Seafloor massive sulfides in arcs: implications for the Aegean

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Seafloor massive sulphide (SMS) deposits of copper, zinc, lead, silver and gold are found worldwide as products of hot spring activity on both sedimented and sediment-starved spreading ridges of ocean basins and back arcs, on abyssal seamounts, on arc volcanoes and in immature arc/back arc rifts as well as continental margin rifts. Many are modern analogs of volcanic-hosted massive sulphide (VMS) ores in the ancient geological record. Initial discoveries were made in continental margin rifts of the Red Sea (the metalliferous mud of the Atlantis II Deep) followed by low temperature springs in the Galapagos spreading and high temperature springs at 21°N on the East Pacific Rise. The early exploration focussed on oceanic spreading ridges and several large, rich discoveries were made, most notably along the slow spreading Mid-Atlantic Ridge. All of the early work on SMS was conducted by research scientists. In the 1990s, Nautilus Minerals and Neptune Minerals, two companies both based in Australia, began staking huge tracts of seabed that were known or were thought to contain SMS. Nautilus is on track to commence mining, probably in 2012, their Solwara 1 SMS deposit in eastern Manus Basin (EMB) off the east coast of Papua New Guinea that had been discovered by Ray Binns of the Australian CSIRO and the author in 1996. We were initially drawn to the EMB through the realization that decades of geological study, including our own, of VMS deposits had shown the most important ores formed during the rifting phase of island arcs. Furthermore, although not the case for the EMB, the largest VMS deposits were developed on continental rather than oceanic crust. Examples include the Iberian Pyrite Belt of Spain and Portugal, the Bathurst district of eastern Canada and the Hokuroku district of Japan. In view of the above, the submarine portions of the Aegean arc and especially its back arc hold great potential for SMS. Both subaerial and submarine hydrothermalism are known in the arc volcanoes. Of particular interest is the Anatolian Trough, an extensive, heavily sedimented back-arc rift in continental crust of the northern Aegean Sea. Nearby Lemnos and Samothrace islands are hydrothermally active. Marine geophysical data are sparse but coincident gravity and magnetic highs with high heat flow can be interpreted as indicating that igneous intrusions into the thickly sedimented crust have created hot springs on the seafloor.

Recent micro-tectonic movement from three karst caves, Slovenia

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Monitoring of micro-tectonic movement in Postojna cave started in 2004 and in Polog and Kostanjevica caves in 2008. In Postojna cave two TM 71 extensometers, 260 m apart, are installed at the same fault zone, which extends about 1 km north from the Dinaric oriented (NW-SE) Predjama Fault. Since 2004 to the present small tectonic movements are detected, dextral horizontal movement of -0.05 mm for Postojna 1 and extension of -0.03 mm for Postojna 2. But the highest peaks can be of 0.08 mm. Preliminary results in Polog cave, where TM 71 is placed in the vicinity of 1998 (Mw=5.6) and 2004 (Mw=5.2) earthquakes on the Ravne Fault, show -0.08 mm of extension between two limestone beds (from October 2008 to March 2009). From March to May 2009 the movement on *x*-axis returned back to -0.02 mm. The highest trend in Kostanjevica cave was detected as vertical movement along *z*-axis for +0.035 mm from June 2008 to May 2009, representing subsidence of the NW block and uplift of SE block. In all three studied caves the data obtained by TM 71 monitoring are related to active tectonic movements of wider fault zones of Predjama (Postojna cave), Ravne (Polog cave) and Brežice Faults (Kostanjevica cave).

Note on the evolution of a Miocene composite volcano in an extensional setting, Zărand Basin (Apuseni Mts., Romania)

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Bontău is a major eroded composite volcano filling the Miocene Zărand extensional basin, near the junction between the Codru-Moma and Highiş-Drocea Mts., at the tectonic boundary between the South and North Apuseni Mts. It is a quasi-symmetric structure (16-18 km in diameter) centered on an eroded vent area (9x4 km), being buttressed to the south by Late Jurassic to Late Cretaceous ophiolites and sedimentary deposits of the South Apuseni Mts. The volcano was built up in two sub-aerial phases (14-12.5 Ma and 11-10 Ma) from successive eruptions of andesite lavas and pyroclastic rocks with a time-increasing volatile budget. The initial phase was dominated by emplacement of pyroxene andesites and resulted in scattered individual volcanic lava domes associated marginally with lava flows and/or pyroclastic block-and-ash flows. The second phase was petrographically characterized by amphibole-pyroxene andesites and was a result of a succession of pyroclastic eruptions (varying from strombolian to subplinian type) and extrusion of volcanic domes that resulted in the formation of a central vent area. Numerous debris flow deposits have been emplaced at the periphery of primary pyroclastic deposits. The end of the magmatic activity was most probably intrusive as recorded by several andesitic-dioritic bodies and associated hydrothermal and mineralization processes in the volcano core complex area. Distal epiclastic deposits are associated with terrestrial detritic material and coal, filling the basin around the volcano in its western and eastern part. Chemical analyses show that the lavas are of calc-alkaline type and are all andesites (SiO_2=56–61%) in composition. The petrographical differences between the volcano evolution stages, showing an increase in amphibole content at the expense of two pyroxenes (augite and hypersthene), are slightly mirrored in the major element compositions of the rocks; only CaO and MgO contents decrease with increasing SiO_2. In spite of a ~ 4 Ma long evolution, the compositions of calc-alkaline lavas suggest insignificant fractionation processes, resulting from the extensional setting in which they occur that did not favored prolonged magma chamber processes.

Geochemistry and U-Pb zircon age of low-grade metavolcanic rocks from the Biga Peninsula, Northwestern Turkey

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Northwest Anatolia and especially the Biga Peninsula is the area having special important in the case of understanding of geology of Turkey and its surrounding. The Biga Peninsula has a Variscan basement affected by Alpine tectonics which is mainly composed of metavolcanic rocks. NE-SW-directed metavolcanic rocks occur in the basement of Çamlıca