TO THE SIGNIFICANCE OF DIFFUSION TRANSPORT OF COMPONENTS WHILE PROCESSES OF LOCALIZATION OF EUTECTIC SMELTINGS

S.V.Ezhov
Moscow State Geological Prospecting Academy, Moscow, Russia

This study was supported by the Russian Fundamental Research Foundation (Project No 99-05-64908)
Herald DGGGMS RAS № 5 (15)'2000 v.2
URL: *http://www.scgis.ru/russian/cp1251/h_dgggms/5-2000/magm8.eng*

Formation of large melt amounts while continuos rock anatexis is not difficult for understanding - the only need is sufficient heating to make the rock matter melted. In the case of partial fusion the problem is more complicated. Melted phase in the mineral mixture appears as films and drops. Large isolations of eutetic composition is forming as a result of merging of small ones. To explain such a merging assumptions of pressing-filter (expression of melts out of low pressure areas) or gravity sedimentation are taken into account. Our recent experiments give possibility of one more mechanism that can explain various natural phenomena.

The sulfide eutectic ($PbS+Cu_2S$) that is quite handy because of low temperature (550°C) was under modeling. The experimental matter contained both silicate (granodiorite-porphyry) and carbonate (limestone and dolomite) rock. Ore components were introduced as a barley mixture of galena, chalcopyrite, and sphalerite. The preparations were heated up to 550-600°C at 1 kbar pressure with the presence of NaCl and KCl water fluid.

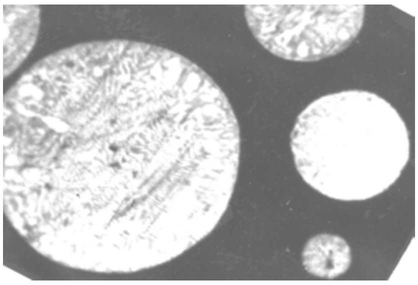

Fig. 1. Drops of sulphide eutectic

The eutectic fusion takes place in two locations:

1 - in situ, replacing initial components among sulfide minerals clumps. The fusion fills the intergrain space .

2 - in the places far from initial layout of components. The fusion looks like drops of various dimension with characteristic inner morphology (fig. 1). They were located both on the carbonate rock surface that are in contact with chloride fluid, and in the area of bimetasomatic skarn columns parallel to their borders (fig. 2). In the last case drops combined into long-shaped lens microdeposits. The surface carbonate rock drops give up to 1mm coating. Also distinct distribution of the drops' dimension through the depth coating was marked. The smallest of them are sited directly at the carbonate rock surface, and going aside their dimensions are rapidly increasing. It is obvious that melt formation is evolving simultaneously to the limestone dissolution: the drops' nucleation takes place on the surface of kaolonite and calcite grains. Henceforth, while calcite dissolution, the growing drops becomes sited at some distance from the border of carbonate rock.

Change on the fusion composition vs its site is detected. The on-situ fusion, as well as the melted drops that are close to its components source, contains 24% of galena and 76% of chalcocite. The drops separated more than 6 mm from its source contain 17% and 83% of galena and chalcocite respectively.

The noted observations show that both melted segregation and crystalline phases could be sited far from its components' source. The matter travels not as a melted phase. Components of the hereafter anatexis fusion are in the solute state, and are transported via fluid phase because of diffusion. The only gradient of concentrations is needed – solubility of ore components in place of their initial localisation must be higher than in place of melt formation. The causes of concentration of components as a melt may have as geochemical nature, like in conducted experiments when the melt was concentrated on the surface of limestone or dolomite, so physicial one, for example in zones of falled pressure (within opened tectonic fissures, interboudin space, etc.). Such nature may have as a different granitoid smeltings and pedmatite bodies in ultrametamorphism regions, so some ore bodies of magmatic genesis.

Fig. 1. Drops of sulphide eutectic

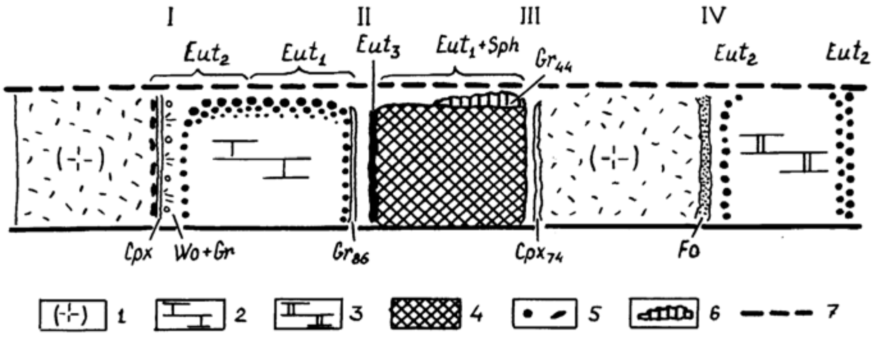

Fig. 2. Scheme of sulphide meltings location whithin specimen structure. Experiment AT-93: 1 – granodiorite-porphyry, 2 – limestone, 3 – dolomite, 4 – mixture of galena, sphalerite and chalcopyrute (before the experiment realisation), 5 – sulphide melt segregations, 6 – garnet on the suphyde ore surface, 7 - perfomated side of ampule where the specimen had free contact with open solution. Nomenclature of minerals: *Cpx* – clinopiroxene (lower index - hedenbergate share, %) , Fo – forsterite, Gr - garnet (index – andradite share, %), Shp – sphalerite, Wo – wollastonite, Eut – sulphide eutectic