Modeling of formation of uranium ore deposits related to granitoids

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We modeled leaching, transport, and deposition of uranium during filtration of water through a granite massif at gradients of temperature (800-100°C) and pressure (3000-700 bar). The modeling was carried out for the 14-componet system O-H-Si-Al-K-Na-Mg-Mn-Fe-C-Cl-F-Ti-U. The computer simulation technique [1] was used, which allows to develop a model of ore formation based on geological and geochemical constrains [2]. Input data for modeling were based on geological and mineralogical [3], and fluid inclusion [4] studies. It was shown that leaching of uranium from granite takes place in high temperature zones. Further moving of hydrothermal fluid to colder zones is accomplished by re-deposition of uranium. As the mass of filtrating fluid increases, the stronger leaching takes place. It results in increase of quartz and mica amounts, formation of kaolinite and other secondary minerals. Consecutive change of mineral assemblages, including U-ore minerals, takes place. At the same time the fronts of uranium mobilization and re-depositions moves in the line of T and P decrease (Fig. 1). The dominant uranium aqueous species are fluorine complexes of U(IV) at high temperatures, and $UO_2(CO_3)_2^{2-}$ и $UO_2(CO_3)_3^{4-}$ at lower temperature.

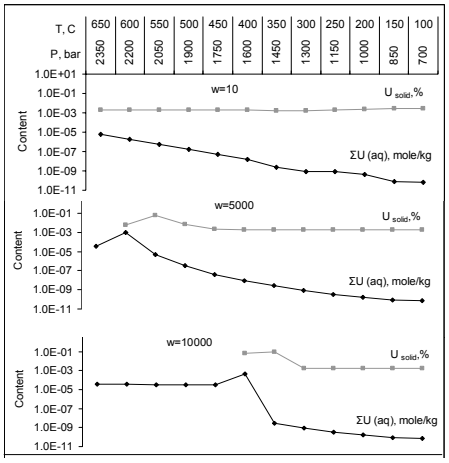

Figure 1.

[1] Grichuk (2000) *Nauchny Mir*. [2] Borisov (2000) *Nauchny Mir*. [3] Ischukova *et al*. (1998). [4] Chabiron *et al*. (2001) *Chem Geol.* **175**, 273-290.

The case of continuous redistribution of intermediate ^{238}U daughters radionuclides migration and exotic U-Pb age discordance

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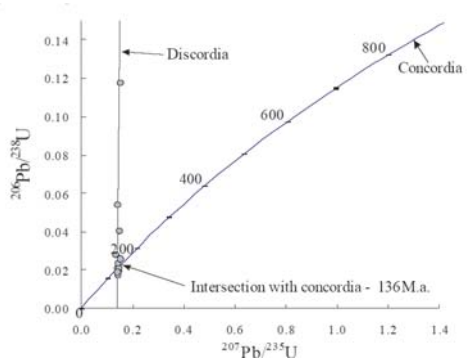
U-Pb ID-TIMS study of multicomponent macrosamples (4-10 cm^3) set drawn along 3.5 m profile within uranium hydrothermal mineralization zone in Streltsovskoye deposit (E.Transbaikalia) showed that their age relationships are distinguished fundamentally from age discordance pattern which is well known for the majority of U-Pb systems as a result of radiogenic lead loss.

The data points displaying great variation by $^{206}Pb/^{238}U$ lie along discordia (see figure) which is parallel to $^{206}Pb/^{238}$ axis. When occupying such position the discordia intersect a concordia at the point 136 M.a. corresponding to the age of uranium mineralization - 135±3 M.a. [1]. By this it meant that: 1) ^{235}U–^{207}Pb isotope system remained closed in individual samples while ^{238}U–^{206}Pb was significantly broken down; 2) this set of data is inexplicable in the context of lead/uranium migration. The scatter of T(206/238) values have resulted from continuous long-term (tens of M.a.) migration of intermediate ^{238}U daughters radionuclides ($RD^{238}U$).



It is believed that $RD^{238}U$ have lost from mineral volumes containing fine-grained uranium oxides with high Si, OH^- contents and $^{+6}U/^{+4}U$ ratio and have deposited in neighbouring volumes containing sulfides. The last have played role of geochemical 'barriers' for the most long-lived $RD^{238}U$. The main factor have provided a closeness of ^{235}U–^{207}Pb system lies in very short halflives $RD^{235}U$. The later had no time to leave U mineral volumes before ^{207}Pb formation.

[1] Chernyshev & Golubev (1996) *Geoch. Int*. **34**, 834-846.