Gallery of Geology - Late Triassic pisolites in Socorro County, New Mexico

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Gallery of Geology—Late Triassic pisolites in Socorro County, New Mexico

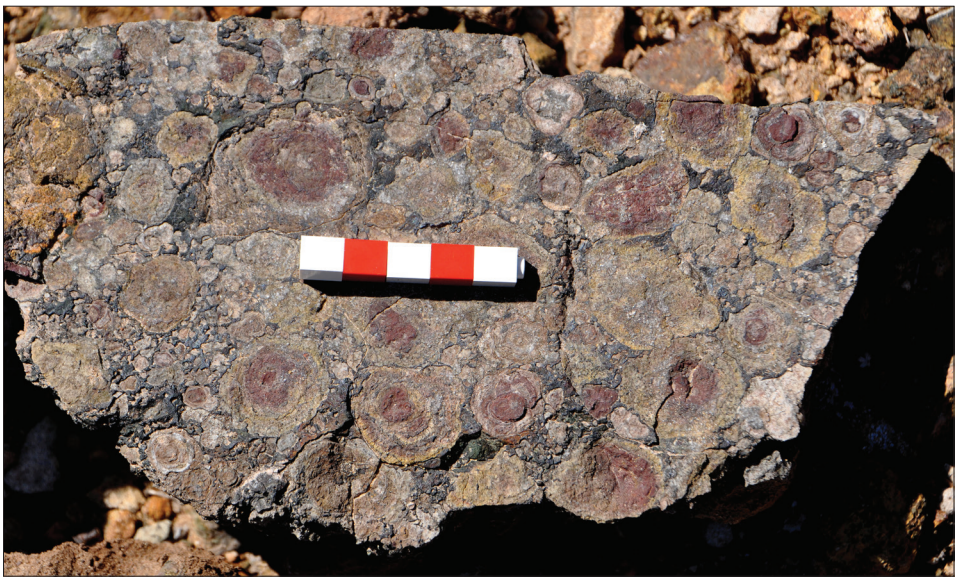
One of the most visually distinctive outcrops of sedimentary rock in New Mexico is located in Socorro County, a few kilometers northwest of Carthage, at Cañon Agua Buena. Strata of the Chinle Group, of Late Triassic age, crop out in the ravines here and are assigned primarily to the San Pedro Arroyo Formation, a unit of mudstone, limestone, and sandstone that overlies sandstone and conglomerate of the Shinarump Formation, with the limestones concentrated in the Ojo Huelos Member. Lucas (1991) first named this unit and established the type section in southern Valencia County at Ojo Huelos (Lucas 1991; Lucas et al. 2004). The Ojo Huelos Member is a persistent, distinctive marker unit throughout the Upper Triassic section in both Valencia and Socorro Counties, from Hubbell Springs near Belen and Carrizo Arroyo in the Lucero uplift to its southernmost outcrops near Carthage (Lucas 1991; Lucas et al. 2004; Cather and Osburn 2007; Spielmann and Lucas 2009; Tanner and Lucas 2012). The member consists mainly of micritic lime mudstone, ostracode-bearing wackestone to grainstone, peloidal grainstone, and distinctive pisolitic rudstone, interbedded with fine-grained siliciclastic mudstone. The age of the San Pedro Arroyo Formation strata is provided most reliably by a vertebrate fossil fauna that includes isolated bones and teeth of phytosaurs, metoposaurs, and the aetosaur Desmatosuchus, indicating an Adamanian (late Carnian) age, though it is possible that the upper part of the San Pedro Arroyo Formation is as young as Revueltian (early–middle Norian) (Heckert and Lucas 2002; Spielmann and Lucas 2009).

The section at Cañon Agua Buena is unique in that the lower part of the Ojo Huelos Member is dominated by distinctive, meter-scale beds of pisolite—densely packed, semi-spherical carbonate pisoids, as much as 3 cm in diameter, set in a sandy, slightly cherty limestone matrix that weathers to black (see photographs). These pisoids, where broken, expose crudely concentric layering, and commonly display prominent reddish-brown hematite staining that varies between the layers. The bedding style varies from massive to crudely stratified beds, to tabular sets. Some of the beds display an upward-decreasing trend in the size of the pisoids and are capped by sandstone completely lacking pisoids. The finer-grained pisolite beds contain a greater proportion of matrix and diverse clast sizes, including petrified wood and fossil bones as long as 6 cm, most representing metoposaurid amphibians.

The organization of the pisolite into discrete beds, locally displaying an upward-fining grain-size trend, demonstrates deposition of the pisoids by water currents. Additionally, the pisolite beds at Cañon Agua Buena are overlain by and interbedded with planar crossbedded sandstone. Consequently, we interpret the pisolites as the gravel bars of energetic, high-bedload, low-sinuosity (braided) streams (Miall 1996). This does not explain the origin of the pisoids, however. Coated grains (pisoids, oncoids) are known to form in a variety of continental settings, including lakes, stream travertines, and mature calcrete paleosols. We interpret the Ojo Huelos Member pisoids as the product of intense pedogenic reworking of previously deposited carbonate sediment that was subjected to subsequent erosion and fluvial redeposition. This interpretation is supported by the interbedding of the pisolite with the crossbedded sandstone facies (Tanner and Lucas 2012).

The base of the Ojo Huelos Member at Cañon Agua Buena consists of massive beds of pisolite. The hammer in the photo is 30 cm long.

The Ojo Huelos Member of the San Pedro Arroyo Formation comprises a variety of carbonate lithofacies that record deposition on a low-gradient alluvial plain of shallow water bodies and wetlands of various sizes in which carbonate sedimentation took place. The lakes and ponds were subject to episodes of shrinking, during which the lacustrine and palustrine carbonate sediments were subjected to pedogenic processes, such as desiccation and rooting. Falling base level, likely driven by aridification of the climate and the consequent change in regional hydrology, caused



This hand specimen shows that the pisolite consists of tightly packed pisoids, as much as 3 cm wide, which, when seen in cross section, commonly display concentric layering and hematite enrichment. Scale bar in centimeters.

Top of a tabular bed of pisolite containing a large metoposaurid bone fragment, which is just below the scale bar (which is in centimeters).

erosional reworking of the pedogenically modified carbonates, and significant fluvial incision, with a significant portion of the channel fill derived from reworked calcrete (Tanner and Lucas 2012).

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