

The laboratory Simulation of interaction between local inter stellar medium and solar wind

R. RANA, S. MINAMI, AND S. TAKECHI

Dept. of Electrical Engineering Osaka City University Osaka.
(rana@em.elec.eng.osaka-cu.ac.jp)
(minami@elec.eng.osaka-cu.ac.jp)
(takechi@elec.eng.osaka-cu.ac.jp)

We have performed the laboratory simulation of the interaction between supersonic and sub-Alfvenic solar wind and the Local Inter Stellar Medium (LISM) with neutral components. The main objective is to observe the temporal and spatial change in the heliopause due to the interaction between the solar wind and the neutral components contained in LISM. The main theory involves the equilibrium between the pressures of two interacting flows. We have used the spherical producing solar wind plasma gun and the externally applied magnetic field source for the production of LISM, applied to any direction to the flow of solar wind. We have used two different methods for the interaction between solar wind and the LISM. In first case the LISM was fully ionized while in second case, a neutral gas plume of several cm^{-3} was contained in the LISM. The direction of externally applied magnetic field was changed in order to get the different Alfvenic Mach (M_A) numbers.

Conclusion

It has been observed that for fully ionized plasma the heliopause has asymmetrical and arrow-edge type structure. In case of neutral gas plume contained in the LISM, the pressure at the nose of heliopause reduces and as a result the magnetic field in LISM diffuses.

References

- Dameet al, *Ast. T.*, 305, 892,(1986)
Minami, S., *Geophysics. Res. Let.*, 21, 81-84(1994)
Minami S., et al., *Geophysics. Res. Let.* 13, 884(1996)

The embryonic porphyry copper system at White Island, New Zealand

M. H. RAPIEN¹, R.J. BODNAR¹, S. F. SIMMONS²,
CS.SZABO³ AND S.R. SUTTON⁴

¹Dept. of Geological Sciences, Virginia Tech, Blacksburg VA
USA 24061 [rjb@vt.edu]

²Geothermal Institute, University of Auckland, Auckland,
New Zealand

³Dept. of Petrology and Geochemistry, Eötvös University,
Budapest, Hungary

⁴Dept. of Geophysical Sciences, University of Chicago,
Chicago, IL USA 60637

White Island, New Zealand, is an active andesitic-dacitic volcano which is located in a plate tectonic setting characteristic of porphyry copper deposits. In this study, the geochemistry of the magma chamber has been characterized through detailed analyses of silicate melt inclusions, phenocrysts (plagioclase, orthopyroxene and clinopyroxene), and matrix glass contained in recent ejecta (1977-1991).

Major, trace element and volatile composition trends reported for both economic and non-economic (or barren) porphyry copper deposits are similar to those measured in our samples at White Island. Compositions of melt inclusions are generally peraluminous with $\text{Al}_2\text{O}_3/(\text{Na}_2\text{O}+\text{K}_2\text{O}+\text{CaO})$ ratios ≥ 1.3 . The glass in unhomogenized 1991 melt inclusions is corundum normative, with $\text{Si}/(\text{Si}+\text{Ca}+\text{Mg}+\text{Fe}) > 0.91$ and $\text{K}/(\text{K}+\text{Ca}+\text{Mg}+\text{Fe}) > 0.36$. Melt inclusions also show a positive Eu anomaly. Trends in high field strength elements versus Y and in Mn versus Y are, however, more consistent with barren than productive intrusions.

Copper concentrations (up to several hundred ppm) in melt inclusions from White Island are sufficiently high to generate an economic porphyry copper deposit, based on theoretical models. Moreover, high $\text{Cl}/\text{H}_2\text{O}$ ratios (0.15) in melt inclusions favor the efficient extraction of copper from melt by the magmatic aqueous phase. The inferred pressure in the magma chamber at depth (1 kbar) is also ideal for extracting copper from the melt, given the absence of pyrrhotite, biotite or amphibole. Concentrations of S in the melt are low, which further inhibits pyrrhotite crystallization. The oxidation state of the magma at depth, based on the presence of SO_2 in the magmatic gas, is consistent with that predicted for porphyry copper deposit magmas.

Geochronologic, tectonic, petrologic and geochemical data suggest that White Island may represent an embryonic porphyry copper system that has not yet reached the productive stages of copper mineralization. Based on analyses of melt inclusions, the magma beneath White Island exhibits many of the geochemical characteristics common to known economic porphyry copper deposits (but also shows characteristics of non-productive systems for some elements).