Genetic algorithm as a tool for paleoclimate records correlation

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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

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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 level (1σ). Usually it varies around 3 % relative. Despite the perfect sample preparation and analytical work some results are dubious owing to natural reasons and should be eliminated from further consideration. There are several ways to check reliability of results: (1) K-concentration should correspond to the dated phase; (2) percentage of $^{40}Ar_{rad}$ should be high enough; (3) consistent results on different fractions/phases; (4) consistent results on samples of the same unit (statistical testing); (5) testing by the isochrone method – identification of phases with excess $^{40}Ar_{rad}$ (xenocrysts and/or plagiclase and amphibole phenocrysts) and $^{40}Ar_{rad}$ loss (glass). One has to be always aware of statistical aspects, especially confidence interval of a single datum. Appropriate statistical methods should be used in evaluation of multiple data. With multiple data for geological units differences in age smaller than error of a single datum can be recognized – one of the possibilities is a graph of normal distribution densities. If results do not fit with geological relationships something must be wrong – either radiometric dating or more likely our geological assumptions. Our results on rhyolites and related mineralizations of Kremnické vrchy are in other presentation of Lexa and Pécskay.

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Mineralogical–Geochemical Study of Uranium Bearing Granite Phases in Paranesti Area, N. Greece

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This study concerns the petrological-geochemical characters of the “granite type” rocks from Paranesti area, in which I.G.M.E. has localized the most important uranium ores in Greece. Their mineralogical phases are examined and they are correlated with the geochemical data of the major elements, as well as with some of the trace elements from mineralized samples of the area.

Raman spectroscopy as a tool to distinguish grossular/hydrogrossular from vesuvianite in rodingites from the Othrys ophiolite (central Greece)

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Raman Spectroscopy was employed to confirm the presence of hydrogrossular, rather than vesuvianite, in rodingites of the Othrys ophiolite suite, central Greece. The Raman spectra obtained from the fine-grained, weakly birefringent minerals, with anomalous bluish-grey interference colours documented the presence of hydrogrossular by its characteristic bands at ~360-362, 534-537, 817-819, 870-872 and 3600 cm-1. No Raman spectra indicative of vesuvianite were obtained precluding the existence of this phase. The absence of vesuvianite implies that the metasomatising fluid phase was rather rich in CO2, an observation which is also verified by the abundance of calcite and assists in further studying the evolution of these rocks.