# Modelling of contact metamorphism and metasomatism near the Talnakh intrusion: Effect of fluid convection versus conductive heat transfer

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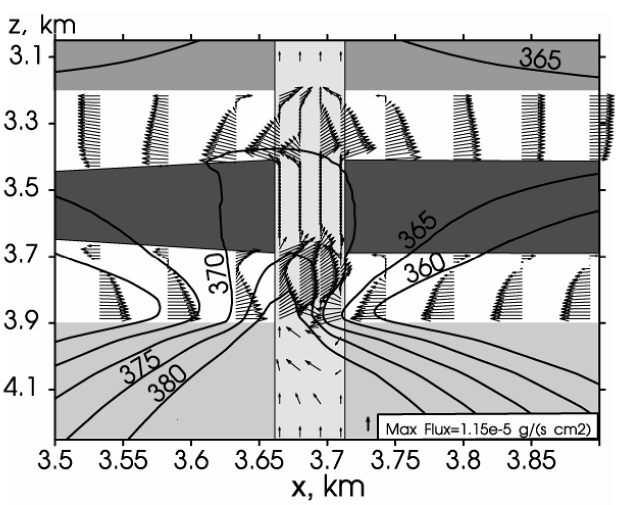
As was shown for a number of geological and theoretical models, convective heat-and-mass transfer near magmatic bodies is of great importance. The country rocks of intrusions in the Noril'sk ore district at the northwestern margin of the Siberian Craton are one such case. In this communication, mathematical modeling is used to describe the heat redistribution and fluid convection in the volcanosedimentary sequence at the contact with the Talnakh ore-bearing intrusion. The objective of this study was to simulate the temperature and hydrodynamic patterns that would fit the arrangement of isotherms and isograds, as well as the distribution of metasomatic rocks near the intrusion.

The problem of modeling of heat transfer and convective flows of a two-phase fluid is solved in the 2D setting in the Cartesian coordinate system on the basis of time-dependent equations of nonisothermal hydrodynamics with account of vapor-liquid phase transition (USGS HYDROTHERM code).

Patterns of fluid flow in the hydrothermal system with a permeable vertical zone that crosscuts the intrusion were obtained from the modeling results. The suggested mechanism of mixing of magmatic fluid with formation water may be efficient only at sufficiently high permeability of the rocks (fig. 1).




As the modeling results show, metasomatic zoning may arise at the postmagmatic stage within a zone 150-200 m thick above the intrusion and no more than 30-40 m thick below the lower contact.

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# Temporal distribution and cyclicity in formation of porphyry Cu-Mo deposits

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The recent increased applicability of global paleo-reconstructions, coupled with improved geochronology from most of the world's investigated Cu–Mo porphyry deposits, allows for an improved understanding of the distribution pattern of orogenic copper and molybdenum in space and time, as well as the relation between the resources of deposits and time of their formation. Geochronological data compiled for about 350 known large to medium (with resources > 0.05 mln. t) porphyry Cu–Mo deposits from all over the world including Asian part of Russia (Sora, Zhireken, Schakhtama, Aksug and others) and Mongolia (Kharmagtai, Tsagan-Suburga, Erdenetuin-Obo) are represented on the diagram in the time of deposit formation vs resources coordinates (Fig. 1). Data distribution and their mathematical treatment show that:

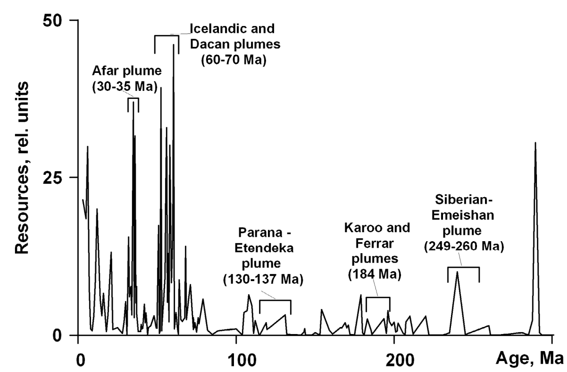


**Figure 1:** Geochronological density of copper resources

1) there is an irregularity in geochronological density of Cu-Mo resources; 2) discreteness in phases of maximum ore-forming activity (28-39; 50-60; 66-73; 75-82; 235-245 Ma) with duration up to 10 Ma; 3) in time, not every significant plume correlates with the epochs of intense ore formation; 4) spectral and wavelet-analysis of geochronological data reveals quasi-periodic cycles of 120-100, 69-60, 36-28, 20-15, 12-10, 8-7 Ma alternating at different time intervals. The latter two factors indicate the formation of porphyry Cu-Mo deposits is related not only with plumes but also with tectonic plate reorganization.

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