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Recent Mineral Discoveries in Central Asia

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Afghanistan, Ainak Copper, Baluchistan, Bronze, Chanhudaro, Copper, Faience, Indus, Kerman, Mundigak, Oman, Seistan, Silver Smelting, Tal–i–Iblis.

By 1963 the Soviet Union had taken control of Afghanistan, a control strengthened by the Marxist coup of 1978. After 1963 hundreds of Soviet geologists were introduced in the name of aid, to explore the country's mineral resources, and to undertake the mapping that was desperately needed. In 1958 American topographers had begun aerial stereographic photography to produce such maps, an activity to which the Soviets objected strongly. Two Canadian geologists also undertook survey work. The maps that were prepared became State secrets, and with the departure of the Russians and the fighting in Kabul since, have disappeared (Sweetwood 1968). Further, the Soviet advisers were systematically deluding the Afghan government about the resources they had discovered – even Mr Afzali, the Director of the Afghan Geological Survey (Afzali 1984). It was usual for the Soviet geologists to prepare two sets of information: one pessimistic for Afghan consumption, and another accurate one for Moscow. Maps were falsified and made misleading (Shareq et al. 1977).

This state of affairs came to light after 1981 when Afghan resistance fighters captured Soviet documents in an ambush, containing a letter from the Minister of Mines, M.E. Danesh to General Boyarov, which described the Ainak copper deposit in Kabul Province as one of the richest and largest in the world with 11½ million tons of copper metal, and four times bigger than the largest copper deposit in the USSR at Dzhezkazgan in Kazakhstan.

Prior to the Russian invasion it was generally thought that Afghanistan possessed little mineral wealth, apart from oil and gas in the north, vast unexploited coal deposits, and the famous lapis lazuli deposit of Badakhshan. The country was remote and communications were bad. The Afghans were also historically averse to foreign intervention.

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Geology

The geology of Afghanistan is very complex. The country represents a mosaic of crustal fragments formed from repeated plate collisions over geological time. Three basic plates:

1. The main Eurasian plate in the north,
2. The African–Arabian plate sub–ducting under the Eurasian Plate in the south–west, and
3. The Indian plate, part of ancient Gondwanaland forcing up the Himalayas and their outliers from the south (see fig. 1).

Fig. 1 - The World, 100 million years ago showing how the Afghan mineral belt was formed by the collision of the Eurasian Plate moving south–eastwards under the African/Arabian Plate and the fast moving Indian Plate also subducting under the Eurasian Plate and pushing up the Himalayas. This collision brought up ancient pre–Palaeozoic rocks and the heat and pressure of the two sub–ducting plates would have mobilised the mineral deposits in the shaded area on fig. 2.

Crustal rift areas are commonly associated with vulcanism and mineral emplacement: e.g. the mineral rich Andes and rocky Mountains of the Americas pushed up by the subducting Pacific plate.

The mineral rich zone in Afghanistan extends from the tectonically active north–east to Seistan in the south–west (see fig. 2). Afghanistan is thus a country of high earthquake activity and of volcanic eruptions both geologically old and new. Igneous rocks occur together with granites, while much pre–palaeozoic rock is present in the central and north–east mountains. In adjacent Iran, south of Kerman, the Kuh–i–Jamal Bariz range which forms the north–west side of the Bampur basin is of granite rising to 4,600 metres with the copper deposit of Bahr–Asman which probably provided the copper that was smelted at the nearby archaeological sites of Tal–i–Iblis (Caldwell and Shahmirzadi 1966) and Tepe Yaya (Lamberg–Karlovsky 1984). However the copper could have come from Oman, equally distant.

As might be expected from the Plate Tectonics, Afghanistan is quite rich in mineral deposits, some of which, eg the Ainak copper deposit and the Hajigak iron ore, are world class. In all 898 deposits or traces of metallic minerals were located by the Russians (Schroder 1987). Nearly all of these were of a minor and un–economic nature, but included iron, copper, lead and zinc, and for our purposes here, tungsten and tin.

Tin was found in seven different areas from Wakhan and Badakhshan in the north–east to Shindan–Kishmaran on the south–east border with Iran. Only the latter deposit which occurred with copper was of any significance (see map 1). Note that no silver was found in Afghanistan, nor is it known in Iran or the Indian continent. The source of the silver of the ancient world is another problem for archaeologists (see Dayton 1978: 79–86 and 442).

Tin and Copper

For archaeologists the source of the tin used in the bronzes of the Ancient World has been a subject of heated discussion since the writer's paper of 1971 (Dayton 1971). We now have the existence of a small but respectable tin deposit in Seistan in Afghanistan, near the Iranian border, and the writer has in his possession a fine sample of large black cassiterite crystals from this area, obtained from an Afghan geologist after the advent of "Glasnost" and freedom in the Soviet Union.

However the deposit shows no sign of ever having been worked, and the outcrop is located in very inhospitable bandit country. Cleuziou and Berthoud (1982) found traces of alluvial tin in eastern Iran, near the Afghan border. It appears that this tin came from the Shindan deposit.

With the associated copper the deposit would have been capable of producing a tin bronze. The site of Mundigak, near Kandahar in Afghanistan has produced the first Indus copper object with tin in it. Namely an axe with 5% tin from level III–6 which has a carbon date of 1600 BC (Lamberg–Karlovsky 1967) and (Casal 1961: 247). Copper objects are present in all levels at Mundigak.

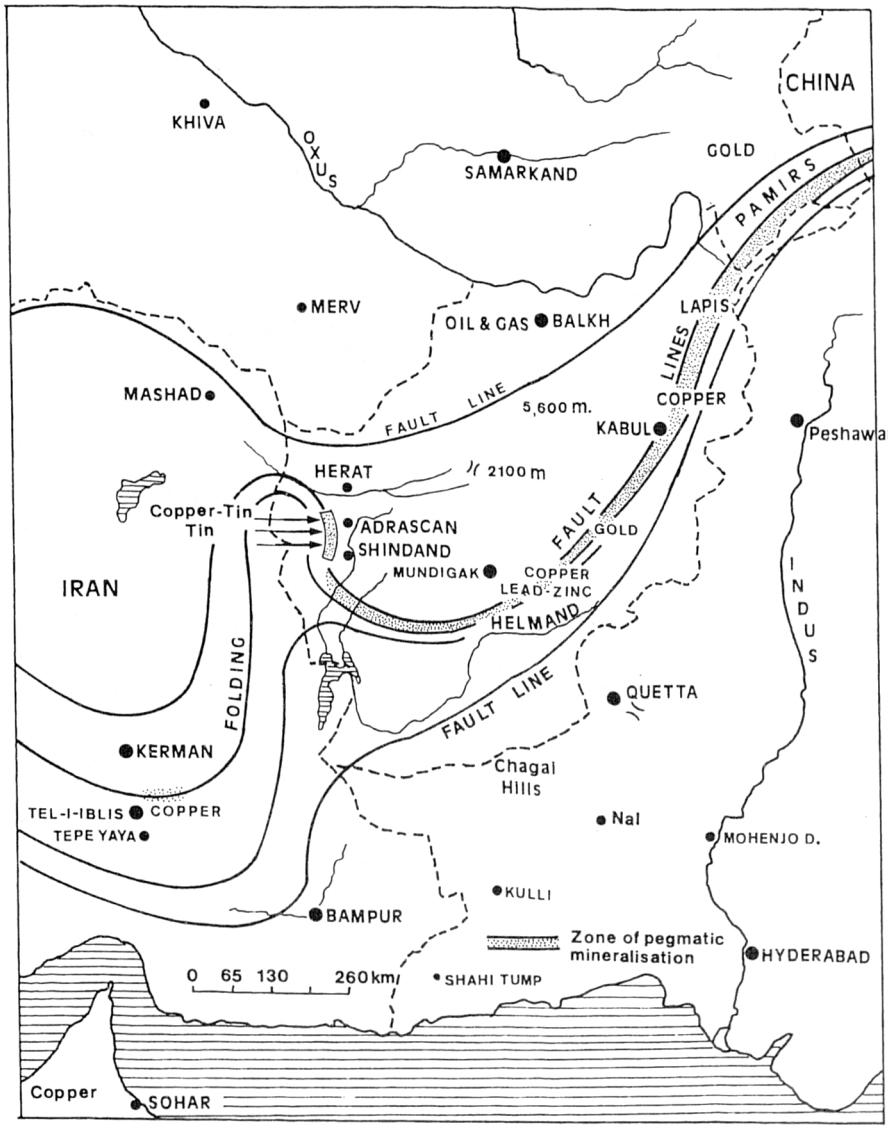

Fig. 2 - The mineralised zone of Afghanistan (shaded) and south–eastern Iran. Afghanistan consists of arid deserts in the east, and a succession of very high mountain chains running from the south–east to the north–east where the Pamirs reach a height of 8,000 metres. The easiest route from or to the west would be via the Bampur depression and Baluchistan with their important archaeological sites, or more easily by sea along the coast, never out of the sight of land, to the Gulf.

Period III brings a cultural change at Mundigak which appears to stem from the north–west and from Iran (Lamberg–Karlovsky 1967:147). Shaft–hole adzes appear similar to those at Hissar and Susa (Casal 1961: fig. 139; here see fig. 3).

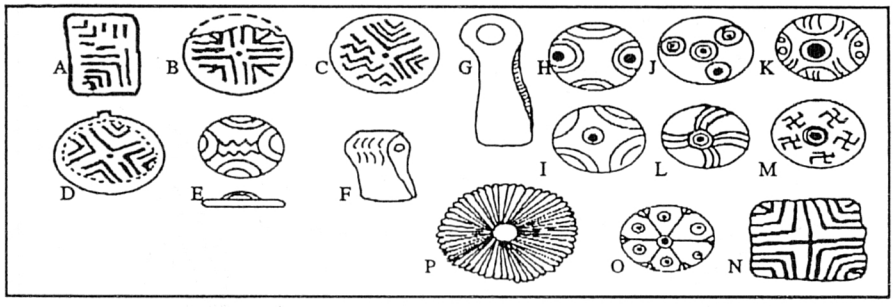

Fig. 3 - East–West Connections. A, B and C stamp seals, F and G shaft–hole axe and adze from Mundigak, D stamp seal from Troy VI, E copper stamp seal from Shahi Tump (similar copper seals are found at Susa, Hissar, Alishar and Troy).

H, I, J, K, L and M white paste filled incised balls from Harappa, Mohenjo–Daro, Hissar, Troy (L and M), and Alalakh. N is a copper stamp seal from Poliochni. P is a faience fluted disc bead common in the Mycenaean world and at Mohenjo–Daro.

In nearby south–eastern Iran at the important metallurgical site of Tal–i–Iblis evidence of smelting and crucibles were uncovered (Caldwell and Shahmirzadi 1966). As at Tepe Yaya, all the objects were of copper with no tin, and may come from the copper deposits in the nearby Kerman mountains (see map). The copper objects had high traces of arsenic which is more typical of the copper ores of the Caucasus and central Iran at Anarak.

In Baluchistan copper objects, flat axes, pins, knives and mirrors have been found at Kulli, Nal and Mehi (Lamberg–Karlovsky 1967).

In the Harappan Culture of the Indus basin tin bronzes occur. At Mohenjo–Daro high traces of lead occur in the coppers. It will be noted that in Afghanistan on the other side of the Bolan Pass, near Kandahar, deposits of copper with lead and zinc occur. Some of the Indus copper objects could well have come from this area. However many of the copper objects from Mohenjo–Daro are rich in nickel (which has not been found in Afghanistan) but is found with the copper ores of Oman. It has been reasonably suggested that the Indus Civilisation traded with Oman and the Gulf, Oman being the ancient Magan. The Indus Valley being all alluvium has no mineral deposits. Indus seals, decorated with elephants and rhinoceros have been found at Ur (Dayton 1978: 463; see fig. 4). Other curious features of the Indus civilisation are stamp seals like those of Troy VI found at Mundigak, and incised white paste filled "spindle–whorls" with parallels in Minoan Crete (ibid: 430 fig. 27/12 4 and 4 fig. 27/13). The stamp seals were clearly needed with trade, and the incised balls were either a means of identification for merchants or even money. Trade obviously existed over the Indo–Aryan axis, which was later to be the Royal Road of the Achaemenids from Troy

to Taxila. Another strange feature of the Indus Civilisation is its objects of faience which have been largely ignored (Dayton 1978: 425–8). The tin–copper objects of the Indus Civilisation cannot be described as bronze, as the tin content ranges from 5% to 26% – the highest tin content being in bangles. It appears that tin per se, either as a metal or as the oxide cassiterite was not known, but that copper ingots with variable amounts of tin accidentally in them existed. At Chanhudaro copper–tin ingots were found, but do not seem to have been properly analysed (Mackay 1943). The writer's suggestions of Aegean and Levantine connections with the Indus have been ridiculed (Dayton 1978:134).

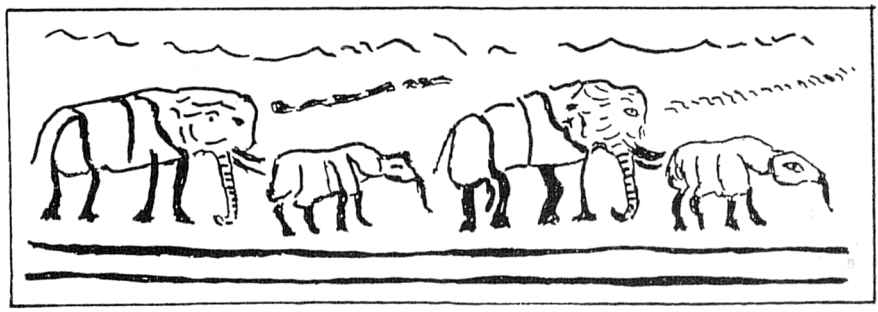

Fig. 4 – The impression from an Indus cylinder seal found at Ur.

Conclusions

It is to be hoped that archaeologists will not rush to hasty assumptions because of this discovery of a real workable tin deposit in Afghanistan. The deposit is very small and has no sign of ever having been exploited. However the tin is in the form of good–sized cassiterite crystals, not stannite – the difficult sulphide of tin.

The archaeological evidence outlined above is also against it ever having been worked, and the deposit is not large enough to have provided the tin of the ancient world. It also appears that although copper objects containing varying amounts of tin are known in the Indus Civilisation, the haphazard percentages in coppers that did not need to be hardened show that tin either as a metal or as cassiterite was not known in that culture but was imported by accident, in copper from some other source.

It is to be hoped that when normality and peace return to Afghanistan further archaeological and geological work will throw more light on the source and use of the metals of interest to archaeologists, and that perhaps the secret geological information and maps will emerge from the ruins.

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