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Magmatic nature of Sn-bearing fluids from isotopic (H,O) data of tourmalines (Solnechnoye deposit, Far East of Russia)

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It was shown, that the main factors, controlled Sn-W ore deposition in hydrothermal systems in connection with granites were: a) cooling, b) mixing of fluids of different composition and genesis,
c) heterogenization (boiling) of mineral forming fluids (Heinrich, 1990; et al). The results of physical chemical modelling of water-rock interaction pointed to magmatic nature of tin-bearing fluids in the hydrothermal systems, connected with granites. Tin concentration in model magmatogeneous fluid was calculated to be three times higher than in the model exogenic fluid (Sushchevskaya, Ryzhenko, 1998).
New data on the source of ore forming fluids, which had formed the large economic Solnechnoye Sn deposit (Far East of Russia), were obtained from hydrogen and oxygen isotopic composition of tourmalines from successive mineral associations. Hydrogen position in the tourmaline crystal structure allows to suppose, that postproductive processes did not change the initial D values, in contrast to phyllosilicates, often used for this purpose. During mineral formation at the Solnechnoye deposit tourmaline was formed practically without interruption. Its composition was gradually changed from schorl to dravite, when temperature decreased. The ores of cassiterite-tourmaline type were formed in a vertically dipping fracture zones, extended in a metamorphosed sandstone-shale rocks.
Hydrogene and oxygen isotopic composition of fluids were calculated from tourmaline data with the help of equations, proposed in (Kotzer et al., 1993). The temperature intervals for these calculations were accepted as: 1-450-400o C for quartz-tourmaline preore stage, 2 – 400-350o C –for early productive quartz-cassiterite stage, 3 – 350-300o C – for late quartz- cassiterite stage.
The obtained results corresponded to magmatic character of the fluids of productive stage of the Solnechnoye deposit, because their isotopic composition lied in the interval: 18 (3.2-9.3)%■, D -(31.7-76.6)%■. The variations may be explained by temperature dependence and also by changes in chemical compositions of tourmalines.
Comparison with our previous results, where we had measured D values of water from fluid inclusions in quartz (Sushchevskaya et al., 1991) showed the close tendency of evolution of ore-forming fluids. However D values of fluid inclusions water were much lower (up to –120%■), because of the inevitable presence of postproductive generations of inclusions. The 18O values of fluids, calculated from the 18O, obtained for the minerals show a distinct trend of decrease toward later stages. Along with the results of oxygen isotopic zonality of wall rocks (Bannikova et al., 1994) it gave us possibility to conclude, that mixing of endogeneous and exogenic in the hydrothermal system of the Solnechnoye deposit took place and was the most important factor in accumulation of the commercial cassiterite ores.