GEOCHEMISTRY OF DETRITAL RUTILE IN LATE PALAEOZOIC SEDIMENTS FROM CHIOS, GREECE

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Knowledge of the provenance of ancient clastic sedimentary rocks is important for exploration of mineral resources, for basin analysis as well as for palaeo-tectonic reconstructions. In addition to whole-rock petrography, geochemistry and heavy-mineral analysis, geochemical discrimination studies of specific detrital minerals are a powerful tool in provenance characterisation. This study focuses on rutile that is one of the most stable heavy minerals during the sedimentation cycle and commonly present as an accessory phase in clastic sedimentary rocks. The Cr and Nb contents of rutile provide information about source rock lithology while its Zr content gives clues about its temperature of formation (Zack et al., 2004a, b; Watson et al., 2006), i.e. magmatic or metamorphic. In a case study, detrital rutile was separated from psammitic samples belonging to three different sedimentary successions (Carboniferous, Permo-Carboniferous, Permo-Triassic) that occur on Chios Island, Greece. The Ti, Cr, Al, Fe, Nb, Zr, Si, and V contents of the rutiles were obtained by electron-microprobe analyses to retrace their provenance.

The Cr and Nb values of the analysed rutile grains show a wide range and indicate that this mineral in the Carboniferous succession is mainly derived from metamafic rocks, whereas in the Permo-Carboniferous and Permo-Triassic successions from a metapelitic source. The calculated formation temperatures using the Zr-in-rutile thermometer are 495–1000°C (according to Zack et al. 2004a) or between 520–850°C (according to Watson et al. 2006) with more rutile of higher formation temperature occurring in the Permo-Carboniferous and Permo-Triassic successions. This feature together with the rutile chemistry indicate a change in source rock lithology through time, which could either reflect an increasing depth of erosion of an exhumed 'Variscan' nappe pile of heterogeneous composition in the hinterland or a change in the style of accretion and erosion of different terranes at the southern margin of Laurussia during the subduction of a branch of the Palaeotethys Ocean in the Late Palaeozoic. In general, this study underscores the importance of rutile chemistry and thermometry in quantitative single-mineral provenance analysis and in chemostratigraphic analysis of clastic sedimentary rocks.

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