FLOAT COPPER IN MICHIGAN

by
Theodore J. Bornhorst
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What is "float" copper?

The term "float" copper locally refers to glacially transported native copper in the western Upper Peninsula of Michigan. The name "float" copper was used in a 1924 publication in the American Mineralogist by University of Michigan renowned mineralogist Edward H. Kraus (1). Mechanical rounding of rocks and minerals occur in glaciers as the clasts impact each other, the physical contact abrades the clasts and thus smooths and rounds them. Native copper occurs in Mesoproterozoic bedrock of the Midcontinent rift exposed around Lake Superior (Figure 1). The advancing glacial ice plucked the native copper from lodes or veins and entrained it in the glacial ice. As the ice moved generally southward the masses of native copper moved in the direction of ice movement (Figure 1). The masses of native copper were abraded by other rocks and minerals carried by the glacial ice which resulted in smoothing the malleable native copper and removing attached rocks or minerals from the surface. Glacial striations are visible on some float copper specimens from scraping of the surface by rocks carried by the glacial ice. On occasion, edges of the copper masses were bent over by collision with larger rocks carried by the glacier. When the glacier retreated these masses of native copper that were "floating" in the glacial ice were deposited along with smoothed and rounded clasts of the other rocks carried by the glacier.

Geologic History

During the Pleistocene, from about 2.6 million to 10,000 years ago, the Upper Peninsula of Michigan was subjected to repeated glaciations. These repeated glaciations removed overlying rocks down to the level of the native copper ores hence, masses of native copper and hosting rocks and minerals were at the surface and could be removed from the bedrock and entrained in the moving glacial ice. Most of the materials are carried less than about 10 miles (16 km) from their source in the bedrock (2) but some are carried 100s of miles by the moving ice. The glaciers dispersed float copper mostly within the western Upper Peninsula of Michigan consistent with the direction of ice movement during the latest glacial episode, the Wisconsinan episode with maximum advance about 20,000 years ago and retreat about 10,000 years ago (3) . Most masses of float copper are small, ranging from a few to 50 cm across. The largest known float copper was discovered in the early 2000s and weighed about 25 tons (50,000 lbs) near the Houghton County airport not far from its source; it was cut into smaller masses and was smelted and refined into pure copper for commercial use. To the south and west float copper has been reported over 130 years ago in southern Minnesota and southern Wisconsin (4). A 1,700 lbs piece was found in Bayfield County in northern Wisconsin (4). Float copper is reported from southern Illinois, Central Indiana and southern Michigan, Ohio, and New York (Figure 1).

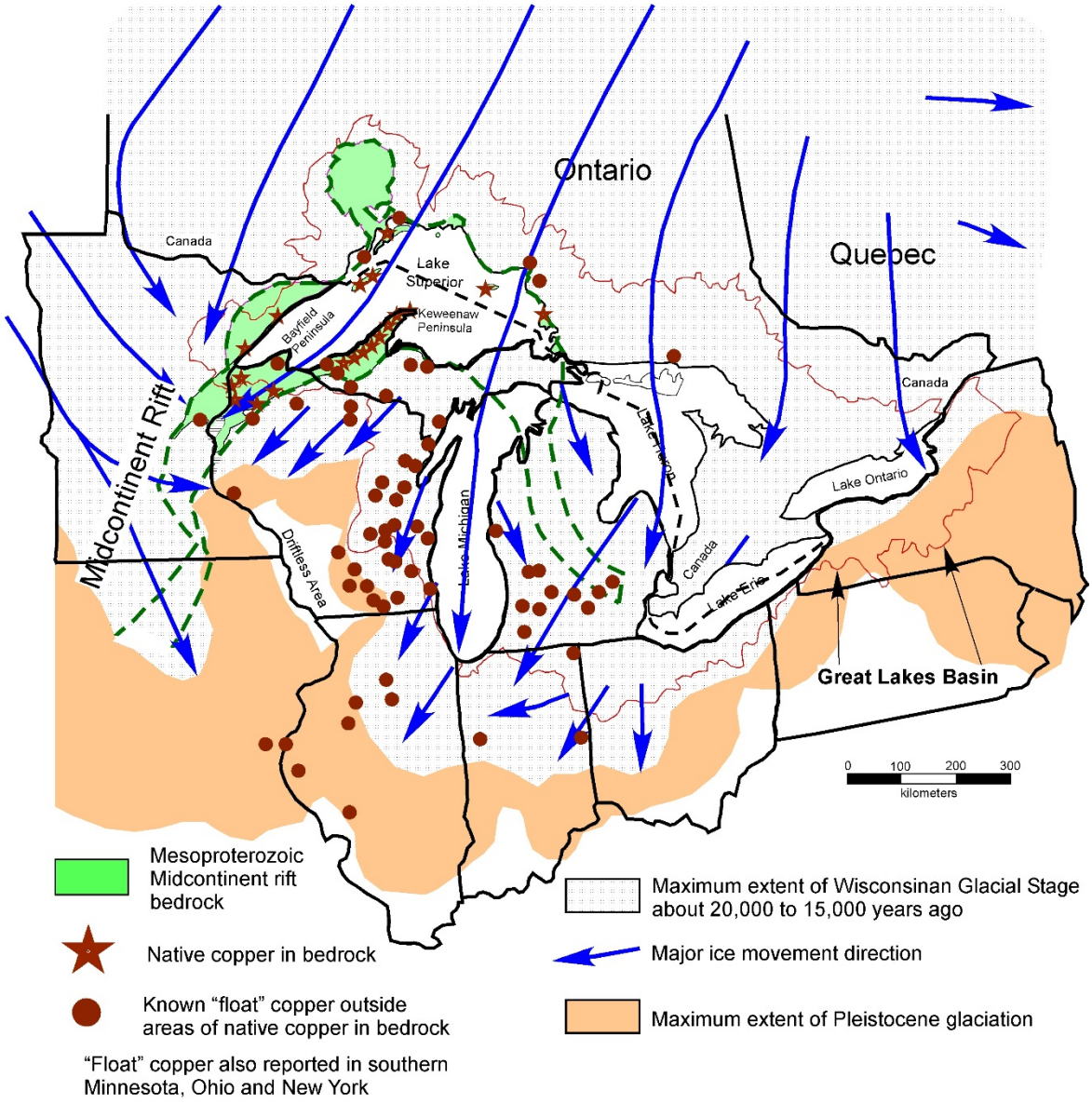

Figure 1: Map showing location of the native copper deposits of the Keweenaw Peninsula and the extent of float copper transported south by movement of glacial ice. Location of float copper from (4, 5 cited in 6, and 6)

Float copper is considerably denser than most other rocks and minerals carried by the glacier. After it was deposited among other less dense unconsolidated gravel and sand, action of water preferentially removes the lighter gravel and sand thereby concentrating the float copper. This process results in a greater abundance of float copper masses at the surface today where they are also incorporated in surface soil.

The abrasion during transport in the glacier left the surface of the float copper pieces as "shiny" copper. Since the glaciers retreated about 10,000 years ago, these surfaces have been in contact with oxygen in the atmosphere and with oxygenated water (rain and groundwater connected with the atmosphere). The "shiny" native copper on the surface underwent chemical reactions during this time that altered the

copper on the surface of the float copper mass from pure native copper to other forms of copper including cuprite (copper oxide), tenorite (copper oxide), malachite (hydrated copper carbonate) and rarely azurite (hydrated copper carbonate). These copper oxide and carbonate minerals are stable at surface conditions. During the past 10,000 years the typical thickness of surface alteration is only a few mm because the coating of the surface of the native copper mass by stable copper minerals generally protects the interior of the float copper mass from further alteration. Highly porous and fractured float copper pieces can be more altered as they allow continuing access of water to alter the native copper.

Humans returned to the Keweenaw Peninsula and Isle Royale about 7,000 years ago after glaciers retreated from Lake Superior and the initial large glacial lakes decreased in size. They likely first exploited native copper from discovery of float copper (7). When they saw unusual colored "stones" in stream gravels or on the surface, they gathered them up and experimented on them. The loose copper pieces were formed into shapes by cold hammering but hammering would have made the copper brittle. They discovered using fire to anneal them which facilitated them making native copper objects that they traded across eastern North America. As the easily found float copper diminished the first humans turned to digging pits where native copper occurred in the bedrock. Today buried float copper is located in shallow surface soil and sediments using metal detectors or by chance it is exposed during excavations.

The float copper on display in the Copper Pavilion has an attractive coating of malachite on its outer surface.

References Cited

(1) Kraus, E. H., 1924, Some unusual specimens of "float" copper: American Mineralogist, volume 9, p. 23-26.

(2) Salonen, V. P., 1986, Glacial transport distance distribution of surface boulders in Finland: Geological Survey of Finland Bulletin 338, 57p.

(3) Syverson, K.M., and Colgan, P.M., 2011, The Quaternary of Wisconsin: An updated review of stratigraphy, glacial history, and landforms, in Ehlers, J., Gibbard, P.L., and Hughes, P.D., eds., Quaternary Glaciations -- Extent and Chronology, Part IV – a closer look: Developments in Quaternary Science, v. 15, Amsterdam, Elsevier Publishing, p. 537-552.

(4) Salisbury, R. D., 1885, Notes on the dispersion of drift copper: Wisconsin Academy of Sciences, Arts, and Letters, volume 6, p. 42-50.

(5) Glock, W.S., 1935, Native copper masses in glacial tills: Pan-American Geologist, v. 63, p. 24-26.

(6) Rapp, G., Allert, J., Vitali, V., Jing, Z., and Henrickson, E., 2000, Determining geologic sources of artifact copper: University Press of America, New York, 156 p.

(7) Bornhorst, T.J., and Lankton, L.D., 2009, Copper mining: A billion years of geologic and human history: in Schaetzl, R., Darden, J., and Brandt, D., eds, Michigan Geography and Geology, Pearson Custom Publishing, New York, p. 150-173.