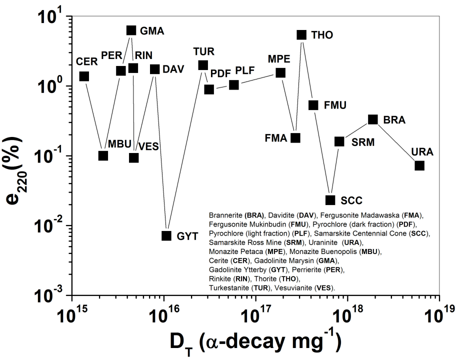

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Metamict minerals. Emanation Coefficient of ^{220}Rn

Metamict minerals develop from initially crystalline phases that experience physical damage due to the decay of ^{238}U, ^{232}Th and ^{235}U. This presentation reports the relantionship between the results of ^{220}Rn emanations and absorbed α-dose for a representative group of metamict oxides, phosphates and silicates [1]. The radon isotope ^{220}Rn (thoron, $T_{1/2}$ = 55.6 s) belongs to the ^{232}Th decay series, and occurs as an inert gas that is detectible in Th bearing mineral phases. The α-decay of ^{224}Ra (E_α = 5.67 MeV) is accompanied by recoil of the ^{220}Rn nucleus with an energy of 103 keV. Similarly to ^{222}Rn, the emanation coefficients of ^{220}Rn (e_{222}, expressed in percentage) measure the number of thoron atoms released per the number of thoron atoms produced within the ^{232}Th decay series for a given mineral. This ratio provides a quantitative measure of the quality of the mineral's internal structure.

Results

The ^{220}Rn emanation coefficients for the presented minerals vary from 7 x 10^{-3}% (gadolinite Ytterby) to 6.24% (gadolinite Marysin). Unlike ^{222}Rn, the ^{220}Rn emanation coefficients were apparently independent of D_T for all of the investigated minerals (Fig. 1).

Figure 1: ^{220}Rn emanation coefficients (e_{220}) for metamict minerals vs. total absorbed α-dose.

Samples with the glassiest appearance (gadolinite from Ytterby and samarskite from the Centennial Cone) exhibited the lowest e_{220} values (10^{-4} % and 3 x 10^{-4} %, respectively). For the other minerals, the e_{220} values varied within the relatively narrow range of 0.1 - 10% (Fig. 1).

[1] Malczewski & Dziurowicz (2015) *Am. Mineral.* **100,** 1378-1385.