Iron isotope fractionation during precipitation of chalcopyrite

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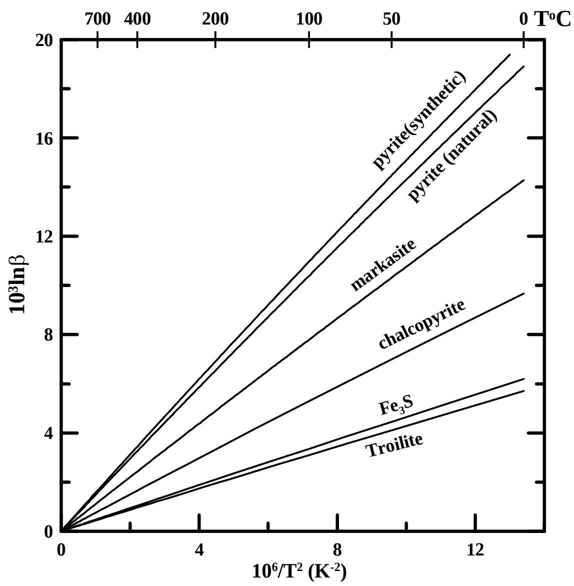
We computed the iron β-factor for chalcopyrite from the ^{57}Fe partial vibrational density of states (PVDOS) obtained from inelasric resonant X-ray scattering (INRXS) synchrotron experiments [1]. The temperature dependence of the iron β-factor for chalcopyrite is presented on the figure in a comparison with Moessbauer- and INRXS-derived iron β-factors for sulfides [2,3].



Application of these data to hydrothermal sulfides precipitation [4] allows one to conlude that chalcopyrite likely precipitated directly in the form of $FeCuS_2$ and is isotopically equilibrated with Fe dissolved in aqua solution. Pyrite precipitated as FeS intermedient and converted to FeS_2 without isotope effects as was previously suggested [5,6].

[1] Kobayashi *et al*. (2007) Phys, Rev. B **76,** 134108; [2] Polyakov and Mineev (2000) *GCA* 64, 849-865; [3] Polyakov *et al*. (2007) *GCA* 71 3833-3846. [4] Rouxel *et al*. (2008) *Chem. Geol.* **252,** 214-257; [5] Butler (2005) *EPSL* **236,** 430-442; [6] Butler and Rickard (2000) *GCA* **64,** 2665-2672

Computer model of granite-gneiss diapirism

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Numerical model has been developed for the study of process of macroscopical differentiation within the stratified earth crust due to a Rayleigh-Taylor (R-T) gravitational instability. The reason of gravitational redistribution of matter is partial melting of granite crust as a result of mantle heat supply. Granite-gneiss uplifting and the Teya dome origin in the Proterozoic rocks in central part of the Yenisey ridge (Siberian platform) have been examined. The granite dome is dated at 864-868 million years by the U-Pb zircon age. Computer modelling of diapirism was carried out on the basis of solution of closed system of equations of mass, energy and momentum conservation in the frameworks of mechanics of deformable solid body. The finite-element model takes into consideration the melting and initiated diapirism above the roof of plate-like body of basaltic magma in the base of continental crust. It was accepted, the melting in granite crust proceeded in the range of 650-700°C; the density of partially molten granite and surrounding host rocks were taken as 2600 and 2800 kg/m^3. Rheology of granite-gneiss, as well as a quasi-solid crust, was assumed to be an elastic-plastic, submitting to von Mises flow law with a yield stress of 1 MPa (Gerya, Burg, 2007). The law of plastic flow accounts for a strain-softening material that defines the rock transformation, in contrast to the viscosity based model. It was found, the advective ascent begins at the attainment of critical volume of rock melting. Critical height of the partially melted chamber ranges up to 6-7 km before the melt floating-up. By results of calculations, the rate of melting front in the lower crust for the conductive (initial) stage of heating and the rate of the R-T diapiric uplifting at advective (subsequent) stage were determined. By modelling estimations the melting front moved with a rate of 4-5 mm/years, but the combined melting and diapiric uplifting has advanced with a rate no less then 10 mm/year. At the initial stages the ascending partial melting body had the shape of dome, at a later time a channel and a "head" of diapir were formed. At uplifting to shallowest emplacement level, the diapir attained a sill-like form. Then, in the course of cooling (about 10 million years) advective flows were stopped.