

Acid Mine Drainage in the Chinkuashih-Shuinantung Area

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ABSTRACT

The Chinkuashih-Shuinantung area is mainly composed of outcrops from the Miocene Nankang Formation. Crustal movements after the late Pliocene have led to several high-angle faults and lifted the Shitih Formation to the surface. During the Pleistocene, dacite intruded into Miocene sediments and thereafter hydrothermal gold-copper ore deposits were formed. These deposits are composed mostly of metal sulfides, including pyrite, enargite, galena, tetrahedrite, and sphalerite, together with limited native gold. All these sulfides may produce acid mine drainages. The river bed course of the Chiufen Chi is rather close to the fault traces, indicating a close relationship between water flow systems and tectonic movements.

Water and soil samples were collected from several selected sites, including the upper, middle, and lower stream areas of the Chiufen Chi; along with the west, south, and east banks of the Shuinantung Bay; in addition, mine waters drained directly from the Penshan 5th adit and 7th adit were also collected near their portals. Geochemical data such as pH value, water temperature, turbidity, conductivity, dissolved oxygen, and selected ionic concentrations, were measured later. All samples were collected and analyzed during each season of a year. The results indicate that water drained from the two mine adits and the lower stream area of the Chiufen Chi exhibit low pH values, high metal (esp. Cu and Fe) and sulfate contents, and great conductivities. The acid mine drainage effect is very obvious, especially during the rainy season.

The Transient Electro-Magnetic (TEM) method, using square loops 20 m on a side, was also applied in this area for prospecting purposes. Measured transient voltages were inverted in terms of 1-D models. Four-layered models consisting of low-high-low-low resistivity patterns best fit the 49 coincident loop data. The effective exploration depth was between 5 m to 50 m. Furthermore, resistivities measured along the Chiufen Chi varied with the season, indicating high porosity and permeability in rocks underlying the study area, probably due to ore mineralization, faults or joints; on the other hand, resistivities measured along the Shuinantung Bay are not affected by seasonal change, indicating a saturated aquifer underneath the area near the sea.

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