Implications of the stratigraphic results of the Colorado Plateau Coring Project (CPCP): salt vs. plate tectonics vs. eustasy in the Late Triassic Chinle Formation

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Understanding of the basic tectonic framework for the deposition of the highly fossiliferous continental Chinle Formation (Fm) of the western US is poorly understood; it is far from clear if the setting was a back arc basin [1], a passive margin [c.f., 2], or something else. In addition, the role of eustasy in driving basin-wide sequences, unconformities, and hiatuses [e.g., 3] is contentious. Analysis of cores from Phase 1 of the CPCP in Petrified Forest National Park, AZ, USA (PFNP) integrated with new field studies suggest that the major control was halokenesis of Paleozoic salt, not tectonics or eustasy. Core 1A spans 520 m of the lower Owl Rock Member of the Chinle Fm to the formation base (L Triassic), as well as all of the Moenkopi Fm (E - M Triassic), with TD in the Permian. While the overall stratigraphy of the major units encountered in the core correspond well to those based on local outcrops [e.g., 4], a major facies complex present in southern part of the PFNP, which we call the "Monitor Butte facies" (MBF) is completely lacking, along with its associated palynologically- and macro-plant-productive levels. Our field studies suggest that MBF is associated with very rapid deposition in localized basins associated with syndepositional tilting and well-developed to profound local, angular unconformities, and extreme development of multi-colored mottled strata (MS), all related to basins produced by salt withdrawal.

Halokenesis-related unconformities and basins are well documented in the Chinle Fm in Utah [5] overlying the Paleozoic Paradox Basin, and we argue such features are widespead. In the Fort Wingate NM, USA area, steeply dipping to vertical Chinle strata with recumbent-folded MBF with a major plant locality [USGS 10060: 6] are overlain by a profound angular unconformity by virtually flat, black, lacustrine strata of the "Ciniza Lake Beds" (CLB) [7]. Adjacent undeformed facies include very thick MS. The overlying CLB are consistent with a slightly later and longer wavelength overlying sag. Both facies and geometry are similar to the salt withdrawal basins of Utah [5]. Such features are present not only elsewhere in New Mexico and Arizona, but also in the Dockum Group of Texas (with important plant localities [e.g., 8]), and fossil-fish-bearing lacustrine strata at Lisbon Valley, UT and Dolores Canyon, CO [9] may be in CLB-type sags. Lateral restriction of MBF as seen PFNP and core 1A, at Fort Wingate, as well as the unconformities and lacustrine strata reported elsewhere were not proximally a result of plate tectonic or eustatic processes but rather salt tectonics, which may be the most important control on local facies development other than climatic context for these Triassic strata in the western US.

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