5.3.P20

Copper-Gold systematics and arc magmatism in the eastern Manus Basin

W. SUN[1], R. J. ARCULUS[2] AND V.S. KAMENETSKY[3]

[1] Max-Planck Institut f. Chemie, Postfach 3060, Mainz, 55020, Germany
[2] Department of Earth and Marine Sciences, The Australian National University, Canberra, ACT 0200, Australia
[3] Center for Ore Deposit Research and School of Earth Sciences, University of Tasmania, Hobart, Australia

Most of the world's large Cu-Au porphyry/epithermal ore deposits are closely associated with convergent margin magmatism; models to explain this association range from oxidation of sulfide and redistribution of Au and Cu in the mantle source by high fO_2 melts or fluids released from subducted slabs to brine exsolution formed during magmatic evolution (1). Based on results for submarine volcanic glasses and phenocryst-hosted glass (formerly melt) inclusions from the eastern Manus Basin, Papua New Guinea, we propose that degassing of andesitic magma (at SiO_2 content of ~58 wt%) may have played a major role.

The samples studied here range in composition from basalt to rhyolite, with SiO_2 from 50.6 to 73.7 wt%, and MgO contents from 10.6 to 0.3 wt%. This sample set was selected from a larger group recovered from the Eastern Rifts in the Basin, with coherent major and trace element fractionation patterns consistent with a common genesis. All samples have strong arc characteristics, with marked relative Nb, Ta depletion and Cs, Rb, Ba, U, Pb enrichment (2, 3). The results show that Au is moderately incompatible during the early stage of arc magmatism, similar to Cu. Remarkably, Au and Cu concentrations are dramatically elevated as SiO_2 content increases, and then drop sharply at about 58 wt% SiO_2, accompanied by other significant changes, e.g., Ti and Fe switch from relatively incompatible to highly compatible. This indicates that the abrupt changes of Au and Cu abundances are associated with titanomagnetite saturation: reduction in magmatic Fe content, led to a decrease in S solubility, saturation with sulfide, and enhanced partitioning of sulfide and chloride into the accompanying supercritical vapor. The released volatile-rich components extract considerable amount of Au and Cu from the magma, and may become Cu-Au ore-forming fluids. The subsequent migration of these fluids is an important process that could form the crucial link between Cu-Au porphyry/epithermal ore deposits and convergent margin magmatism.

References

[1] Mungall J. E. (2002) *Geology* **30** (10), 915-918.
[2] Kamenetsky V. S., Binns R. A., Gemmell J. B., Crawford A. J., Mernagh T. P., Maas R. and Steele D. (2001) *Earth and Planetary Science Letters* **184** (3-4), 685-702.
[3] Sun W. D., Arculus R. J., Bennett V. C., Eggins S. M. and Binns R. A. (2003) *Geology* **31** (10), 845-848.

5.3.P21

U-Th isotopes of explosive eruptions of the Campanian volcanic field

B. SCHEIBNER[1], A. HEUMANN[1], I. ARIENZO[2], L. CIVETTA[2] AND G. WOERNER[1]

[1] GZG - Universitaet Goettingen, Germany
2 Osservatorio Vesuviano - Naples, Italy
(bscheib@gwdg.de)

Introduction

Campanian volcanoes (Vesuvius and Campi Flegrei, South Italy) are characterized by several large explosive eruptions during at least the past 40 ka. The largest known protohistoric eruptions in this area occured within the Campi Flegrei (Neapolitan Yellow Tuff, Campanian Ignimbrite) and the nearby Somma - Vesuvius volcanic complex. It is still a matter of debate, (1.) if the magma of both volcanoes derived from the same magma source and which modal composition the magma source(s) have; (2.) if they have a unique deep (20-10 km) magma chamber and (3.) if the magma source of the young Campi Flegrei magmas differs from that of the other volcanic complexes and provinces of South Italy.

Magma sources for Campanian Plain volcanoes

For resolving the temporal evolution of the magma sources beneath the Campanian Plain, we present U-series analyses of whole-rock powder samples from the young deposits (<14 ka) of Campi Flegrei (Neapolitan Yellow Tuff, Averno, Mt. Procida, Nisida) and the Mt. Somma - Vesuvius volcanic complex (Mercato, Avellino).

U-Th-isotopes compositions of the young eruptions of the Campi Flegrei (Neapolitan Yellow Tuff - 14 ka, Mt. Procida - 10.8 ka, Nisida 10.8 ka, Averno 3.8 ka), measured by TIMS, show a range of ($^{238}U/^{232}Th$)-ratios from 0.8784 to 0.9895 and age-corrected ($^{230}Th/^{232}Th$)-ratios between 0.7929 and 0.8730.

These results indicate for the young explosive Campi Flegrei eruptions a $(^{230}Th/^{232}Th)_i$-ratio ("melt source composition") below the typical $(^{230}Th/^{232}Th)_i$-ratio of the other Italian volcanic provinces and the Campanian Ignimbrite. Furthermore, a recently published study [1] of U-series from whole-rocks of the Avellino eruption (3.7 ka) indicates that protohistoric magmatism of the Somma - Vesuvius volcanic complex (8000-2700 ka) shows higher ($^{230}Th/^{232}Th$)-ratios than the magma of Campi Flegrei, which was erupted during a comparable time period of the Avellino-eruption.

References

[1] Voltaggio M., Branca M., Tedesco T., Tuccimei P., Di Pietro L. D. (2004). - *GCA* **68**, 167-181