

Geochemical modeling for exploration of copper scarn deposits

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Lead, Zinc, Silver, Cadmium, Arsenic, and Antimony are known as “supra ore indicator elements” and Vanadium, Cobalt, Nickel, Molybdenum, Bismuth, Tin, and, Copper as “sub ore indicator elements” for copper polymetallic deposits. The above mineral forming system is called Zonality and identifies by knowing the special indicator elements of each kind of scarn mineralization.

Base on the correlation between elements of surface and under ground rock samples of Anjerd copper scarn deposit in northeastern Iran, Pb, Ag as supra and Cu, Zn, as sub ore indicator elements are investigated. The zonality coefficient index of scarn copper deposit in Anjerd old mine introduces a standard zonality index ($Pb*Ag/Cu*Zn=0.00002$), while the same zonality index for copper anomaly zone 1 Km north of Anjerd old mine is 0.000018. Comparing these two zonality indexes (0.00002 and 0.000018) approve genetically relation between a known copper scarn deposit (Anjerd old mine) as a Standard Model and an unknown geochemical anomaly zone which could be associated with a blind or weakly eroded scarn deposit.

After calculating the above zonality indexes in Anjerd old scarn copper mine, 5 boreholes designed to drill for controlling the mineralization or the probable scarn copper reserve at depth within the anomaly zone. The results of logging the boreholes indicate that the grade increase gradually up to 2.7% which continue up to 38 m at depth. The scarn zone extends up to 80 m down with average grade 12% of copper, but just 1/3 part of the scarn zone has an economic grade of copper.

However the zonality index for copper scarn deposit base on the above indicator elements is varied between 1/10000 up to 9/10000, which could be used as a standard applicable model to discover outcropped, weakly eroded or blind scarn deposits.

Preservation of organic matter in macroaggregates

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Solid-state ¹³C NMR and FTIR spectroscopy were applied to establish the chemical features of mucous macroaggregates of phytoplankton origin in different stages in the northern Adriatic in 2000. In the early beginning of mucilage event, the mucous macroaggregate was sampled at the sea surface while the sedimented macroaggregates in the sea bottom at the end of this phenomenon. Microscopic composition of surface sample showed predominance of alive fitoplankton cells in contrary to bottom sample containing mostly senescent and degraded cells and minerals.

¹³C NMR spectra show major spectral bands including alkyl C (0-50 ppm), O-alkyl C (50-110 ppm) and carboxyl/carbonyl/amide C (160-220 ppm) resonances. The broad signal between 15-50 ppm indicates heterogeneity of alkyl carbon. The other main peaks were assigned to carbons α of C-O or C-N functions (57 ppm) primarily attributed to methoxyl groups, protonated C-O or C-N functions (72 ppm) representing mostly polysaccharides, glycosidic C-O (103-105 ppm), olefinic and /or aromatic C=C (120-130 ppm), and quaternary ester or amide C (173 ppm). The ¹³C NMR spectra of sedimented macroaggregates revealed some differences in N-alkyl region (45-60 ppm) indicating the preservation of part of labile nitrogen-containing materials during mucilage event.

FTIR spectra confirm the ¹³C NMR data. The relative intensity of bands characteristic for minerals such as quartz and calcite were higher in bottom sample spectra. This higher relative abundance of mineral component in the sedimented macroaggregate is due to degradation of organic fraction (remineralization) and contribution of sediment resuspension. Compared to surface sample (17.2 % C_{org}, 1.2 % N_{tot}), the bottom macroaggregate was pure in organic material (5% C_{org}, 0.5 % N_{tot}). Higher contents of polysaccharides and proteins, indicating fresher organic material with relatively high C/N ratio of 16.7, were observed in surface sample.