Channeled fluid flow through slabs: Reactive porosity waves

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The conversion of blueschist into eclogite is a very important and ubiquitous metamorphic transformation that takes place along low geothermal gradients in subduction zones. It is associated with changes in rheology, with earthquakes and arc magmatism.

In the Tianshan mountains (China) it is possible to study initial eclogitisation (i.e., dehydration) of blueschists and the associated fluid flow regime. Field evidence shows that the preferential flow field of released slab fluids is highly channelized and that these fluids tend to react with their wall rocks, thereby serving as agents for the mobilisation and transport of trace elements [1]. In some cases, we observed well-developed reaction selvages formed along several-meter long exposed veins. Within these selvages, the degree of eclogitisation -and thus dehydration- increases towards the vein [2]. The petrological and structural observations, however, suggest that an external fluid formed these veins and selvages.

The main driving forces behind mineral reactions are variations in composition, temperature, and pressure. Our hypothesis is that any observed change of composition within the selvage is a function of its formation. Temperature variations within a meter scale are negligible in non-magmatic systems, thus leaving pressure as the only variable to change. We suggest that the observed dehydration selvages and the related chemical changes can be explained by adapting the concept of porosity waves [3]. Such a porosity wave would have an over-pressured fluid head that produces the pathway through the rock followed by an under-pressured tail, causing a zone of a certain thickness around the pathway to be drained. There would be a fluid-pressure gradient across this zone, which could be approximated by a water fugacity (f_{H2O}) gradient. We evaluate whether this predicted change in the f_{H2O} is able to induce the dehydration reactions that we observe in the field.

[1] John *et al.* (2008) *Lithos* **103**, 1-24. [2] Beinlich *et al*. (in review) *GCA*. [3] Connolly & Podladchikov (2007) *JGR* **112**, B10205.

Modelling sources of dust aerosol in the Sahara

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The Sahara desert is the world's largest source of mineral dust aerosol. A recent measurement campaign called the GERBILS experiment (Geostationary Earth Radiation Budget Intercomparison of Longwave and Shortwave radiation), June 2007, focussed on the influence of dust aerosol on the radiative budget of the Western Sahara. This involved aircraft measurements by the UK FAAM aircraft and comparisons against satellite observations and models. Dust forecasts were produced by Crisis-Area Mesoscale Model (CAMM), a limited area version of the Met Office Numerical Weather Prediction Model running with a horizontal grid spacing of approximately 17km.

The CAMM model was used to test two different dust emission scheme; one based on the Met Office Hadley Centre dust scheme [1] and one based on the Dust Entrainment and Deposition (DEAD) scheme of Zender *et al*. [2]. Both emission schemes led to a good representation of the dust events during the campaign. Aerosol optical depths and vertical profiles of aerosol concentration compared well with satellite and aircraft measurements. Aerosol size distributions and optical properties also compared well with aircraft and AERONET after improvements to dust refractive index. The geographic distribution of dust sources was mainly confined to regions with high soil clay fraction and very low soil moisture content. In the DEAD scheme dust emission was also favoured over regions of low topographic variability and high surface reflectance.

[1] Woodward (2001) *J. Geophys. Res.*, **106** (D16), 18155-18166. [2] Zender *et al*. (2003) *J. Geophys. Res.*, **108** (D14), 4416, doi:10.1029/2002JD002775.