

Tectonic effects of metamorphic fluids in the deep crust; 'lithosphere extension' that isn't and differential epeirogenic uplift that really is

**Miles Osmaston, The White Cottage, Sendmarsh, Ripley, Woking, Surrey GU23 6JT, UK.
miles@osmaston.demon.co.uk**

When the temperature of the continental lower and mid-crust is raised, large amounts of fluid, particularly water, may be released. Received petrological wisdom asserts that the water 'escapes from the system', so a net increase in column density is inferred. If, on the contrary, the water merely migrates to higher in the column a major overall volume increase (up to several tens of percent in the zone affected) and reduction of column density results. Moreover, that volume increase is achieved with well under 10% of the heat input that pure thermal expansion would require.

This makes non-unroofed deep crustal metamorphism potentially a major and sensitive player, both in epeirogeny and in horizontal displacements in the basement. The epeirogenic response will differ according to the thickness and constitution of different blocks of crust, offering a much-needed mechanism for differential uplift that doesn't rely on thrusting. Dilatation engendered in the mid-crust will be partitioned between vertical and horizontal according to the constraints involved.

A good example is the initiation of a passive continental margin. Here, abundant heat spreads laterally into the continental lithosphere from the adjacent newly forming oceanic lithosphere and one of the lateral constraints is removed. So a major component of the dilatation in the oceanward direction is to be expected, along-strike dilatation being inhibited on a straight margin. Consequently the upper crust, resting upon this dilating material, will develop oceanward-directed extensional structures at or soon after the time of ocean initiation, such as are indeed widely observed. I will show recent evidence from the continental margins of Gabon, Galicia and the Red Sea that convincingly support this interpretation.

The same processes may cause high-mountain tectonic windows to develop through allochthons, whose presence had heated the autochthon. The Alps offer examples. Below rift valleys, dilatation by magmatic heat may cause the plates to push themselves apart.

Keywords:- metamorphic fluids; crustal volume changes; epeirogenic movement; passive margins; tectonic windows; rift valleys.