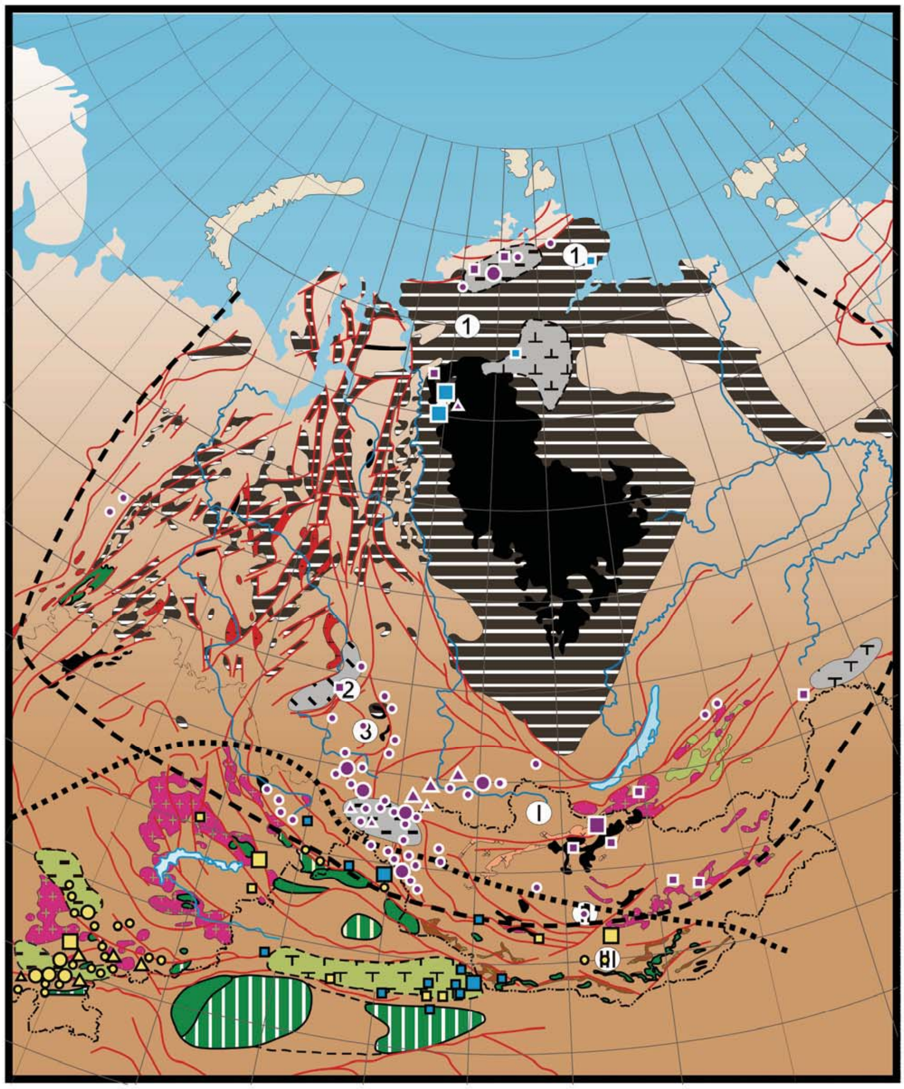
International Symposium

LARGE IGNEOUS PROVINCES OF ASIA, MANTLE PLUMES AND METALLOGENY



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UNCERTAIN TEMPORAL AND SPATIAL CORRELATION BETWEEN CRETACEOUS GLOBAL-SCALE SEDIMENTATION BREAKS AND EMPLACEMENT OF LARGE IGNEOUS PROVINCES

D. A. Ruban[1,2], S. O. Zorina[3], O. S. Dzyuba[4], B. N. Shurygin[4]

[1] - Division of Mineralogy and Petrography, Department of Earth Sciences, Southern Federal University, Rostov-na-Donu, Russia

2 - Department of Geology, University of Pretoria, South Africa

3 - Central Research Institute of Geology of Industrial Minerals, Republic of Tatarstan, Russia

4 - Trofimuk Institute of Petroleum Geology and Geophysics, Siberian Branch of RAS, Novosibirsk, Russia
ruban-d@mail.ru

Four global-scale sedimentation breaks occurred during the Cretaceous. Mantle plumes have been suggested as a cause; with the emplacement of a Large Igneous Province (LIP) initiating the uplift necessary to disrupt sedimentation. A comparison of the timing of global-scale sedimentation breaks with the timing of LIP emplacement shows that the Jurassic–Cretaceous (~145 Ma), the Early–Late Cretaceous (~99.6), the Santonian–Campanian (~83.5 Ma), and the Cretaceous–Paleogene (~65.5) sedimentation breaks can be temporally correlated with mantle plumes with different degrees of uncertainty. A comparison of the geographical location of global-scale sedimentation breaks with the location of LIP emplacement, revealed a spatial correlation between the Venezuelan–Colombian and the Kerguelen LIPs with the unconformities of the Early–Late Cretaceous boundary (Fig. 1B). Similarly, the Peary Land and the Deccan LIPs were of a magnitude that could have initiated the uplift, which caused the Cretaceous–Paleogene sedimentary unconformity (Fig. 1D). However, no appropriate geospatial correlations were found for the Jurassic–Cretaceous (Fig. 1A) and the Santonian–Campanian (Fig. 1C) global-scale sedimentation breaks.

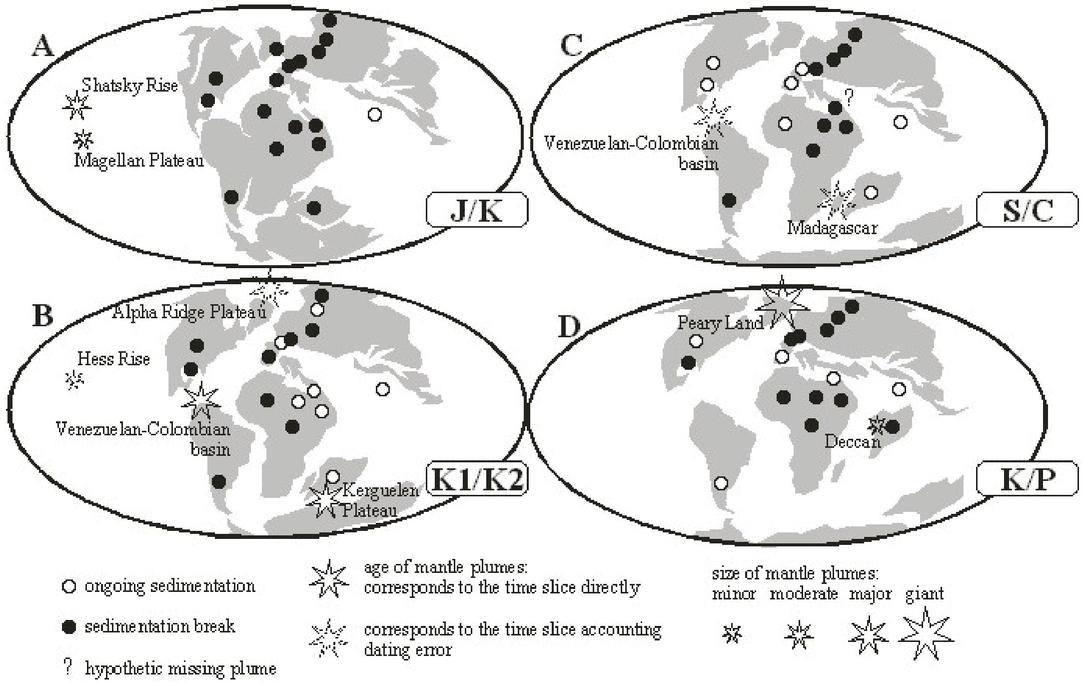

Fig. 1. *Palaeogeographical distribution of unconformities and mantle plumes at times of the Cretaceous global-scale sedimentation breaks (A-D). Plate tectonic reconstructions are simplified from Scotese (2004). Constraints by Stampfli and Borel (2002) for the Neotethys and Smith (2003) for the Pacific are accounted.*

An analysis of the distribution of the Santonian–Campanian sedimentation break around the Earth indicates that Eurasia and a large portion of Africa–Arabia were affected by an interruption in depositional systems. Thus, a LIP emplacement somewhere in the Neo-Tethys Ocean or on its northern margin can be hypothesized. Although no direct evidence is known, magmatic complexes related to that probable LIP might have been erased by subduction along the northern Neo-Tethyan margin and further closure of this ocean. Therefore, this missing Late Cretaceous LIP may never be found "physically" and its remains are likely dispersed somewhere within the structure of Central or Southern Asia. Thus, recognition of the Santonian–Campanian sedimentation break can serve as one of the reliable, although indirect evidences to the emplacement of this enigmatic LIP. Relationships of the latter with magmatic activity in Madagascar, the Seychelles, and the Saya de Maha bank should be testified.

Three issues may complicate the analyses above. Firstly, not all of the LIPs recognized necessarily represent plume activity. Thus, if any of the Cretaceous LIPs discussed were not produced by mantle-plume uplift we would not expect them to be associated with interruption of the sedimentary record. Secondly, the size and frequency of mantle plumes that occurred during the Cretaceous may, in contrast, have been underestimated. The Neo-Tethys Ocean provides an interesting example; Santonian–Campanian sedimentation was clearly interrupted in regions surrounding the Neotethys, yet no LIP has been identified. Thirdly, it is possible that the position of the mantle plume may influence any uplift associated with LIP emplacement. At the Early–Late Cretaceous and the Cretaceous–Paleogene transitions, LIPs were located on continents or on their margins. In contrast, the LIPs of the Early Cretaceous and the Middle Cretaceous (e.g., the Ontong Java Plateau) were centered within oceans. When considering the oceanic locations, even uplift associate with large LIPs, might not significantly affect a far-located continent, and thus would not interrupt sedimentation within the latter.

In general, the results argue against a simple causal mechanism between plume activity and a resultant break in the sedimentological record. Major eustatic falls resulting from climate changes can be considered as another mechanism for global-scale sedimentation breaks. However, a similar temporal and geospatial comparison would be necessary to test this alternative mechanism. A clearer distinction between plume-related and plume-unrelated LIPs, new techniques to identify missing oceanic plateaus, and better documentation of global-scale unconformities will be the key to improving the analyses presented here.

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