**The Latemar Controversy in 2008**

**Linda A. Hinnov**
*Department of Earth and Planetary Sciences, Johns Hopkins University, 3400 North Charles Street, Baltimore, MD 21218*

The more than 500 m-scale carbonate cycles of the Triassic Latemar carbonate platform (Dolomites, Italy) have a non-random stacking pattern suggestive of a 10 myr record of precession-forced sea-level oscillations at a 50 m/myr accumulation rate. However, the platform was recently constrained by U-Pb-dated zircons from intercalating volcaniclastics bracketing 400 m of section to a mere 0.6 myr duration. This timing is supported by only one magnetozone recorded over 500 m of section. Thus, the Latemar appears to have had one of the most rapid, sustained accumulation rates observed in the Phanerozoic, $\geq$670 m/myrs, with serendipitous millennial-scale facies oscillations mimicking standard Milankovitch periodicities. Such a high accumulation rate is normally associated with drowning platforms; however, the Latemar spent most of its life subaerially exposed and never drowned. The high rate is also difficult to reconcile with the many hundreds of cm-dm thick dolomite-crust-caliche vadose caps and dozens of tepee zones, one reaching13 meters in relief, that characterize the buildup. These exposure facies are known from Holocene Lake McLeod tepee cements to develop very slowly, only 2 to 4 m/myrs.

If the zircon dating is accurate, then our understanding of platform carbonate accumulation and early diagenesis of the Latemar is deeply flawed. It means that Holocene analogues do not apply, and comparative sedimentology fails. To explain the formation of tepees, cements and caliche at rates up to 3 orders of magnitude higher than Holocene, we must turn to modeling. For example, Carb3D+ with reactive transport might be called on to simulate conditions leading to the formation of the modern and Holocene analogues. These conditions can then be varied until the formation rates of caliche and tepee cement match those implicated by the Latemar zircon dates. Evaporative pumping is thought to be a major process responsible for the formation of the caliche caps and tepee cements. Compared to today, or the Holocene, how much greater must the evaporative pumping have been in order to increase caliche formation rates by 2-3 orders of magnitude for the Latemar? Would a different seawater chemistry or temperature be more appropriate variables? Tides? Wind-driven currents? Is there any realistic combination of these or other variables that could explain such high formation rates?

Resolving the Latemar controversy is important to Earth scientists who depend on the geologic time scale. If we can demonstrate that early diagenetic features cannot achieve rates in excess of 1 to 10 m/myrs, then, for the Latemar, at least, the question of whether the zircons represent stratigraphic age becomes more important. This would be quite troublesome, as U-Pb dating of zircons extracted from ash beds is today considered to be the gold standard of geochronology. On the other hand, if high rates are possible under realistic conditions, then the problem shifts to explaining the non-random stacking pattern of the Latemar cycles.