# The new views on alteration and mineralization of Sanshandao gold orefield in the Jiaodong Peninsula, China

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The Sanshandao gold orefield is located in the western part of the Jiaodong Peninsula of eastern China, the western margin of the Pacific Plate. The deposits in the orefield are altered-fracture type, typical Jiaojia-type gold system. The gold mineralization is most closely associated, both spatially and temporally, with the Guojialing Suite of granitoids that consist of porphyritic hornblende–biotite granodiorites and is confined to a major NE to NNE-trending fault zone (Sanshandao-Changshang fault) that cuts the Guojialing granodiorite suite. Some dating by Rb-Sr and K–Ar methods on hydrothermal alteration-related micas and mineralized whole-rocks shows gold mineralization occurred at ca. 130-100 Ma.

The main hydrothermal alteration types are silicification, sericitization, sulfidation, potassic alteration, Carbonation and local chlorite alteration. It is shown that the Sanshandao gold mineralization was the result of multiple events. A total of 6 hypogene stages can be identified in sequence: 1) K-feldspar stage, 2) silicification stage, 3) pyrite–quartz stage, 4) quartz–pyrite–polymetallic sulfides stage, 5) chlorite stage and 6) carbonate stage. This discrimination is much different from the existing opinions. These stages are not all developed in all the gold deposits. Stages 2, 3 and 4 are most widespread, whereas Stage 3 and 4 are the main mineralization stage for the deposits. Meanwhile, it is more important that all alteration and mineralization mentioned above occurred two times in the orefield. In other words, we can recognize two integrated cycles of the alteration and mineralization successively. This is the reason to form the super-large gold deposits with recent major global gold production and ore reserves.

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# Post-eruption sulfide and iron content of hydrothermal vent fluids from East Pacific Rise, 9°50′ N

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We measured iron and sulfide concentrations of high temperature vent fluids from 9°50′N East Pacific Rise in the three years (June 2006, January 2007 and June 2008) following an eruption that occurred between October 2005 and March 2006. Upon retrieval of the samples, free $H_2S/HS^-$ and FeS were fixed as ZnS, which was measured in the laboratory upon acidification, giving the acid-volatile sulfide (AVS) concentration. Vent fluid AVS ranged between 1.33 – 16.5 mM (n=6) in 2006, 0.63 – 11.5 mM (n=5) in 2007 and 1.2 – 2.42 mM (n=4) in 2008. The averages of these datasets were 9.6, 5.83 and 2.03 mM in 2006, 2007 and 2008, respectively. The average Fe(II) concentration was lowest for the 2006 dataset (0.54 mM) with 1.89 and 1.51 mM for 2007 and 2008. The AVS content of unfiltered and filtered (0.2 μm) subsamples was not significantly different, indicating the samples contained mostly free $H_2S$ and/or FeS nanoparticles. Data over time following the eruption showed a decrease in AVS along with an increase in Fe(II).

Chromium reducible sulfide (CRS), which measures pyrite ($FeS_2$) sulfur, was also measured after the acidification step. CRS was 3 – 42% of total sulfide (AVS + CRS) in unfiltered and 2 - 10 % of total sulfide in the filtered samples. The existence of CRS in filtered samples indicates the presence of <200 nm pyrite nanoparticles in vent fluids. Pyrite nanoparticles are more resistant to oxidation than FeS at ambient seawater conditions. Thus, pyrite nanoparticles, as soluble entities and which make up 1-10 % of the filterable Fe emanating from vents, may be transported over longer distances into the deep ocean and contribute to the dissolved Fe inventory in remote parts of the ocean. The existence of Fe and S in CRS in significant amounts also shows that both total dissolved reduced sulfide and iron content of hydrothermal vent fluids are underestimated if methods that measure only free sulfide and FeS are used to analyze for sulfide (e.g., zinc-acetate fixed fraction, methylene blue method and iodometric titrations).