

Giant dyke swarms and triple junctions do not necessarily define a mantle plume signature!



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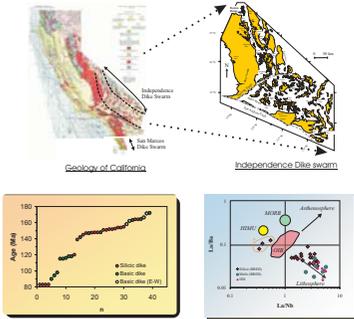
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The Independence dyke swarm



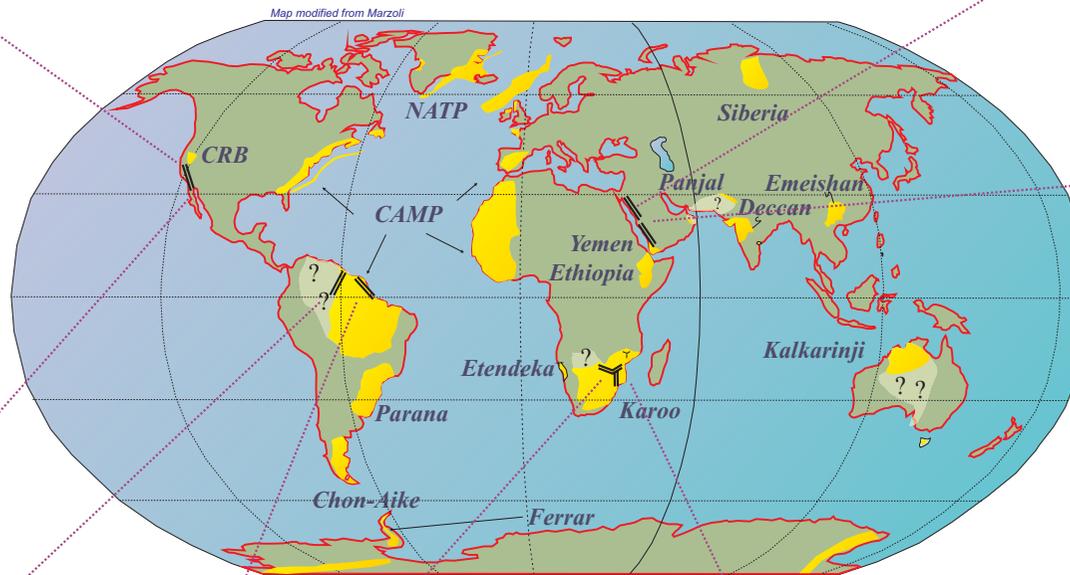
The Independence dike swarm (IDS) is a locally profuse, mostly NNW striking and ~700 km-long dike swarm occurring throughout southeastern California. Dike compositions range from mafic to silicic (though strongly bimodal) and span the composition range of the coeval Sierran calc-alkaline arc plutons. Despite major changes in the orientation of plate convergence, the direction of dyke emplacements remains constant.

IDS Indicates a mantle plume origin?

No, the IDS is not CFB-related but is a subduction-related feature with unambiguous arc-type signature

Jourdan et al., 2005 & in prep.

Phanerozoic CFB world map



The red sea dyke swarms

A mantle plume proof?

No, Although the origin of the magmatism is most certainly related to mantle plume activity, the 1700-km-long Red Sea dyke system include both Neoproterozoic and Cenozoic (24-21 Ma) dykes (Bertrand & Feraud, unpublished). This direction has not been initiated by the Afar plume and does not constitute an evidence for a plume signature

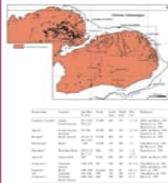
Sebai et al., 1991

Jourdan et al., 2006

Many Giant dyke swarms follows follow craton boundaries and are often parallel to mobile belts, shear zones and other pre-existing basement structures and are not "forced" by mantle plume impact.

Ar-Ar "speedy step-heating" dating (Jourdan et al., 2004) should be applied on giant dyke swarms to test if they contain older inherited dykes....

CAMP South American dyke swarms

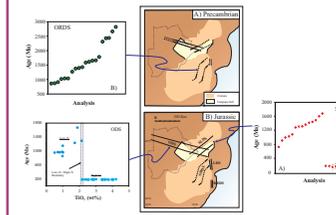


Mantle plume evidence?

No, many jurassic dyke swarms follow pre-existing Precambrian dyke swarms and Craton directions, thus suggesting that the radiating structure predates CAMP

Nomade et al., 2002

The Karoo 'triple junction'



A mantle plume proof?

No, the "triple junction" structure is probably an artifact characterized by (1) a strong basement control, (2) the occurrence of Precambrian dykes within the ODS, SLDS and possibly LDS, (3) a branch (ORDS) which is not Jurassic in age and (4) a branch (SLDS) which does not really radiate from the (Mwenezi area) focal point.

Jourdan et al., 2004 & 2006

References

- H. Bertrand and G. Féraud, unpublished results
- Jourdan et al. (2004), EPSL 222, 985-1006
- Jourdan et al. (2005), AGU Abstract V11D-0634
- Jourdan et al. (2006), EPSL 241, 307-322
- Nomade et al. (2002), J. Geodyn. 34, 595-614
- Sebai et al. (1991), EPSL 104, 455, 472

Take home messages

- Location and orientation of dyke swarms were generally controlled by ancient basement structures and were not "forced" by plume head impact.
- Giant dyke swarms / triple junction are not a sufficient proof of a mantle plume impact and additional evidences must be provided when this scenario is envisaged.