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# PROJECT REPORTS

## Documentation and Study of Archaeometallurgy and Non-Literate Knowledge Systems of Uttarakhand with special reference to iron and copper *

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This project aims at studying the indigenous knowledge systems, their origins and growth, relationship with the elite knowledge systems and their relevance today for eco-friendly and sustainable development of a remote hilly areas of Uttrakhand. It thus became a multi-dimensional study.

The study was carried out under the following :

I. Non-literate knowledge systems (TKS) & Archaeometallurgy of Kumaun

II. Metallurgical analysis Report

III. Field work report

IV. Conclusion

The United Nations University proposal (1990) defines TKS as, 'Traditional Knowledge which maybe technical, social, organizational, or cultural was obtained as part of the great human experiment of survival and development". The World Conference on Science (Budapest 1999) in its declaration (Para 26) notes : 'traditional and local knowledge systems … make and historically have made, a valuable contribution to science and technology, and that there is a need to preserve, protect, research and promote this cultural heritage and empirical knowledge". Traditional Knowledge Systems (TKS) is a scientific system in its own right (Agrawal 1997). Laura Nader (1996) condemned the western attitude of creating hegemonic categories. She said that the Western science imposes the

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contrasting categories of science/religion, rational/magical, developed/under-developed and so on. But these categories are contrived and arbitrary.

Uttarakhand, the 27th state of the Indian Union, spreads over an area of about 53,485 sq. km with diverse geographical conditions and forms a part of the Central Himalaya. It comprises two administrative regions Kumaun and Garhwal. It was supposed to be insulated from rest of the country due to the geographical barriers and harsh climate conditions. But some recent researches in this area have proven thus notion wrong. In primitive societies early humans learnt empirical science through their daily interaction with their ambient environment. They depended upon plants and animals as well as rocks and soils to build their shelters as well as practicing agriculture. The early humans in Kumaun also became acquainted with dark colored heavy soils which were infact copper and iron minerals.

In Uttarakhand, mainly Kumaun is known for its ancient metallurgical tradition which, of course, continued till some decades back in some parts of the state but now with peoples' fascination towards the fancy utensils made of stainless steel and easy availability of other iron implement in the market, it is almost extinct now. Uttarakhand has a great deal of minerals. The requirement of iron and copper was only confined to the use as utensils and agricultural implements. So it is clear that Uttarakhand supplied surplus metals to the other nearby regions and most probably to the Ganga Valley.

The lack of metal in the Ganga valley and abundance of iron slag and ore and the copper minerals in Uttrakhand suggest that there was a close interaction between the two regions and the metal was one of the main commodities being supplied to the Ganga Valley. Some implements made a local iron were found and the owners do not remember how old they are but they know that those have come to them through generations. The quality of metal is superb; the artifacts are rust free even after hundreds of years; a testimony to the metallurgical skills of the people of early Uttarakhand. For the urbanization of Ganga valley in the 1st millennium BC, plenty of Iron and Copper was required. The Ganga valley is basically the foredeep created by Miocene progeny of the Himalayas, which was filled up with the alluvium through millions of years and as a result the original rocks are buried too deep for exploitation. Uttarakhand was close by and replete with copper and iron minerals. The extensive archaeometallurgical remains indicate

that metal industry was not only very ancient here but also quite prolific and which probably catered to the demands of the Ganga Valley. Thus, at least the Himalayan medicine system and ancient metallurgy probably did contribute significantly to the urbanizations process of the Ganga valley.

The discovery of the Copper Hoard type anthropomorphs from Pithoragarh area suggests that the copper metallurgy could go back to the second millennium BC in this area. The received wisdom was that this Central Himalayan region was cut-off and not interacted with the Ganga Valley but circumstantial evidence is clear and conclusive that Kumaun area was in constant cultural and technological contacts with the Ganga valley. In the process data were collected on ancient metal working sites, ancient mines and even on smelting remains. The diagnostic presence of arsenic in the Ganga Valley Copper Hoard artifacts; the Munda and Mon Khmer residue in the Kumauni dialects; the finds of Copper Hoards type artifacts in Kumaun; the Kumauni copper minerals with arsenic; early dates of metallurgy in SE Asia; and the new evidence of movements along the Himalayan corridor – all seem to fit into an internally consistent framework relating early SE Asia, Central Himalayas and the Copper Hoards (Agrawal 2000a).

The Central Himalayas had an extensive pre-modern iron industry based on local ores. High grade goethite, magnetite, and pyrites are available there. The sites with the affix *agar* (Sanskrit for mine) are invariably associated with copper and iron mines. It is said that till a few decades back rust-green iron vessels were being produced in Lohaghat area of Kumaun. Geological surveys have shown extensive evidence of iron minerals/workings in the region. Early 14 C dates (c. 1000 BC from Uleni iron smelting site near Dwarahat) and ancient iron smelting traditions suggest Kumaun to be the probable source of early iron for northern India. Kumaun is rich in iron and copper minerals (Agrawal et al 1995; Pant, CC 1988; Raghunandan, K.R., Shruva B.K. Rao and M.L. Singhal 1981).

The Traditional Knowledge systems or folk science of Uttarakhand is very rich in all its diversity: architecture, hyudraulics, ethno medicine, ethno botany, metallurgy, agriculture etc. (Agrawal et al 2007).

In secular architecture, there are examples of houses made of timber and stone which have resisted the ravages of time and earthquakes for the last 1000 years (Das 2007; Rautela and Joshi 2008) Such architecture has direct relevance for designing modern houses in highly seismic zones.

The traditional hydraulics of Uttarakhand was also quite developed and sophisticated. They built *naulas* (Perennial wells), water mills and a variety of irrigation channels. The whole process of making a *naula* reflects an ancient empirical knowledge based on trial and error and close observations. Even to identify the site to dig, they go by the occurrence of five typical plants including Brāhmī. In the masonry no mortar was used so that water can ooze through easily. To ensure a perennial supply of water, they tested with a special type of clay (*kamet*) which absorbs and sucks out water. In earlier times they used to put copper sheets/pots to purify water. Even the digging operation of such a *naula* starts on a full moon day, when the gravitational pull of the moon is at its peak? Such *naulas* provided pure drinking water for villages and towns. When the capital of the Chand Kings was shifted from Champawat to Almora in the 16th century, the king commissioned the digging of 300 odd *naulas*; only a few of them survive today. To keep them clean they were regarded as temples and any kind of pollution was strictly taboo. They knew the importance of infiltration wells and used shallow depressions (*chals/khals)* to collect rain water for recharging such aquifers (Manikant Shah in press).

During our field study, many such sites were encountered where iron slag was strewn all over the agricultural fields which have turned infertile: the more the villagers plough the land, the more iron slag comes out. There used to be mining shafts (earlier we had reported them from Lohaghat area) but now they are almost buried due to road and other construction activities. Actually there were iron or copper mines from where iron and copper ore was dug out as told by some elderly villagers. It is estimated that with the advent of the Gorkhas in the 18th century the metallurgy in Uttarakhand declined and gradually the British dismantled the metal industry.

Main early Metal working sites of Uttarakhand are Askot, Bankot, Ganai, Kholia-gaon, Nainipatal (Pithoragarh), Gair-Sikera, Bhat-khola, Bihargaon, Ghingarkhola, Binsar (Almora), Chanauli, Dewaldhar, Chaugaonchhina, Khan-garh, Dewaldhar (Bageshwar ) and Forti and Lukhani (Champawat).

In addition to the previous ones discovered, some other metal working sites in Uttarakhand, discovered during our recent field trips are : Siroli, Simalkhet, Son Agar(Almora), Naan, Kanyalikot ( Bageshwar) and Tam-Khani (Chemoli).

Some other metallurgical sites, mentioned by local people are :

Mahendrabunga, Tamakhani, Risen and Saari-chaura in Bageshwar and Uta-dhura (Munsyari) and Kalmatiya (Munsyari) in Pithoragarh.

## Conclusion

The explorations have been very exhaustive as intensive work requires collaboration with archaeologists so that small scale excavations could be undertaken at some potential sites.

The old workings for copper are much rarer than iron workings. But the presence of Copper Hoard type anthropomorphs from Bankot, Nainipatal in Pithoragarh area and some scrap dealer of Haldwani show that one can get copper smelting sites going back to second millennium BC, as this area is replete with both copper and iron minerals. Iron metallurgy goes back to the early First Millennium BC. Our earlier studies of copper hoard artifacts had indicated that half of the Copper Hoard artifacts analyzed had significant amount of arsenic. Thus, there is circumstantial evidence of the use of Kumauni copper minerals even for the Copper Hoard artifacts. The Iron and copper smelting were a popular industry until the 19$^{th}$ century when the British banned all smelting. This can easily be revived on a cottage scale.

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