# ASTRONOMICAL TIME CONSTRAINTS FOR THE TRIASSIC-JURASSIC TRANSITION PERIOD: *preliminary results*

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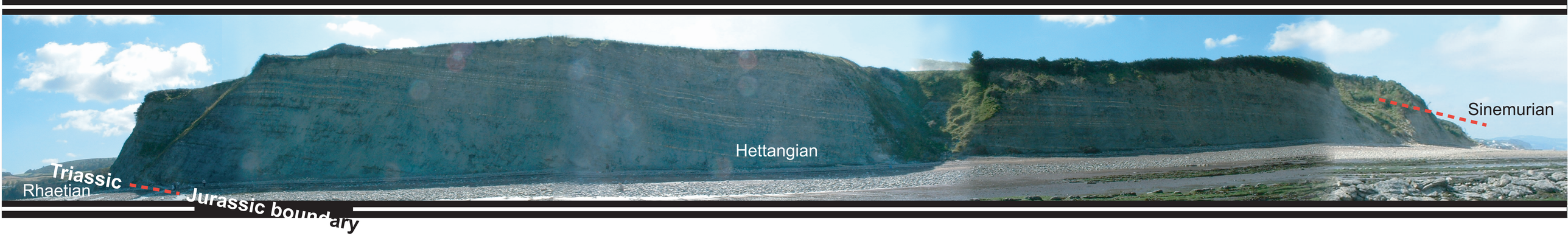
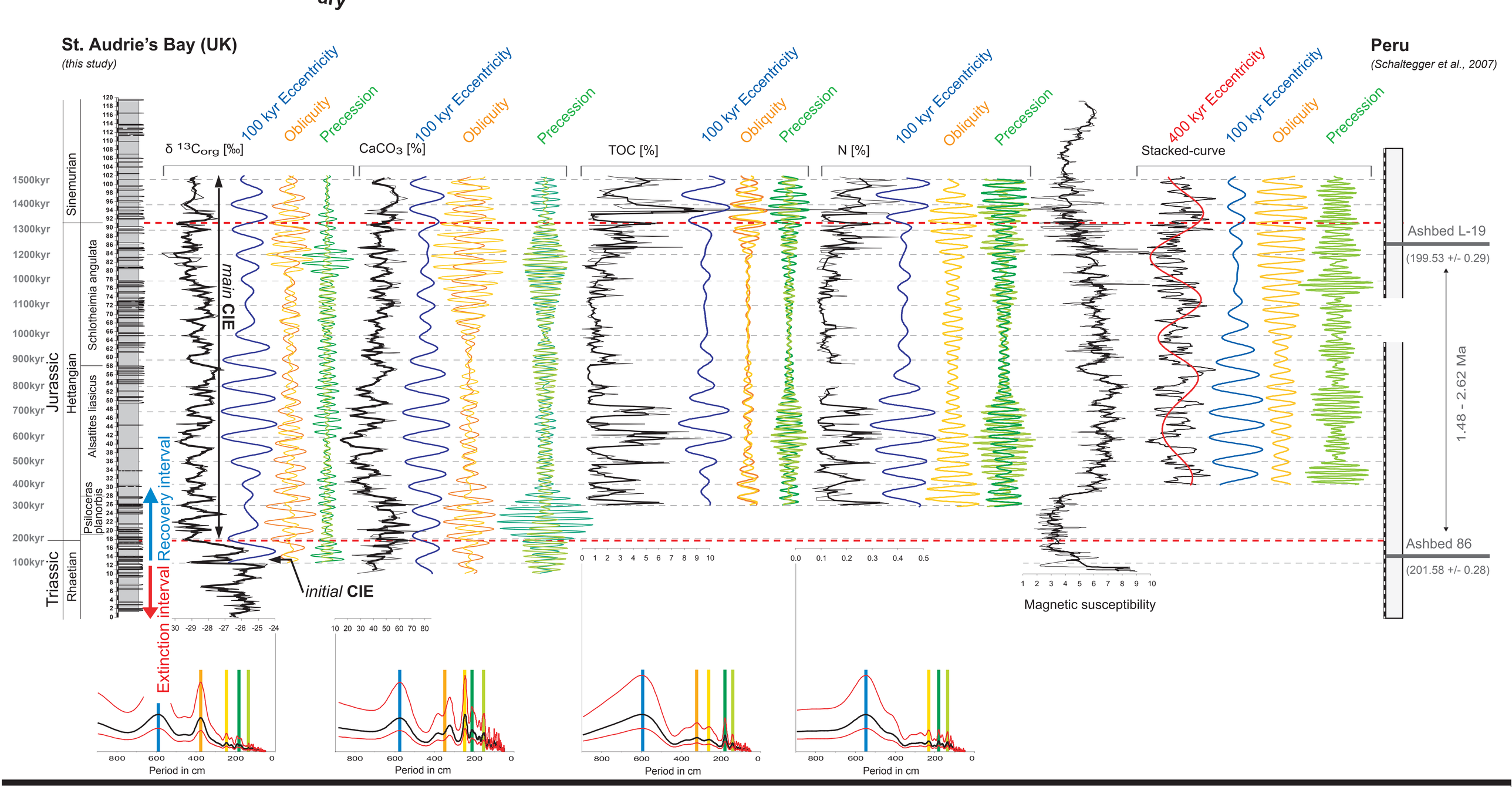
## Introduction

The end-Triassic is one of the "*Big 5*" major mass extinction events of the Phanerozoic. This period and the transition to the Jurassic, is marked by major faunal extinction events in both the marine and terrestrial realms, major floral turn-overs, large perturbations of the global carbon cycle and the deposition of the Central Atlantic Magmatic Province (CAMP), the largest igneous province on earth. Timing and duration of events during this important interval in earth history are subject to major debate. The duration of the Hettangian, the first stage of the Jurassic, was previously reported to be 3.1Ma (Gradstein et al., 2004). Schaltegger et al. (2007) reduced this to 2.05Ma based on U-Pb dating of volcanic ash layers close to the Hettangian stage boundaries (Utcubamba valley, northern Peru). Insights in sedimentation rate, duration of c-isotopic events, biozones etc. for this period is critical in understanding recovery processes after the major ecological disturbance of the end-Triassic.

## Results

We present high resolution $\delta^{13}C_{org}$, $CaCO_3$ (weight %), TOC (%), N (%) and magnetic susceptibility records from a 120m long Triassic-Jurassic boundary record from St. Audrie's Bay (UK). Bandwith filters of these proxy records, based on Blackman-Tukey power spectra, show periodic forcing of the data with an average period of ~578cm, ~313 & ~230cm and ~163 & ~130cm, representing 100kyr eccentricity, obliquity and precession forcing respectively. In addition, a stacked proxy-curve also records 400kyr eccentricity forcing.




## Discussion

Based on this floating astronomical time-scale, we suggest a length of the Hettangian of ~1.2Ma. Ammonite zones in the Hettangian, in contrary to common view, are different in duration, with the first zone less than half the length of the second zone. The short *initial* Carbon Isotope Excursion (CIE) and long *main* CIE are suggested to be related to major volcanic activity in the transition from the Triassic to the Jurassic (Hesselbo et al., 2002). Astronomical forcing of lacustrine sediments in the Newark basin (eastern US) suggest a period of 600kyr for the duration of the volcanic activity (Olsen et al., 1996). A minimal duration of the *main* CIE of 1.4Ma suggests either a longer volcanic activity or an other cause for the *main* CIE.

## Conclusions

- High resolution proxy records (end-Triassic to first stage of Jurassic) show *eccentricity*, *obliquity* and *precession* forcing
- Duration of the Hettangian is reduced from 3.1Ma to 1.2Ma
- Ammonite zones at the base of the Jurassic are different in duration
- We suggest either an extended duration of volcanic activity or a different cause for the *main* CIE

**Hesselbo, S.P., Robinson, S.A., Surlyk, F., Piasecki, S.**, 2002. Terrestrial and marine extinction at the Triassic-Jurassic boundary synchronized with major carbon-cycle perturbations: A link to initiation of massive volcanism? Geology, v. 30, no. 3, p. 251-254.
**Gradstein, Ogg & Smith, 2004.** A Geologic Time Scale. Published by: Cambridge University Press
**Schaltegger, U., Guex, J., Bartolini, A., Schoene, B. and Ovtcharova, M., 2007**. Precise U-Page constraints for end-Triassic mass extinction, its correlation to volcanism and Hettangian post-extinction recovery. Earth and Planetary Science Letters, In Press
**Olsen, P.E. and Kent, D.V., 1996**. Milankovitch climate forcing in the tropics of Pangaea during the Late Triassic. Palaeogeography, Palaeoclimatology, Palaeoecology, 122(1-4): 1-26.