



RED WULFENITE

From the Kuruktag Mountains, Xinjiang Uygur, China

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Wulfenite appears to be quite rare in China. Until recently, only a few mediocre specimens with small yellow to red crystals have reached the specimen market, from a rare-earth mine in the Mianning area, Sichuan province. In October 2006, however, the first really fine Chinese wulfenite specimens were brought out of a remote area in Xinjiang Uygur Autonomous Region which has a geology and arid climate similar to that of the great Arizona/Mexico wulfenite province.

INTRODUCTION

Red wulfenite was discovered in a small iron-manganese deposit about 300 km south of the ancient city of Hami, and about 500 km south of the Mongolian border in the hinterlands of Xinjiang Uygur Autonomous Region of China in 2004. The nearest airport is in the city of Ürümqi about 600 km to the west of Hami. The Jianshan iron deposit (尖山铁矿) is located in the Kuruktag Mountains in Shanshan County (鄯善县), near ancient Lake Luobupo (罗布泊), also called Lop Nur (*Nur* = "Lake"), now only a dry lakebed of 3,000 square kilometers at the edge of the Taklamakan Desert. Luobupo is one of the largest salt playas in the world, with a large-scale sylvite mining operation exploiting parts of the lakebed evaporite zone and subsurface potassium-rich brines.

The ancient city of Loulan (楼兰) was founded on the northwest side of the lake in the second century BC, and was a bustling town with a large population of merchants and businessman for over 800 years. It served as the capital of Loulan Province and was an essential stop on the "silk road." The city disappeared mysteriously after 700 AD, and by the time of Marco Polo's visit in 1224

it had become buried in the desert. He saw no living creatures, but only tons of yellow sand. Today it is being excavated as an archeological site.

WULFENITE IN CHINA

Despite the voluminous outpouring of mineral specimens from China during the last 20 years or so, the mineral wulfenite has been almost completely absent. A small number of modest but intriguing wulfenite specimens from China began reaching the Western market in the late 1990's, labeled as coming from Mianning, Xichang, in the Liangshan Yi autonomous prefecture of Sichuan province. These are generally small, gemmy, yellow wulfenite crystals on a white barite matrix. Weigang Chen (a dealer in Xiamen, Fujian province) also has advertised small, red, bipyramidal to tabular crystals on white matrix from Mianning, and has researched the origin of these specimens. He says they are from the Maoniuping mine, near the town of Maoniuping in Mianning County (which is adjacent to Xichang County). A new mineral species from this



Figure 1. Location map.

Figure 2. Wulfenite, 4.5 cm, from the Kuruktag Mountains. Wayne Thompson, Bill Larson and Rob Lavinsky specimen; Jeff Scovil photo.

mine, maoniupingite-(Ce), has recently been described (Shen *et al.*, 2005). The mine is owned by a private consortium of about a dozen people, and has been in operation for 40 or 50 years. It began as a molybdenum mine, but in later years converted to the production of rare-earth minerals (Wang *et al.*, 2001; Xie *et al.*, 2006). The sulfide-rich carbonatite orebody, which is quite interesting geologically, contains large quantities of massive bastnäsite and is considered to be the second largest rare-earth deposit in China. No wulfenite crystals larger than about 1 cm have been found there.

Ren (1980), in the book *Minerals in China*, pictures two mediocre wulfenite specimens, from unnamed localities in Gansu and Liaoning, but, as far as we know, no specimens from these areas have ever reached the international market. Zhou and Guo (1996), in the book *Mineral Treasures*, published by the Geological Publishing House in Beijing, cites no Chinese localities for good wulfenite specimens, relying instead on Mexican and American examples for illustrations. Smith *et al.* (2005), in their "Guide to mineral localities in China" (in the previous China Issue, vol. 36, no. 1), also list no localities for wulfenite. Liu (2006), in his book *Fine Minerals of China*, mentions only the Mianning locality as having produced wulfenite specimens for the collector market. There seems to be little doubt that the geochemical and climatological conditions necessary for wulfenite formation are rarely met with in China.

Recently, however, a group of attractive wulfenite specimens in deep red crystals appeared on the market, labeled as coming from "Nonan," Xinjiang Autonomous Region. These were purchased from Chinese wholesalers and offered for resale in 2005 by Scott Werschky (*Miner's Lunchbox*), Kevin Downey and Guanghua Liu. The new specimens are of considerably higher quality and larger crystal size than the Mianning specimens, and have a matrix of soft gossany Fe-Mn oxides. Investigations in China have tracked these to an iron-manganese mine in the Kuruktag Mountains southeast of the provincial capital of Ürümqi—probably the Jianshan mine. (It turns out that "Nonan" is where the miner lives who dug the specimens, and is a long distance from the mine.)

The Kuruktag specimens all originated with one miner, who



sold them to a single dealer in Guilin, from whom various dealers in Changsha have purchased small lots. The best specimens were retained, however, and much of the lower-grade material was apparently discarded by this dealer in order to keep the average quality high. The bulk of these specimens was not sold until one of us (MO) visited Guilin in October 2006 and made a deal to purchase the lot on behalf of several American mineral dealers including Bill Larson, Rob Lavinsky and Wayne Thompson. A number of fine pieces were hand-carried back to Arizona, and the major portion of the lot has been shipped.



Figure 3. Wulfenite with partial coating of white calcite, 10 cm wide, from the Kuruktag Mountains. Wayne Thompson, Bill Larson and Rob Lavinsky specimen; Jeff Scovil photo.



Figure 4. Wulfenite with partial coating of white calcite, 4.5 cm, from the Kuruktag Mountains. Wayne Thompson, Bill Larson and Rob Lavinsky specimen; Jeff Scovil photo.

Figure 5. Wulfenite, 12 cm, from the Kuruktag Mountains. Wayne Thompson, Bill Larson and Rob Lavinsky specimen; Jeff Scovil photo.





Figure 6. Wulfenite, 6.5 cm, from the Kuruktag Mountains. Wayne Thompson, Bill Larson and Rob Lavinsky specimen; Jeff Scovil photo.

GEOLOGY

The Kuruktag Mountains form a southern branch of the Tianshan Range, just north of the Altunshan Range in central Xinjiang Uygur Autonomous Region of China. The Tianshan, Kuruktag and Altunshan ranges are products of the Hercynian Orogeny. These mountain ranges circumscribe to a large extent what is called the "Tarim Block," a vast expanse of flat desert incorporating the Tarim Basin and the Taklamakan Desert. Six major ore-bearing formations formed within the mountainous perimeter of the Tarim Basin. Since the 1970's over a thousand ore deposits have been located around the Tarim Block (He *et al.*, 2000), including a number of gold, copper-molybdenum porphyry, iron-copper, copper-nickel sulfide, manganese, and Cu-Ag-Pb-Zn skarn deposits in the eastern portion of the Tianshan Range (Mao *et al.*, 2005), adjacent to the Kuruktag Range. This area is referred to as the Jueluotage Orogenic Belt.

The Jianshan iron-manganese mine is in the general vicinity of the much larger Hongshijing gold mine (Xiao *et al.*, 2003), in Paleozoic marine volcanic rocks known to host manganese, copper, iron and gold deposits. The Hongshijing deposit is in a shear zone that was mineralized 267-261 Ma (million years ago) and again 220-209 Ma, at middle to low temperatures (381–115° C). This area of the range separates the desert basin south of Hami from the eastern end of the Tarim Basin and the Luobupo playa.

The Cu-Mo porphyry deposits in this area have been dated at 322 Ma, whereas the Au, Ni-Co and Pb-Zn deposits formed more recently, around 290-270 Ma. These late Carboniferous to early Permian metallic deposits appear to be associated with basaltic to

andesitic eruptive rocks. The presence of Cu-Mo porphyry deposits and secondary lead deposits in a region of arid weathering sets the stage for the formation of wulfenite deposits. The molybdenum from the weathering porphyry (many of the skarn deposits also contain molybdenite) can be carried in ground water for great distances, until encountering weathering lead deposits where the reaction occurs to precipitate lead molybdate (wulfenite). A similar geological situation prevails in Arizona and northern Mexico, where many of the world's greatest wulfenite deposits occur, commonly emplaced within andesite flows. Limonite-jarosite gossan zones are common in the near surface zones of the deposits; the red wulfenite specimens occur on a friable, dark brown to ochre-yellow rock, probably a mixture of iron and manganese oxides (which can be stabilized by impregnation with a thin solution of water and white glue).

MINERALS

Wulfenite PbMoO_4

Thus far, wulfenite is the only collectible mineral to emerge from the locality, although some specimens of unidentified lustrous radiating needles resembling a manganese oxide have also been seen (MO). The wulfenite ranges in color from red-orange to bright red to a somewhat darker blood-red to brown-red. Some crystals are coated on one or both sides by a thin layer of dull, white, porcelainous calcite (identification by powder X-ray diffraction and Raman spectroscopy), removal of which leaves a pitted, lusterless surface; in many cases the specimens are more aesthetic with the partial calcite coating left intact, as it provides a nice contrast.

The specimens show a range of habits, probably reflecting the four or five different pocket zones that have been mined over the last couple of years. The first crystals to reach the market ranged from tabular to bipyramidal (probably actually contact-twinning single pyramids) showing no trace of a *c* face. Tabular crystals range from paper-thin to fairly robust plates up to 5 or 6 mm thick. The modifying pyramid faces tend to be rather steep; in some cases the tablets are essentially square, with the first-order pyramid predominating almost exclusively, whereas in other cases the second-order pyramid becomes increasingly prominent, ultimately becoming more-or-less equal with the first-order pyramid to produce octagonal rather than square tablets. Some crystals appear hemimorphic, exhibiting pyramidal modifications on only one side of the tablet, and a larger flat *c* face on the other.

Crystal size ranges from microscopic to around 4 cm on an edge; most of the best crystals seen so far are 1 to 2 cm on edge, in dense clusters on matrix. A bright luster adds to the beauty of the red crystals.

CAVEAT

It must be emphasized that we have not actually visited the mine. The location of the occurrence in the Kuruktag Mountains has been attested to by several sources, but the exact mine name given here has been deduced from the details of the location given by the mineral dealer in Guilin and by a private mineral collector in Hami, Xinjiang, the nearest town to the northeast of the mine (see map).

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