^{40}Ar-^{39}Ar dating of volcanic rocks from Fernando de Noronha hot spot

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Dating of magmatic rocks of Fernando de Noronha (FN) Islands is important for the understanding of magmatic evolution of this hot spot. According to Almeida [1] volcanic rocks in the FN Archipelago constitute three different Formations: Remédios, Quixaba, and São José. K-Ar dating by Kordani [2] and Kogarko *et al*. [3] shows that alkaline basanites of the São José Formation (11.7±0.6 Ma) and trachytes of the Remédios Formation (11.8-11.7 Ma) are the oldest magmatic FN rocks. Some Remédios phonolites are younger (9.5-8.6 Ma), and Olv-melanephelinites of the Quixaba Formation are the youngest rocks. In contrast to this model, Almeida [1] suggested that basanites of the São José Formation are younger then Quixaba ankaratrites (note that contact between these rocks is hidden below sea level). We applied ^{40}Ar-^{39}Ar dating [4]to FN magmatic rocks. Remédios phonolites ^{40}Ar-^{39}Ar plateau ages agree with previous K-Ar dates (FN51a: 9.7±0.19 Ma) or are slightly older (FN50: 9.23±0.24 Ma, compared to 8.6±0.3 Ma). As suggested by [2] and [3], trachyte is the oldest rock of the Remédios Formation (FN33: 11.84±0.29 Ma). However - contrary to [3] - alkali basalt FN10a from São José yields a plateau age of 8.57±0.42 Ma comprising ~90% of the ^{39}Ar release, which is at the lower end of the K-Ar age interval for the Remédios phonolites. The ^{40}Ar-^{39}Ar age of Quixaba ankaramite FN121 (2.66±0.45) is indistinguishable from its K-Ar age . The most intriguing results were obtained for ankaratrite FN59: both whole rock and Pl-separate samples yielded ages far above those reported in [3]. FN59WR yielded a plateau age of 16.37±1.86 Ma (75 % of ^{39}Ar release). The Pl-separate does not show a plateau, but its K-Ar age is 18.81±2.69 Ma. Thus, our new results favour the initial suggestion by Almeida [1] that Quixaba ankaratrites are older than basanites of São José Formation. They are possibly the oldest magmatic rocks of the Fernando de Noronha Archipelago.

[1] F.F.M. Almeida, in Geologia e Petrologia do Arquipelago de Fernando de Noronha (Argic. Mon., 1958) [2] U.G. Kordani, in Proc. Symp.Continental Drift in the Southern Hemisphere (Montevideo, 1967) [3] Kogarko *et al.* (2007) *Dokl. Earth Sci.* **412**, 85-88 [4] Schwarz W.H. & Trieloff M. (2007) *Chem. Geol.* **242**, 218-231.

A complete thermodynamic formalism for high-pressure aqueous silicate solutions in the model system CaO-SiO_2-H_2O

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The results of experimental solubility determinations at high pressures up to 5 GPa are often difficult to gauge w.r.t. precision and accuracy, because of the potential uncertainties inherent in the available experimental approaches. Existing models of aqueous silicate solutions at low pressures are either unsuitable for extrapolation beyond 0.5 to 1.0 GPa, or involve polynomial fits in which the fit parameters lack direct physical meaning.

An approach described by Gerya *et al*. [1], based on statistical thermodynamics, allows aqueous silicate solutions to be described as mixtures of fictive oxide "components" together with water molecules in both clustered and "gas-like", i.e. unassociated, states. Experimental results can be modeled and thermodynamic properties of "components" as well as their interaction (i.e. formaton of complex species) extracted. Fit parameters represent conventional thermodynamic quantities.

For the model system CaO-SiO_2-H_2O we have now extended the approach of Gerya *et al*. [1] by introducing 1) the ionization of H_2O via a homogeneous reaction formalism to allow the modeling of charged species, 2) data on dissolved SiO_2 species from Gerya *et al.* [2] and the *ab initio molecular dynamics* (*AIMD*) simulations of Doltsinis *et al*. [3], 3) new *AIMD* data on the relative proportions of Ca^{2+}, $Ca(OH)^+$ and $Ca(OH)_2$ complexes as a function of P and T. This extended model provides a complete thermodynamic description of the aqueous solution coexisting with wollastonite + quartz up to 4 GPa and 900°C.

[1] Gerya *et al*. (2004) *Phys Chem Minerals* **31**, 429-455. [2] Gerya *et al*. (2005) *Eur. J. Mineralogy* **17**, 269-283. [3] Doltsinis *et al*. (2007) *J. Theor. Comp. Chem*. **6**, 49-62.