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PRIMITIVE mining and metallurgy has today almost disappeared. Probably the only remaining tribal tin mining and smelting is practiced by the Laotian natives in one of the less known tin areas of the world. This district lies almost a thousand miles from the sea along the Mekong River, one of the longest rivers in the world, that marks the border between Siam and Laos, one of the five states forming French Indo-China. Less than twenty years ago it took more than two weeks' travel on elephant-back to reach the spot and today it still takes many days of travel, using all kinds of transportation from automobiles to native canoes and small Siamese horses, to arrive in Ban Tonka on the northern edge of the Nam Pathene valley. There, lives a small group of Laotians, protected from the outside world by unexplored limestone cliffs and from civilization by the absence of roads and weather conditions, who are still making their peaceful living from fishing and tin smelting.

Tin mineralization in this area is all eluvial, coming from the decomposition of old pyritic veins which have been completely oxidized into hematite, then weathered and disintegrated in situ, leaving on the slope of the mountains an accumulation of cassiterite-bearing rocks which are prized by the natives for their metallurgical industry.

When a favorable place has been found, it is worked by men who dig irregular holes, sometimes as deep as 20 ft., and take back to the village only the highly mineralized rocks of hematite, leaving behind the surrounding low-grade tin clay or decomposed sandstone.

Almost every house in the village has its crushing unit (Fig. 1) near-by and composed of a mortar in which the ore is stamped to final washing.
size. This mortar (Fig. 2), about 18 in. in diameter, is hollowed out of a section of “May Kanay,” heavy, hard, red native wood. The stamp, also made of this wood, is inset at the end of a long pole, thus forming a lever. A man steps on the short arm of this lever to raise the stamp which then drops by gravity. During crushing, the ore is moved by hand, generally by a woman. From time to time it is removed for sifting by hand through a basket-like screen (Fig. 3). The oversize is returned to the mortar.

The ore, crushed to size, is taken to the river for panning (Fig. 4). This work is done exclusively by women, who use large batea pans made of light wood and about 30 in. in diameter. The concentrate, carefully separated by hand, is stored until a good day for smelting.

Smelting is carried on only on bright, sunny days, for the ground has to be very dry so that a hole for the crucible may be dug. In the hard, dry clay ground a small hemispherical bowl about 6 in. in diameter is dug; then around its edges a collar of wet clay is set (Fig. 5) on which a baked clay oven is fixed and carefully sealed. (Fig. 6), leaving an opening for a baked clay pipe into which the air is blown. Two blowers are then set at a convenient distance and connected to the oven by means of two small bamboo stalks converging in the clay pipe (Fig. 7). These blowers are made of two large-sized bamboo about 8 in. in diameter with wood plungers sealed by chicken feathers.

A charcoal fire in the oven is started with a burning ember while the concentrates are agglomerated with water (Fig. 8). The oven is then charged alternately with concentrates and charcoal (Fig. 9). When smelting is finished, the blowers and oven are dismantled (Fig. 10) and the remaining embers and molten tin are thoroughly stirred with a piece of wood to clear the tin from any dirt or ashes (Fig. 11). After being cooled by water (Fig. 12), the spongy tin ingot (Fig. 13) is removed from the crucible, and is ready for the Chinese traders.

The average grade of the ore treated is about nine per cent tin, washing
giving a 57 per cent tin concentrate with 51 per cent recovery. A 94 per cent metal is obtained from smelting although recovery is only about 41 per cent, owing mostly to losses of concentrate blown out of the oven despite agglomeration with water. The over-all recovery appears then to be not more than 20 per cent.

Since the poor smelting is probably due to their small ovens, I was curious to know what their recovery would be on washing a low-grade tin ore such as the one treated by the mining companies of the Nam Pathene valley. I managed to send the “phoban” or chief of the village a fairly large sample of about 200 lb. of the average low-grade ore already ground by one of the near-by European mills. The metallurgical results obtained by these natives on such ore were surprisingly good. They obtained a 24 per cent concentrate, which is about the grade of the table concentrate at the mills. This mill product is further improved by magnetic separation. The ratio of concentration of the native panners was 84 to 1 and their recovery was about 40 per cent.

I suppose that seldom has such good concentration work by natives been recorded. Considering that cassiterite concentration in any of the Far Eastern mills working on low-grade argillaceous tin ore has never reached a recovery of 60 per cent, despite different affirmations, it must be admitted that these primitive Laotian miners, or at least their wives, are marvelously proficient in the art of panning.