36Cl in a soil in the hyperarid Atacama Desert

RONALD AMUNDSON1*, STEPHANIE EWING1,2, CHLOE LEWIS1, MARC CAFFEE3 AND KUNIHIKO NISHIIZUMI4

1Division of Ecosystem Sciences, UC Berkeley (earthy@nature.berkeley.edu, saewing@nature.berkeley.edu, chlewis@nature.berkeley.edu)
2Center for Isotope Geochemistry, UC Berkeley
3Dept of Physics, Purdue University (mcaffe@physics.purdue.edu)
4Space Sciences Lab, UC Berkeley (kuni@ssl.berkeley.edu)

36Cl produced in situ in rocks has advanced the dating of landforms. Additionally, 36Cl is produced in the atmosphere by the spallation of 40Ar, with an average deposition of 6 to 22 x 10^6 atoms 36Cl m^-2 y^-1 [1]. Finally, atm 36Cl was produced by thermonuclear weapons testing. Phillips (2000) calculated the bomb fallout of 36Cl at Antofagasta, Chile to be 5 x 10^12 atoms m^-2. This exceeds natural deposition rates by 4 orders of magnitude.

Here, we examine the Cl and 36Cl content of an ancient (2.1 Ma) soil in the one of the driest regions of the Atacama Desert. Since the late Pliocene, the soils have not lost Cl and NO3 by leaching, and thus have retained both atmospherically and in situ produced 36Cl. Because of this unique setting, we have measured the Cl and 36Cl content of atmospheric deposition and in soil layers from the surface to a depth of 2 m in order to begin to decipher the relative roles of atmospheric inputs vs. in situ production over My timescales. Also, the identification of the bomb 36Cl will allow us decipher solute leaching on decadal, or shorter, time scales. We use a simple box model to determine if the age of the soil, combined with measured and calculated production rates, explain the general features of the 36Cl inventory.


Native antimony in hydrothermal gold deposit, Western Junggar (Xinjiang, NW China)

FANG AN
School of Earth and Space Science, Peking University, Beijing 100871, China (yfzhu@pku.edu.cn)

Geological research and mineral exploration in Xinjiang are developing fast recently [1, 2]. Both Baogutu porphyry Cu-Au deposit [3] and many hydrothermal gold deposits in Western Junggar formed during Late Carboniferous period. For example, the Baogutu gold deposit and Hatu gold deposit are hosted in Lower Carboniferous volcanic-sedimentary strata. The Hatu gold deposit consists of quartz vein type orebody in shallow part and alteration-type orebody in deep part [4], with host rock consisting of tuff and basalt of Early Carboniferous. A zircon SHRIMP age of 328Ma was obtained for the tuff [5]. The Baogutu gold deposit is composed of sulfide-quartz veins and sulfide-quartz vein-nets, with host rock of tuff siltite of Early Carboniferous. The Baogutu gold deposit locates nearby Baogutu porphyry Cu-Au deposit. The major metal minerals in Baogutu gold deposit are native gold, pyrite, arsenopyrite, stibnite and native antimony.

The ore-forming process of Baogutu gold deposit can be divided into three stages: coarse grain quartz stage I; fine grain quartz-sulfide stage II; and calcite stage III. Stage II is the main period for gold deposition, during which formed mineral assemblage of arsenopyrite - arsenic pyrite - pyrite - native gold. Temperature (270–350°C), sulfur fugacity (logS2 = -8--12) and Oxygen fugacity (logO2 < -36) of stage II are estimated based on the mineral assemblage and composition thermometer of arsenopyrites. Native antimony is scarce, especially in quartz vein type gold deposit. Native antimony, formed at the late stage of Baogutu gold deposit, coexists with stibnite and calcite or replaces stibnite. The native antimony consists mainly of Sb (96% to 97%) and As (2% to 2.5%). Arsenopyrite- pyrrhotite- native antimony- stibnite mineral assemblage formed during the late stage at 240–280°C with logS2 of -12--14 and logO2 of <38.

The temperature and sulfur fugacity of hydrothermal fluid decrease from stage II to III. We conclude that Sb is transported in the form of HSb2S4 in fluid. At the beginning of stage III, pyrrhotite and stibnite formed due to the decrease of sulfur fugacity, caused by the crystallization of arsenopyrite, pyrrhotite and stibnite. This process facilitated the crystallization of native antimony.