TOWARDS AN ASTRONOMICALLY CALIBRATED TIMESCALE FOR THE JURASSIC

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The useful marine magnetic anomaly record, on which the best-resolved and globally correlatable portion of the geologic time scale is based, ends in the Middle Jurassic (Callovian). The lack of intact and accessible earlier Jurassic oceanic crust precludes an older good quality record from oceans. Records on continental crust will therefore provide the basis for a polarity timescale for most of the Jurassic and older time periods.

Requirements that marine or continental sedimentary sections on continental crust must have to optimize their use for timescale development are as follows: 1, continuous sedimentation for very long periods (~10^7 years); 2, a recoverable and well characterized paleomagnetic polarity record; 3, independent time control, preferably both astronomical and radiometric; 4, a correlatable biostratigraphy and 5. a meaningful isotopic record.

A precedent for this kind of timescale development is in the continental rifts of Eastern North America. Their advantages include: 1, very high accumulation rates; 2, well-behaved and well-characterized magnetic behavior; 3, very obvious and well-behaved Milankovitch pattern of lake-level cycles; 4, dated lava flows at base including potential radiometric monitor standards and other datable materials; and 5, a developing carbon isotopic record. The Triassic age part of this sequence provides the basis for the Newark basin astronomically calibrated geomagnetic polarity time scale for the Late Triassic, now successfully correlated at the substage level with marine sections.

For the Jurassic part of the section, the longest exposed sections are in the Hartford rift basin of Connecticut and Massachusetts. About 2.5 million years of Early Jurassic suitable for timescale development is present, most of it certainly of Hettangian Age and of nearly entirely normal polarity. However, the presence of multiples zones of reverse polarity high in the section indicates the probable base of the Sinemurian Age. The combined Newark and Hartford basin sections have a carbon isotopic record with both the initial and main isotopic excursions of Hesselbo.

For most of the younger parts of the Jurassic elsewhere in the world sections examined by others thus far are entirely marine and too short to be very useful in time scale construction, although there have been several attempts at combining the scattered sections.

Prospects for long, high accumulation rate sections are largely continental and include several basins in China such as the Jungar, Qaidam, Sichuan, Jungar, and Lufeng basins. Other areas that have potential sections include Greenland, Poland, Russia, and Australia.

Of course it is not necessary, or even desirable to rely on outcrops. If the situation warrants core can be obtained either previously by industry or specifically for scientific purposes. We can envision progressing or coring from a section overlapping the well-characterized polarity timescales (from the Rhaetian-Hettangian, up or Callovian-Oxfordian down), in strata with well-developed Milankovitch cycles, perhaps via several basins ultimately linking the marine magnetic timescale, which itself is being astronomically calibrated, to that of the Late Triassic Newark basin timescale.