aligned with fractures and scarps in the ARZ and are approximately parallel to basin-range faults to the north. Flows 10-15 km SE of Arco in the ARZ, estimated to be 40,000±20,000 yrs old, are offset by many extensional faults having as much as 8 m of vertical displacement. Big Southern Butte, a rhyolite dome (300,000 yrs old), and Cedar Butte, an andesite(?) shield with collapsed vent, are located in the ARZ near its junction with the axis of the SRP. They appear to be controlled by NW-trending rifts of the ARZ and N- and NE-trending structures of the axis of the SRP.

The orientation and kinds of structures in the ARZ, particularly in the NW part, suggest that they are extensions of basin-range structures onto the SRP. This correlation implies that other rift zones of the SRP (e.g., Craters of the Moon and Spencer-High Point rift zones) may also be extensions of basin-range structures. Preliminary analysis suggests that basalt volcanism and extensional faulting in the ARZ have recurred at approximately 10,000-year intervals. This estimated time interval may be an important planning and design factor for U.S. government installations and communities in and near the ARZ.

METALLOGENESIS REVISITED

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Many workers have endorsed the concept of a genetic space-time relationship between particular plate tectonically derived environments and epigenetic and many kinds of syngenetic ore types. No definitive proofs presently exist for the original source of many metals, especially those associated with granitic rocks. The problem may be unresolvable until possibly the origin of granites, continents and/or earliest history of the earth is known.

A perusal of the literature also shows that (1) process rather than necessarily anomalous host source rock plus process is effective in the formation of many types of deposits. Examples include selected Au-quartz veins, supergene U deposits, massive sulfide deposits and possibly sandstone type Cu deposits. (2) Acceptance is growing for additional types of ore deposits which form at the surface or at shallow depths. A magmatic heat source may or may not be important in their development. Examples include certain massive sulfide types, U-quartz veins, Midnight Mine type U occurrences and may include stratabound W-Sb-Hg deposits and selected epithermal Au-Ag and Hg deposits. (3) Certain ore deposits and possibly metallogenic provinces are the product of multi-stage histories involving both magmatism and sedimentation processes. (4) A generally complete sequence of types of nonferrous ore deposits developed in most geosynclinal orogenic belts. The apparent lack of significant metal deposits such as Hg in older portions of crust and other metals such as Cr, Ni in the youngest portions may therefore be primarily due to (a) depths of denudation, or (b) crustal tectonic evolution.

COMPARISON OF COMPRESSED FOLIAGE FROM TWO SITES IN THE KOOTENAI FORMATION OF GREAT FALLS, MONTANA

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