Genetic algorithm as a tool for paleoclimate records correlation

Pawlak J. and Hercman H.

Institute of Geological Sciences Polish Academy of Science, Twarda 51/55, 00-818, Warszawa, Poland

Palaeoclimate records which came from different profiles are usually reconstructed on the basis of different geochronology methods. From this reason it is hard to place these profiles on one time scale. Even more problems occur when the correlation of records is based on the non-isotopic time scales (depth, biostratigraphy, etc.). As a solution we propose nonparametric methods and computer software based on genetic algorithms as a tool for correlation palaeoclimatic records regardless of the time scale. Described algorithms we show using stable isotope records from several stalagmites from Demianova Caves System (Low Tatra Mts., Slovakia) dated by radiocarbon and U-series methods.

Radiometric dating of rhyolites by conventional K/Ar method: methodology

Pécskay Z.[1] and Lexa J.[2]

[1]*Institute of Nuclear Research, Hungarian Academy of Sciences, Debrecen, Hungary, Pécskay@namafia.atomki.hu*
[2]*Geological institute of the Slovak Academy of Sciences, Slovakia, geoljalx@savba.sk*

Rhyolite magmatism represents a substantial part of calc-alkaline volcanic rocks in continental margin and/or back-arc setting and frequently associates with epithermal mineralization. Their precise and reliable dating is important for understanding the magmatic evolution, as well as the related metallogenetic processes. Nowadays, the higher precision is reached especially by applying $^{40}Ar/^{39}Ar$ and/or single grain U/Pb dating. However, using a proper methodology, even with the conventional K/Ar age determination, we can reach highly reliable results with precision of 3 % relative for single datings (at 1σ resp. 68 % confidence level). Improved methodology has been applied to rhyolites of the Jastrabá Fm. and related epithermal mineralization in the Kremnické vrchy mountain range in central Slovakia. Obviously, dated samples were carefully selected, knowing their geological setting and processes affecting the rocks. Generally, dating of whole-rock samples can not provide reliable results. Selection of target phases based on careful petrographic investigation, including a use of BSE images and electron microprobe analyses of K-bearing phases, represents an important step. Phases affected by epigenetic alteration should not be dated. Target phases in rhyolites of the Jastrabá Fm. in order of decreasing K-content are: hydrothermal K-feldspar (adularia, 12,6–13,7% K), magmatic K-feldspar (sanidine, 8,4–10,7% K), subsolidus K-feldspar (7,9–9,6% K), biotite (7,1–8,1% K), spherulitic groundmass (3,9–7,0% K), kfs-groundmass (3,6–6,1% K), glass (3,3–4,6% K), amphibole (0,53–0,72% K), plagioclase (0,3–1,2% K). Separation of selected target phases is carried out using heavy liquid, electromagnetic separator, shaking and handpicking (for final cleaning) on grain-size fractions 0.63–0.4 mm, 0.4–0.25 mm and 0.25–0.125 mm, 300–500 g each. As a rule, all datable phases are collected. Potassium is determined by flame photometry with a Na buffer and Li internal standard with relative analytical error 2%. Argon is extracted from the samples by RF fusion in Mo crucibles, in previously baked stainless steel vacuum system. Pure ^{38}Ar spike is added from gas pipette system and the evolved gases are cleaned using Ti and SAES getters and liquid nitrogen traps, respectively. The purified Ar is transported directly into the mass spectrometer and Ar isotope ratio is measured in the static mode, using a 15cm radius magnetic sector type mass spectrometer built in Debrecen. The relative analytical error of ^{38}Ar spike is 2%, the relative analytical errors of $^{40}Ar/^{38}Ar$ and $^{36}Ar/^{38}Ar$ isotope ratios determination are 1%. Age of the sample is calculated using the decay constants suggested by Steiger and Jäger (1977) and isotopic composition of natural potassium ^{39}K - 93.2581%, ^{40}K - 0.01167%, ^{41}K - 6.7302%, assuming that the rock or mineral has been a closed system for K and 40Arrad concentrations. Analytical error is given at 68% confidence