



## **Tectonomagmatic significance of the picrite-rhyolite volcanism in the Northern Ethiopian plateau area**

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The Oligocene Continental Flood Basalts (CFB) of the Northern Ethiopia and the conjugate Yemen province testifies a huge volcanic event related to the "Afar plume" occurred at ca. 30 Ma (in 1 Ma or less; Hofmann et al., 1997) prior to the continental rifting stage. The zonal arrangement of CFB lavas with Low-Ti tholeiites (LT) in the west, High-Ti tholeiites (HT1) to the east and very High-Ti transitional basalts and picrites (HT2, TiO<sub>2</sub> 4-6 wt%) closer to the Afar triple junction has been considered a record of magmas generated from the flanks to the centre of a plume head, currently corresponding to the Afar hotspot (Beccaluva et al., 2009).

In the central-eastern part of the plateau (Lalibela area), neighbouring the Afar escarpment, abundant rhyolites characterize the upper part of the volcanic sequence and have been interpreted as the differentiated products of CFB magmas (Ayalew et al., 2006).

The unusual association of picrite and rhyolite magmas erupted in an elongated area, parallel to the Afar escarpment, appears to be related to peculiar tectonomagmatic events developed in the apical zone of a stretched lithosphere impinged by a mantle plume.

As previously suggested, the HT basaltic and picritic magmas could have been generated in the innermost part (core) of the plume head from the hottest, deepest and most metasomatised mantle domains, enriched by "plume components" (Beccaluva et al., 2009). The late stages of these magmatic events were accompanied by the onset of continental rifting, with faulting and block tilting, leading to favourable conditions for magma differentiation in shallow (crustal) chambers located N-S along the future Afar Escarpment. Quantitative petrological modelling shows that efficient fractional crystallization processes of HT transitional basaltic magmas could result in highly differentiated peralkaline rhyolitic products, generally localized at the top (lower density) of the magma reservoirs. From these latter, abundant rhyolitic magma were erupted (sometimes alternating to HT basalts and picrites) during the paroxysmic extensional phases which ultimately led to continental break-up and the formation of the Red Sea-Gulf of Aden-East African rift system centred in the Afar "triple junction".

### References:

- Ayalew et al. (2006). *Geol. Soc. London Sp. Pub.* 259, 121-130.  
Beccaluva et al. (2009). *J. Petrol.* 50, 1377-1403.  
Hofmann et al. (1997). *Nature* 389, 838-841.