©2004 by Economic Geology
Vol. 99, pp. 1577–1591

The Anarraaq Zn-Pb-Ag and Barite Deposit, Northern Alaska: Evidence for Replacement of Carbonate by Barite and Sulfides

Karen D. Kelley,†
U.S. Geological Survey, Box 25046, MS 973, Denver, Colorado 80225

Julie A. Dumoulin,
U.S. Geological Survey, 4200 University Drive, Anchorage, Alaska 99508

and Scott Jennings
Teck Cominco American Inc., 15918 East Euclid Avenue, Spokane, Washington 99216

Abstract

The Anarraaq deposit in northern Alaska consists of a barite body, estimated to be as much as 1 billion metric tons, and a Zn-Pb-Ag massive sulfide zone with an estimated resource of about 18 Mt at 18 percent Zn, 5.4 percent Pb, and 85 g/t Ag. The barite and sulfide minerals are hosted by the uppermost part of the Mississippian Kuna Formation (Ikalukrok unit) that consists of carbonaceous and siliceous mudstone or shale interbedded with carbonate. The amount of interbedded carbonate in the Anarraaq deposit is atypical of the district as a whole, comprising as much as one third of the section. The total thickness of the Ikalukrok unit is considerably greater in the area of the deposit (210 to almost 350 m) than to the north and south (maximum of 164 m). The mineralized zone at Anarraaq is lens shaped and has a relatively flat top and a convex base. It also ranges greatly in thickness, from a few meters to more than 100 m.

Textures of some of the carbonate layers are distinctive, consisting of nodules within siliceous mudstone or layers interbedded with shale. Many of the layers contain calcitized sponge spicules or radiolarians in a carbonate matrix. Textures of barite and sulfide minerals mimic those of carbonate and provide unequivocal evidence that replacement of precursor carbonate was an important process. Barite and sulfide textures include either nodular, bladed grains of various sizes that resemble spicules (observed only with iron sulfides) or well-rounded forms that are replaced radiolarians.

Mineralization at Anarraaq probably occurred in a fault-bounded Carboniferous basin during early diagenesis in the shallow subsurface. The shape and size of the mineralized body suggest that barite and sulfides replaced calcareous mass flow deposits in a submarine channel. The distribution of biogenic and/or early diagenetic silica may have served as impermeable barriers to the fluids, thereby focusing and controlling fluid flow through unreplaced carbonate layers.

† Corresponding author: e-mail, kdkelley@usgs.gov

0361-0128/01/3472/1577-15 $6.00