Earthquake induced soft sediment deformation (seismites): new data from the Early Triassic Guryul Ravine section (Kashmir)

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Introduction

At the Guryul Ravine section in Kashmir, we report a new lithological unit in the Early Triassic Khunamuh Formation, 120m above the top of the Zewan formation. The beds show typical earthquake induced soft sediment deformations, similar to latest Permian structures present in the lower part of the section (120m below).

Both latest Permian and early Spathian seismites occur at a marked lithological change, visible in the sedimentary deposition.

The seismic activity from the latest Permian coincides with a platform drowning during a transgressive phase. The early Spathian one occured during a platform uplift, also during a transgressive phase.

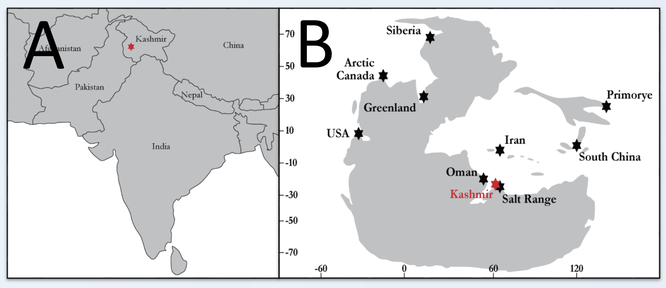

Figure 2A; Location of Guryul Ravine, Kashmir, India. 2B; Early Triassic (250 Ma) paleogeographic map.

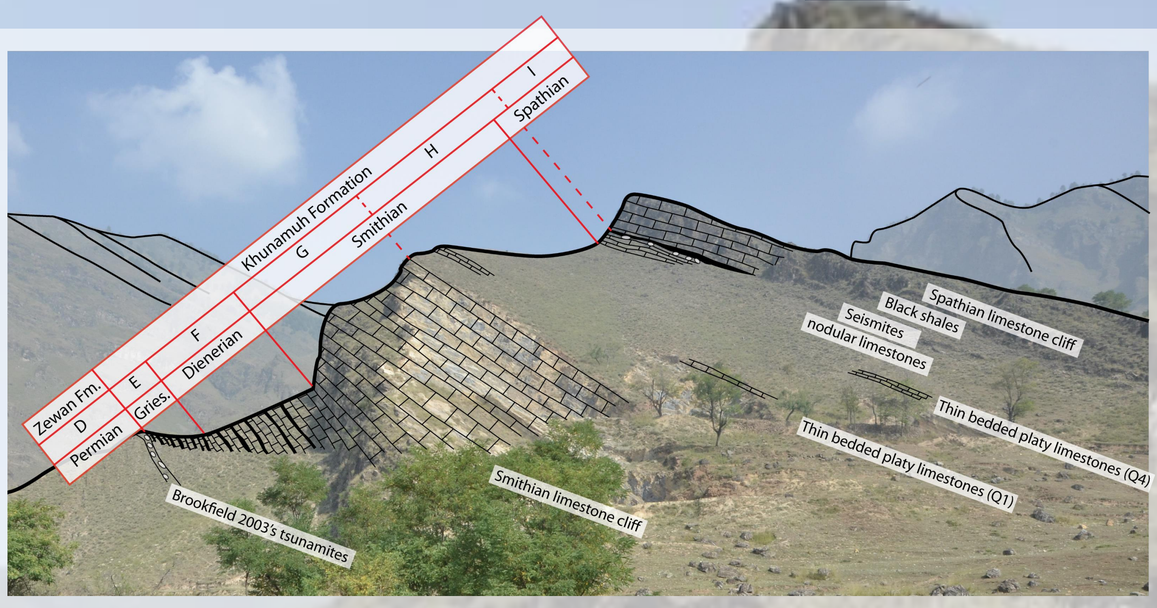

Figure 1; Guryul Ravine section with geological units (D to I) belonging to the Zewan and Khunamuh Formation. It is a continous section from the late Permain to the middle Triassic.

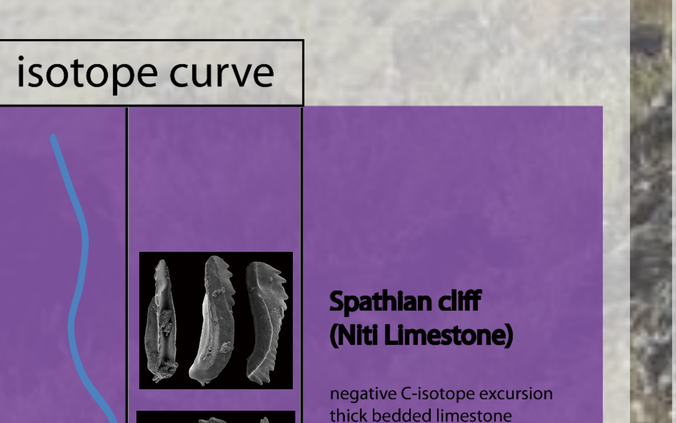

Figure 3; Early Spathian part of the Khunamuh Formation from Guryul Ravine with the nodular Limestone, the seismitic beds (orange colored) and the Spathian cliff.

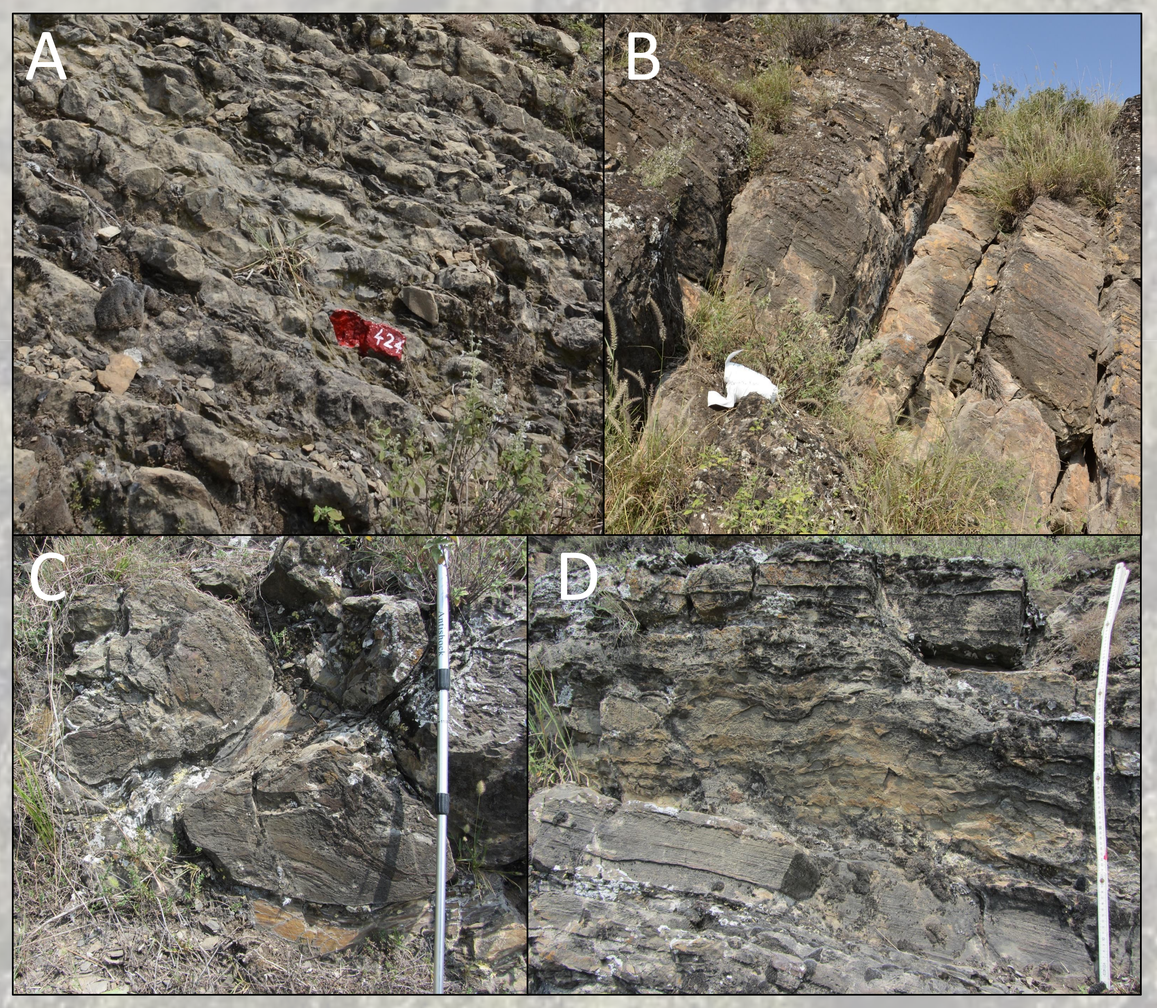

Figure 4: Spathian seismite; A: nodular limestone (7m), at the base of seismites unit, early Spathian. B: Spathian cliff (Niti Limestone), at the top of seismites unit. C and D: soft sediment deformation structures at the top of the nodular limestone, base of Spathian cliff. Contorted beds (1m thick) similar to the latest Permian unit.

Figure 6; Lithological log and inorganic carbon isotope curve. A giant positive peak of $\delta^{13}C_{(carb.)}$ occur at the Smithian-Spathian boundary and during facies changes. Conodonts are shown at the corresponding zones as index fossils.

Figure 5: Latest Permian seismite; A: Bed 46/2 with large pillows and pseudonodules (description in Brookfield et al., 2013), scale 1m; B: Guryul Ravine section around the PTB (red line) with the seismitic bed at the top of the Zewan formation.

Conclusion

Seismites are found in the late Permian and the early Spathian. The seismic activity may conceivably have been driven by recurrent phases of syn-sedimentary block faulting of the northern Indian passive margin. In this, we agree with the conclusions of Krystyn et al. (2014) that any relation between the local occurrences of seismites-tsunamites and the eruption of the Siberian traps, as hypothesized by Brookfield et al. (2013), is unlikely. Yet, we must keep in mind that both coincide also with global shifts in the geochemical, sedimentological, paleontological and climate records.

References

Brookfield, M. E., Algeo, T. J., Hannigan, R., Williams, J. and Bhat, G. M., (2013). Shaken and Stirred: Seismites and Tsunamites at the Permian-Triassic boundary, Guryul Ravine, Kashmir, India. Palaios, v. 28, 568-582.

Krystyn, L., Horacek M., Brandner R. and Suraj, P. (2014). Late Permian Tsunamites in Guryul Ravine (Kashmir, India) – revisited and rejected. Geophysical Research Abstracts, Vol. 16, EGU2014-15312