

Geochemistry of hydrothermally altered zones in the Zand Abad skarn deposit, NW Iran

KARIMZADEH SOMARIN AND K. RADMARD

Department of geology, University of Tabriz, Tabriz, Iran
akarimzadeh@tabrizu.ac.ir

The Zand Abad Cu-Mo skarn deposit, NW Iran, is part of Alpine-Himalayan metallogenic belt. The mineralisation of Cu and Mo, along with Fe, Pb and Zn in other places, is attributed to the emplacement of the Shavar Dagh granodioritic pluton (Oligomiocene) into the Cretaceous lithologies. Geochemical studies show that the Zand Abad I-type granodiorite has formed in a post-collisional volcanic arc setting. Field observations show that three types of alteration have been formed during skarnification: 1) garnet skarn, 2) epidote skarn and 3) endoskarn (potassic alteration). The garnet and epidote skarns have been developed in the calcareous wall rock whereas potassic alteration is seen only in the granodioritic pluton. Based on mass balance calculations and isocon diagram, the major oxides and trace elements in each alteration can be subdivided into three groups, assuming immobile Al_2O_3 .

Garnet skarn:

1. Relatively immobile components: P_2O_5 , TiO_2 , MgO , Nd , Zr and Cu (?). The concentrations of U and Sb are close to detection limit and therefore can not be classified.
2. Depleted components: Na_2O , K_2O , Sr , Ba , Rb , Pb , Th , La , Ce , Ce and Nb mainly due to destruction of feldspars and biotite in the Zand Abad granodiorite.
3. Enriched components: MnO , Fe_2O_3 , CaO , SiO_2 (?), Cl , Cr , Co , Ni , V , Zn , Y and Mo .

Epidote skarn:

1. Relatively immobile components: MgO , P_2O_5 (?), Zr , La (?) and Sr (?).
2. Depleted components: Na_2O , K_2O , Rb , Ba , Ce , Th and Nb due to destruction of feldspars and biotite. Released Sr has been fixed in epidote.
3. Enriched components: MnO , TiO_2 , CaO , Fe_2O_3 , SiO_2 , Ni , Mo , Cu , Cr , Zn , V , Nd , Pb , Co and As .

The endoskarn alteration is a relatively weak alteration in which K-feldspar has been developed whereas accessory phases have been eliminated. As a result, Rb , Ba and K_2O along with Mo , S and Cl show enrichment whereas La and Ce depleted and other components are relatively immobile.

This study show that skarnification at Zand Abad has been developed by hydrothermal fluid enriched in many trace elements of magmatic origin. Mo and Cu enrichment have occurred mainly during epidotisation of the Zand Abad granodiorite and country rocks.

Archaeal community in the hydrothermal system at Suiyo Seamount on the Izu-Ogasawara arc.

H. KASAI¹, K. HARA¹, T. KAKEGAWA², A. MARUYAMA³,
J. ISHIBASHI⁴, K. MARUMO⁵, K. YAMASHIRO¹,
S. ITAHASHI¹, T. URABE⁶ AND A. YAMAGISHI¹

¹Department of Molecular Biology, Tokyo University of Pharmacy and Life Science, 1432-1 Horinouchi, Hachioji, Tokyo 192-0392, Japan s987023@educ.ls.toyaku.ac.jp

²Tohoku University, Graduated School of Science, Aramaki Aza, Aoba, Sendai 980, Japan

³Research Institute of Biological Resources, National Institute of Advanced Industrial Science and Technology (AIST), 1-1-1 Higashi, Tsukuba, Ibaraki 305-8566, Japan

⁴Department of Earth Planetary Sciences, Faculty of Science, Kyushu University, 6-101 Hakozaki, Higashi-ku, Fukuoka 812-8581, Japan

⁵National Institute of Advanced Industrial Science and Technology (AIST), 1-1-3 No. 7, Tsukuba, Ibaraki 305-8566, Japan

⁶Earth and Planetary Science, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan

Microbial community in hydrothermal area at seafloor has been analyzed by culture-independent methods. Hydrothermal fluid from natural vents and vent chimneys have been analyzed by PCR. Though the analysis of these samples can provide the window to penetrate the microbial community under the seafloor, more direct analysis is desired for better understanding of the sub-seafloor microbial community. In the "Archaeal Park Project" supported by Special Coordination Fund, several holes were bored and cased in the crater of the Suiyo seamount on the Izu-Ogasawara arc, Japan (about 1,400 m depth) in 2001 and 2002. Hydrothermal fluids were sampled at various sites of cased hole at Suiyo seamount. The fluids were filtered to collect the microbial cells. Archaeal PCR clones obtained from sub-seafloor belonged to the order *Archaeoglobales* and the clones related to the order *Methanococcales*. These clones reflect the hydrogen dependent chemolithoautotrophic archaea community. However, fluorescent in situ hybridization analysis showed that an archaeal population in hydrothermal fluid from sub-seafloor at the site on Suiyo seamount was low.

References

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