Neoproterozoic Rifting and Sedimentation Events on Earth: Possible Lunar Connection.

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The Neoproterozoic appears to be a critical time in the history of the planet. There are two major horizons of glacial deposits in the more complete sequences and each of the glacial sequences is capped by a significant thickness of stromatolitic carbonates. These features have been interpreted by many investigators as recording alternating "icehouse" and "greenhouse" episodes in a low paleolatitude setting. Many of the glacial-carbonate sequences are several hundred meters thick and are thought to be rift basin fills. Another noteworthy feature of Neoproterozoic sequences is the association of tidally influenced sediments including significant thicknesses of tidal rhythmites.

The Neoproterozoic also appears to be a critical time in the history of the lunar orbit. Peale and Cassen (1978,Icarus,36, p.245) identified an orbital resonance state between Jupiter's orbit and the lunar orbit when the lunar orbit is at 53.4 R_e, They state that if the resonance is stable, then there could be "profound" effects on both the earth and moon. We have done some 4-body (sun, earth, moon, jupiter) numerical simulations (4th-order Runge-Kutta integration procedure) on the effects of this resonance. In the short (100-year) runs that we have done on both circular and elliptical lunar orbits with semimajor axes between 50.0 and 53.4 R_e, we have found a notable increase in orbital eccentricity. Such a geologically short-lived excursion in lunar orbit eccentricity could explain the abundance of tidally influenced sediments and the enhanced rock tides could have an ancillary effect in the development of continental rift zones.