Metasomatism of nephrites hosted in serpentinites and marbles (Sudetes, Poland): Insights into source and transfer of Fe, Mg, Ca, Cl and O

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In Poland, nephrites occuring at the contact of ophiolitic serpentinites with younger granite dykes have MgO (19.1-21.3 wt.%), Fe_2O_3 (2.9-5.6 wt.%) and Cl contents (<10 ppm), as well as oxygen isotope compositions ($\delta^{18}O$ = +6.1 to +7.8‰) more similar to serpentinites (29.2-34.7 wt.% MgO, 6.7-7.5 wt.% Fe_2O_3, <50 ppm Cl, $\delta^{18}O$ +5.1 to +7.1‰), than granites (0.02-0.19 wt.% MgO, 0.18-0.22 wt.% Fe_2O_3, up to 75 ppm Cl, $\delta^{18}O$ = +12.0 to +12.7‰). In contrast, CaO (12.3-15.9 wt.%) differs from serpentinites (0.01-0.90 wt.%) and is more likely derived from granites (4.5-16.5 wt.%).

Inheritance and introduction of these elements differ in the case of nephrite occuring at the contact of dolomitic marbles with younger granitic batholith (Złoty Stok deposit). This nephrite contains 18.3-20.9 wt% MgO and 11.4-14.0 wt.% CaO which may be inherited from the marbles (19.4 wt.% MgO, 31.2 wt.% CaO), rather than introduced from granites (1.1-7.8 wt.% MgO, 2.1-7.6 wt.% CaO). In contrast, Fe_2O_3 (4.5-10.0 wt.%, $\delta^{57}Fe$ = +0.12 to +0.23‰), Cl (112-151 ppm) and $\delta^{18}O$ values (+3.6 to +10.4‰) differ from marbles (0.51 wt.% Fe_2O_3, $\delta^{57}Fe$ = -0.12 to -0.09‰), and reflect reaction with fluids released from granites (1.6-8.1 wt.% Fe_2O_3, <100 to 778 ppm Cl, $\delta^{18}O$ = +7.1 to +10.6‰).

Serpentinite-hosted nephrite underwent moderate metasomatic replacement: Mg and Fe seem to be inherited from the protolith, fluid-rock interaction was insufficient to introduce Cl and significantly modify $\delta^{18}O$ values, and only Ca was introduced in large amounts. A higher metasomatic impact affected the dolomite-hosted nephrite: Mg and Ca were inherited, Fe and Cl introduced, and $\delta^{18}O$ values reset.

Correlation of Fe and Cl suggest Fe transport during nephrite formation as $FeCl_2$, similar as proposed for subduction zones [1], and consistent with an earlier nephritization model [2]. Lack of a Ca and Cl correlation argues against Ca transport in the form of $CaCl_2$ [2].

The study benefited from NCN grant 2016/20/S/ST10/00137.
[1] Debret B. *et al.* (2016) Geology 44, 215-218. [2] Prokhor S.A. (1991) Int. Geol. Rev. 33, 290-300.