

Zeolites and mafic phyllosilicates in Livingston Island, Antarctica

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The present work is a report on the geochemistry and petrology of the very low-grade alteration minerals developed in the volcanic successions from Punta Hannah (PH) and Shirreff Cape (SC), Livingston Island, Antarctica.

The outcrops consist of andesitic-basaltic rocks from volcanic successions assigned to the Upper Cretaceous [1]. These rocks are one of the most extensive volcanic exposures in the South Shetland Islands.

The alteration minerals occur in amygdules, veins, veinlets, groundmass, or patches. This replacement of the phenocrysts can be partial, affecting the crystal edges and fractures or total. Primary plagioclases have been strongly altered to albite, zeolites and calcite, and clinopyroxenes to mafic phyllosilicates and celadonite.

Petrographic, XRD and EMP analyses show the occurrence of the zeolites: laumontite, stilbite, faujasite and heulandite in PH, and natrolite and analcime in SC. Mafic phyllosilicates correspond to interstratifications between chlorite and trioctahedral smectite. Chlorite layer percentages range between 57% and 84%, and display diabantite compositions [2]. Equilibrium temperatures of mafic phyllosilicates from PH, calculated using two geothermometers [3, 4], range between 160 and 190°C for those with chlorite layer percentages above 75%. This range is in agreement with temperature estimates for zeolites of 150-230°C. Zeolites from SC suggest temperatures below 150°C.

The characteristics of these rock successions indicate a Ca-Na remobilization in the light of albitization and the widespread occurrence of Ca-rich zeolites. Hydrothermalism and burial processes would account for the genesis of the secondary minerals.

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[1]Leppe *et al.* (2007) *UGSG Srt Rsrch Pprs* 1407. [2] Hey (1954) *MinMag* **30**, 272-292. [3] Cathelineau (1988) *Cly Min* **26**, 471-485. [4] Jowett *et al.* (1991) *SEG Jnt Annl Mtng* **16**, A62.

FreeGs thermodynamic database project: implementation, lessons, and future?

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Increasing demand in reactive-transport modelling for the purposes of CO₂ sequestration, use of geothermal energy, and nuclear waste disposal requires ready access to standardised thermodynamic data. These must be adopted for multiple formats for ever increasing number of modelling applications.

FreeGs [1, 2] is a web-enabled database developed at Geoscience Australia by the Predictive mineral discovery Cooperative Research Centre (2001-2007). It was intended as a unified Australian hub of thermodynamic data for geochemical modelling for economic geologists. The database was complemented by integrated software to calculate thermodynamic properties of species and chemical reactions at elevated temperatures and pressures. The end users had put a critical emphasis on the following decisive features:

- High end-user usability in an interactive mode
- Transparency of the compiled data
- Extensibility (data formats & incorporated models)
- Options for remote access and maintenance

In the interactive mode, FreeGs readily facilitates (1) comparison of TD data compiled from different sources, (2) their model presentation via alternative algorithms (equations of state), and, (3) output of data in alternative formats (e.g., $\Delta g(T,P)$ vs $\log K_r(T,P)$).

Despite these features and a friendly web GUI, practical usage of the database system by the scientific community was rather limited. As we see it, the development of a human interface and integration with calculation algorithms were over-emphasised at the expense of the implementation of the data delivery web service. That hindered efficient access to data by external parties and created avoidable development and maintenance overheads.

The future of a similar database will lie in the realm of a database located on a cloud server with (1) HTML access ("find and read") for simple and infrequent interactions, and (2) web service for the delivery of plain standardised data that can be further processed by users applications as needed.

[1] Bastrakov *et al.* (2005) *GCA* **69**, A845. [2] Voigt *et al.* (2007) *Pure and Applied Chemistry* **79**, 883-894.