

RECRYSTALLIZATION OF CARBONATE MINERAL AGGREGATES UNDER HYDROTHERMAL CONDITIONS

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Recrystallization with grain size enlargement is common in the zones of pre-ore alteration of a number of hydrothermal stratiform deposits hosted by sedimentary carbonates. This phenomenon takes place at high temperatures and pressures and consists in redeposition of substance from one grains to others, which leads to enlargement of individuals and reduction of their number.

We have carried out experimental modeling of recrystallization of calcite and dolomite aggregates under hydrothermal conditions at temperature 20-400°C and pressure 0-1000 kgf/cm². An attempt was made to determine the relationship between the grain size of the mineral aggregates and temperature and

pressure on the basis of measuring the grain areas in cross-sections (checked method).

Grain size data did not show any strict dependence of the grain size on temperature and pressure. Interpretation of the results was complicated by the fact that we were not dealing with the real structure of the rock, but with the structure revealed by the petrographic microsection. The latter, however, gives a direct and clear idea about the microscopic structure of the mineral aggregates. The maximal mean value for the cross-sectional area of calcite grains was observed at P=1000 kgf/cm², T=350°C, of dolomite grains - when no pressures was applied and T=300°C (table).

Table

Variation of the mean cross-sectional area of calcite and dolomite grains in relation to P-T conditions

T, °C	The mean cross-sectional area of grains, mm ²					
	Calcite			Dolomite		
	without external pressure	P=500, kgf/cm ²	P=1000, kgf/cm ²	without external pressure	P=500, kgf/cm ²	P=1000, kgf/cm ²
20	0.086 (initial)	0.121	0.114	0.0127 (initial)	0.0161	0.0154
100	0.129	0.128	0.126	0.0149	0.0156	0.0152
150	0.104	0.117	0.151	0.0132	0.0166	0.0192
200	0.138	0.166	0.152	0.0160	0.0166	0.0170
250	0.136	0.135	0.124	0.0149	0.0186	0.0199
300	0.112	0.130	0.159	0.0245	0.0200	0.0204
350	0.141	0.141	0.225	0.0143	0.0190	0.0155
400	0.140	0.141	0.184	0.0175	0.0203	0.0145

Histograms of the variation of calcite and dolomite grain size give a more demonstrative picture of the mineral aggregate recrystallization (fig 1, 2). The histograms clearly show patterns in the enlargement of the grains, which at first are of a larger size at the expense of dissolution of smaller grains. Thus the number of calcite grains with cross-sectional area less than 0.033 mm² decreases in the hydrothermal process. On the contrary, the number of the grains over 0.033-0.726 mm² in size increases, grains more than 0.726 mm² in size appear.

The grain size of a rock bears information about recrystallization, indicates the character and degree of the variation of such properties as porosity, density, strength, permeability for hydrothermal solutions.

It is exactly in recrystallization of mineral aggregates of the source rock that the main role of the thermal influence in hydrothermal - metasomatic processes of mineral and ore formations is manifested.

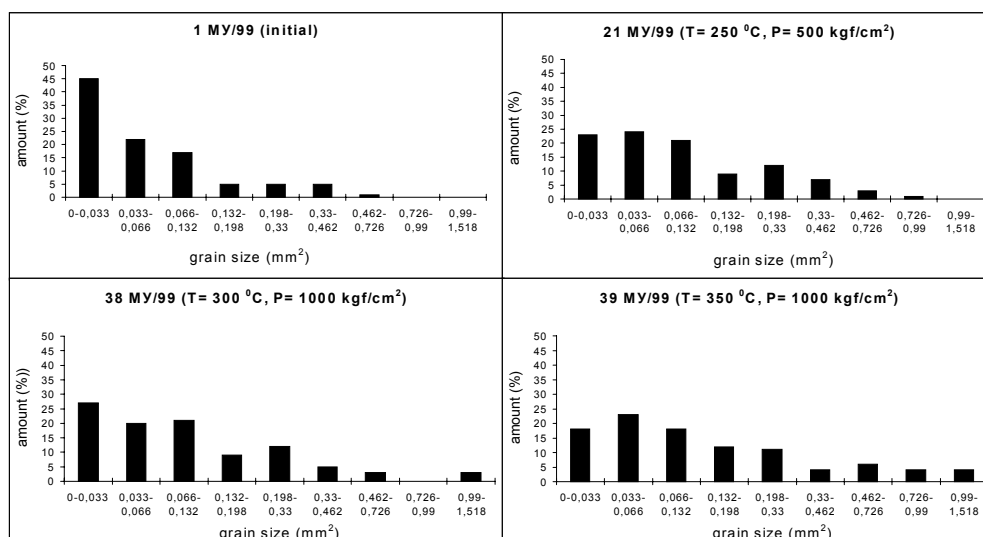


Fig. 1. Grain size variation in a calcite aggregate in relation to P-T conditions

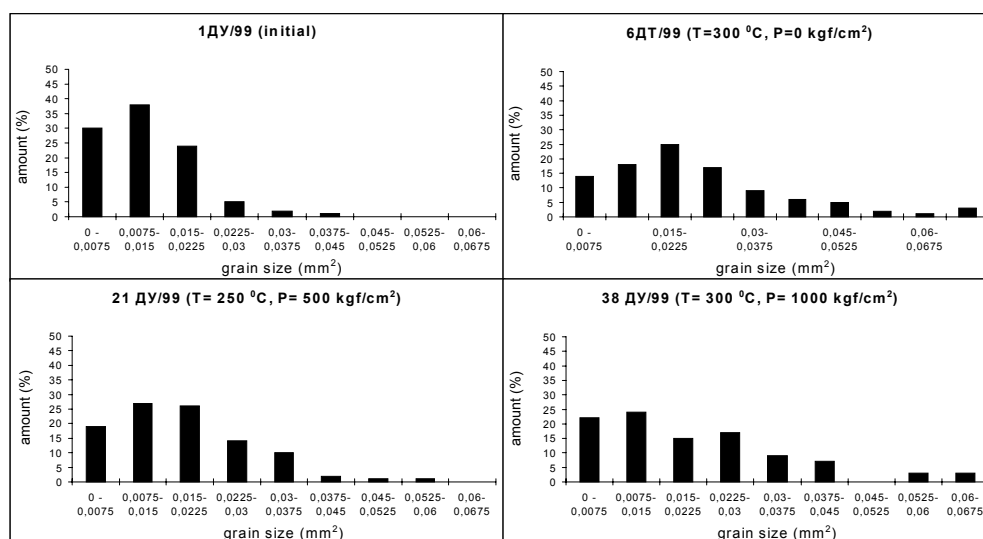


Fig. 2. Grain size variation in a dolomite aggregate in relation to P-T conditions