

The Agaria Tribe and Indigenous Methods of Iron Smelting in Central India: An Ethno-Technological Study

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Abstract: *The present paper wishes to explore the indigenous methods of iron smelting by the Agaria tribe of Central India. In other words, the present paper is an attempt to explore various ethno-technological aspects of the Agaria tribe during the Colonial Period. The paper also deals with the mythical and magical beliefs of the Agaria tribe. The Agarias was one of the major tribes of India engaged in the production of iron especially in Central India. As iron smelting was the main occupation of the Agarias, therefore, the present paper has also dealt with the reflection of religious beliefs and rituals through iron smelting. Apart from the indigenous methods of iron smelting, it has also been shown in this paper that how the mythical, magical and religious beliefs of the Agarias were associated with iron and iron smelting.*

Key-words: *Agaria, iron smelting, indigenous methods, religious beliefs, tribal gods*

Iron smelting in India by indigenous methods has a glorious history. Many tribal communities are associated with iron smelting in India by indigenous methods and techniques. In India, Asur Munda and Agaria have been the main tribes concerned with the manufacture of iron.¹ The traditional iron smelters of India such as the Asurs and Agarias have produced iron in an age-old manner till recent decades.² Hence, the present paper focuses on the Agaria tribe and their indigenous methods of iron smelting and deals with the ethno-technological study of the Agaria tribe. Therefore, the paper has not followed any particular period, but the primary focus here to explore several ethno-technological aspects of the Agaria tribe during the Colonial Period. The term 'ethno-technology' may be used to describe 'the study of the technology-specific to cultural groups of people. The Agarias are the indigenous iron smelters and craftsmen tribal community. During the colonial period, the Agaria art of iron making was studied by Valentine Ball (1881)³. Valentine Ball, *A Manual of the Geology of India, Part. III, Economic Geology*, Geological Survey of India, 1881, R. V. Russel and Hira Lal (1916)⁴, Verrier Elwin (1942)⁵ and many others. Verrier Elwin had surveyed the whole Madhya Pradesh and

neighbouring areas and studied the iron-making by the Agarias in great detail.⁶ During the colonial period, the Agarias was one of the major tribes of India engaged in the production of iron especially in Central India and the major population of the Agaria tribe lived in the Mandla, Dindori, Balaghat and Sidhi districts of Madhya Pradesh and Bilaspur, Kawardha and Raigarh districts of Chhattisgarh.⁷ In Mandla district, the Agarias occupied numerous villages at the foot of the Amarkantak plateau, and in the southeast corner near Umerwani, near the sources of the Seoni and Bormeyer rivers.⁸ They also lived in Eastern Uttar Pradesh, Bihar, Orissa and Andhra Pradesh. But with the development of the modern iron and steel plants, at present, the Agarias are gradually leaving their traditional methods of iron smelting, and the mud-kiln or small Agaria furnaces are rarely found in Agaria work-sheds. But they have a history of iron smelting through their traditional methods and techniques. They also have a history of mythical, magical and religious beliefs in iron. These technological and cultural aspects of the Agaria tribe need to be explored.

Brief Description of the Agaria Tribe and Agaria Belt

The word 'Agaria' probably means a worker in *ag* or fire.⁹ The Agarias are the indigenous iron smelters of Central India. It has been mentioned that, during the colonial period, the Agarias generally lived in MP, Chhattisgarh, UP, Bihar, Orissa and Andhra Pradesh, therefore, it is possible to trace an 'Agaria belt' across the centre of India. It may be noted that Mandla district of Madhya Pradesh and Bilaspur district of Chhattisgarh were the major working centres of the Agarias. It may also be noted that the Agaria iron smelters were quite different from the Hindu iron smelters. The Agarias worshiped tribal gods or demons, who were associated with the ancient Asura, such as Agyasur, Lohasur and Koelasur.¹⁰ The Lohar (Hindu iron-worker), on the other hand, worshiped the ordinary Hindu gods.¹¹ Apart from that, the Agarias also worshiped their family god Dulha Deo, to whom they offered coconuts, cakes fowls and goats, but the deity who presided over their profession (iron smelting) was Lohasur, the iron demon, who was supposed to live in the smelting-kilns, and to whom they offered a hen.¹² Sometimes, in the forest tracts, the Agarias also worshiped Bura Deo, the chief god of the Gonds.¹³ As per the available data, it may be said that, during the early twentieth century, the Agarias had two endogamous divisions, the Patharia and the Khuntia Agarias.¹⁴ The main difference between these two branches of Agarias was, the Patharia Agaria placed a stone on the mouth of the bellows to fix them in the ground for smelting, while the Khuntia Agaria used a peg, and it was believed that these two branches of Agarias did not even take water from one another.¹⁵

We exactly do not know whether the Agarias were also known by some other names or not, but E. R. Watson stated, 'the *Agariahs* are otherwise called *Agarias, Agauriahs, Agorias, Agiyas and Asurs*.'¹⁶ But in any case, as Varrier Elwin

diagnosed, 'the blacksmith Agaria must not be confused with the Agharia, the great cultivating caste of Chhattisgarh'.¹⁷ R. V. Russel and Hira Lal (1916) in their book *The Tribes and Castes of the Central Provinces of India, Vol. II* described the Agaria as an iron smelter, Agharia as a cultivator and Aghori as religious mendicants.¹⁸ So, the traditional iron smelters Agaria should not be confused with the Agharia or Aghori. They (Agaria) produced iron from locally available iron ore and made artifacts and agricultural implements, etc and sold it in the local market. In this dilemma, now, it is necessary to know that who are the Agarias? In 1891, Sir B. Robertson had classified the Agarias among the 'Tribes allied to Gonds'.¹⁹ R. V. Russel and Hira Lal described the Agarias as a small Dravidian caste, who were an offshoot of the Gond tribe.²⁰ R. V. Russel and Hira Lal had also stated, 'the Agarias think that their caste has existed from the beginning of the world and that the first Agaria made the ploughshare with which the first bullocks furrowed the primeval soil'.²¹ Similarly, Roughton in 1921 described the Agaria as 'a small Dravidian tribe, an offshoot of the Gonds'.²² So, from the above arguments, it may be said that the Agarias is an offshoot of the Gond tribe or a tribe allied to Gonds.

Mythical and Magical Beliefs: The Agaria's Theory of Magic Iron

Every ethnic community in India carries some mythical and magical beliefs. Hence, it is quite interesting to study the mythical and magical beliefs of the Agaria tribe. Verrier Elwin described how the myths lied at the root of the social relations that are further connected to the religious and economic structure of Agaria society. As iron smelting was the main occupation of the Agarias, therefore, it is necessary to discuss the mythical beliefs of the Agarias associated with iron. There are two interesting Agaria mythological stories behind the finding of iron ore. The first one, Lohasur (Agaria deity) used to send them (Agaria) a dream and indicate the place where to dig, then they went to find the place.²³ The second one, in the old day's someone used to shoot a red arrow through the air, where it fell, they used to dig.²⁴ But these are mythological stories and there is no such evidence regarding these stories. The Agaria tribe also believed in the magical power of iron. They used iron in the three important events of life—birth, marriage and death. According to their beliefs, iron was used during the birth of a child and intentionally a small piece of iron was kept beside the baby so that the evil spirits couldn't harm the baby's life. The Agarias also used iron during the marriage ceremonies. They believed that evil spirits were active during a marriage ceremony and these spirits would harm the bride and bridegroom. The Agarias and their neighbours, therefore, used iron and especially virgin iron (*kuari loha*), in the marriage to protect the bride and bridegroom from evil spirits during the marriage ceremony.²⁵ At marriage, the ring called *chulmundri* made of virgin iron was used for the protection of bride and bridegroom from the jealous spirits and witches who infested these ceremonies.²⁶ The *chulmundri* wedding ring was a combination of brass, bell-metal and virgin iron, a potent demon-

scarer. Similarly, at the time of death, the evil spirits were also active, therefore, iron was used for protection against the evil spirits.²⁷

The Agarias also made iron rings, anklets and bracelets as charms against all kinds of evil.²⁸ An anklet was worn by a child and it was believed that the anklet would protect the child from lightning.²⁹ The Agarias also made iron nails and these nails were very important for them. These nails were the Agaria's insurance against trouble. The nails kept away ghosts and bad dreams from the sleeper on the cot.³⁰ According to them (Agaria), not all iron had equal magic power. According to their beliefs, it was always dangerous to treat the iron with disrespect; for example, a man's feet would burn if he deliberately kicked a bit of iron.³¹ But it was the *kuari loha*, the virgin iron that was extracted from a new furnace used for the first time, that was most potent for magic and medicine. The best *kuari loha* of all was made when a group of Agaria moved to a new village and there was not only a virgin furnace but a virgin smithy and a virgin home.³²

Indigenous Methods of Iron Smelting by the Agaria Tribe

The iron smelting by the Agaria tribe has been discussed here in five steps. These are-

- A) The raw materials and preparation,
- B) The furnace
- C) The bellows
- D) the tuyere
- E) The process of iron smelting

Raw Materials and Preparation

Iron ore and charcoal were the two essential raw materials that were used in the Agaria furnace. But there is no absolute evidence of the usage of flux.

Iron ore:- Central and Eastern zones of India have rich deposits of iron ore, thence, ore could be found easily in these regions. Several ancient iron ore mines were known to exist in the districts of Jabalpur, Baragaon, Panna, Katola and Sagar.³³ Franklin had already described in around 1827 these mines and the mode of manufacturing iron in Central India.³⁴ Richard Mather also mentioned that Bihar, Orissa and the Central Provinces had rich deposits of iron ore.³⁵ So, there is no question about the existence of iron ore in Central India. But the interesting question is how did the Agarias discover the best places to dig for iron ore? Two mythological stories regarding iron ore have been already discussed. Apart from the two mythological stories, the Agarias could also recognize a good digging site by the colour of the soil. Very often,

sufficient ore was found on the surface. The pits were small in size and generally not deeper than the height of a man.³⁶ The ore body was not dug to a depth of more than 2 to 3 meters but in few places, open-pit digging of up to 5 to 6 meters has been also found.³⁷ The pits were generally situated in the almost impenetrable jungle. During the daytime, men used to visit the jungle for collecting ore and returned home in the evening. The work of digging was usually done by men, though women could accompany them by cleaning the stones or gathering what they found on the surface.³⁸ After these preliminaries, one of the Agaria used to go into the pit for digging with his mattock. A basket was handed down to him and he filled it with earth and stones and heaved it up to the others.³⁹ The stones were cleaned and sorted on the spot and carefully packed into the baskets called *dadu* (fig.1) and *tukna* (fig.2). After obtaining iron ore, they used to return home in the evening. It may be noted that there was no private ownership in the pits and there was not even village ownership.

Charcoal:- Charcoal was another important raw material for smelting iron. Now it would be interesting to know, how did the Agarias prepare charcoal? Verrier Elwin stated, 'Where there are *sarai* trees, there you will find Agaria'. The *sarai* trees gave much the best charcoal and the Agarias were the expert charcoal-burners. They made it usually of *sarai*, though *dhamin* and *saja* were also sometimes used.⁴⁰ They also collected dry wood and green branches of sal, bamboo and teak.⁴¹ For making charcoal, women with bamboo baskets called *ghandri*,⁴² children with small leaf-baskets called *patli* and men with their axes went to the forest to collect wood and to prepare charcoal.⁴³ Generally, they cut wood and made a wood pyre and set it on fire. Once the wood began to burn, they sat down and watched it from a certain distance. Sometimes, they prepared charcoal near a water source so that it could be quenched at a suitable stage.⁴⁴ But mostly they threw earth on the burning wood for maintaining the quality of charcoal. After a short time for cooling, they put the small charcoal pieces into the big bamboo baskets (*ghandri*) and the leaf-baskets (*patli*) and returned home.

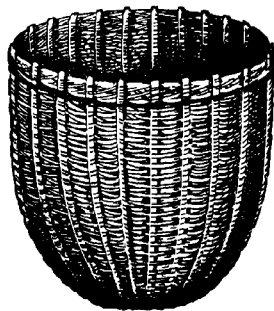


Fig. 1. *Dadu* basket, height 1.5 ft.

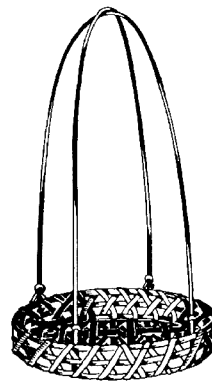


Fig. 2. *Tukna* basket, height 3 ft.

[Source- Verrier Elwin, *The Agaria*, H.M. Oxford University Press, Calcutta, 1942, pp. 175-76.]

The Furnace

In India, during the 18th-19th centuries, the furnaces used were of three types, namely (i) open hearth, (ii) small blast furnaces and (iii) tall blast furnaces.⁴⁵ The Agaria furnaces were the open hearth and small blast furnaces. The furnaces of the Agarias, as mentioned by Valentine Ball, were built of mud and were about 3 to 4 feet high, tapering from a diameter of about 1½ foot at top and 2½ feet at the base and the hearth was a rounded cavity, which was about 10 inches in diameter, and the circular shaft above it was about 6 inches in diameter.⁴⁶ Verrier Elwin described the Agaria furnace in detail. The furnace was a cylindrical clay kiln, called *kothi* or *bhatti* in the local language, 2½ feet high, with a circumference of eight feet at the base and five feet at the top. In Mandla (or Mandala), it was tilted backward on a large stone. At the top, there was a mouth 6" by 6" to receive the charcoal and ore, and at the base there was another mouth 10 inches high and 9 inches broad, to take the blast and to allow the iron to be removed. On the right-hand side towards the back, there was a flue for the slag called appropriately the *hagan* or in Bilaspur *loha hagara* (aperture for excretion). From the top of the tilted kiln there ran backward a bamboo platform 2½ to 4 feet long and 1¼ to 1½ feet broad, inclining upwards, supported on light poles. This was the *machan*, the slide down which ore and charcoal were poured into the furnace. It was plastered with mud and provided with little walls 3 inches high.⁴⁷ The measurement of the furnaces was different in several places—mostly having either circular or rectangular cross-sections. In Bilaspur, the cylinder stood upright and the *hagan* was larger and it had a deep hole in front of it.⁴⁸ The *machan* had no walls to guide the charcoal to its goal. At Doka, the furnace was 3 feet high and had a diameter of 2½ feet and it was upright, circular, without *machan*, but with a *hagan* on the right-hand side.⁴⁹

The Bellows

The blast was produced by a pair of kettledrum-like bellows, consisting of hollowed drums of wood, with goats' skins attached, and nozzles of bamboo.⁵⁰ The bamboos which convey the blast were luted into clay tuyeres, which were themselves luted the front of the furnace. Actually, these bellows were used to blow air into the furnace. The bellows used by all branches of the Agaria tribe were the same and were distinctive. The Agaria bellows were made out of sections of the trunk of the *Trewia nudiflora* (Linn.), a little over a foot in diameter and about 3½ inches thick.⁵¹ The wood was chopped out with an axe or sometimes burnt with a red-hot iron, then a hole was made on one side to take the bamboo tuyere which would carry the blast to the fire. It may be noted that pieces of cow-hide or buffalo-hide (in Mandla) or of sambhar-skin (generally in Bilaspur and Raipur), sometimes of goat-skin, were

stretched across the top and tied down.⁵² There was a hole in the middle of each cover and a cord (known as the *kutidor*) was passed through this and held in place by a small twig. The other end was attached to a springe stick (generally of bamboo) called *dang*, or in Raipur *ada-dang*, which was fixed in the ground behind the usual place for the bellows.⁵³ The pair of bellows lied side by side before the furnace or forge. Two hollow bamboo poles called *tonda* or *behngul*, two to three feet long, lead to an earthen tuyere (*nari*) that concentrated the blast upon the fire. Before the bellows were used, they were soaked in water and when the skin cover was sufficiently pliable, the Agaria's or daughter or wife, or son—but rarely the Agaria himself—stood with one foot on each of the bellows and depressed them in turn.⁵⁴ To keep the bellows secured in place, a big piece of stone was generally put on the bamboo pipes.⁵⁵ The Agarias believed in the existence of spirits in the bellows. According to their beliefs, the spirits living in the bellows were Dhukan Mata, the Blowing Mother, and Pawan Kuari, the Virgin Wind.⁵⁶ The bellows were often described in Agaria folk-talk, as 'two black sisters that fart turn by turn', 'two co-wives with but one throat between them', 'two snakes that whisper in a single hole', 'two heads that speak with one voice saying *phusur phusur*'.⁵⁷

The Tuyere

The *nari* or *nari-thondi* was a clay cylindrical tuyere, splayed open at one end, tapering slightly at the other, which was set in the luting of the furnace or the forge to collect and concentrate the blast upon the fire.⁵⁸ The clay tuyere was generally used for blowing air. It had a shape like a trumpet and was prepared from the same clay used in the furnace.⁵⁹ Verrier Elwin suggested that the size of tuyere varied from 7 to 10 inches.⁶⁰ Elwin further described the measurement of a tuyere which was in his possession having 9½ inches in length, 2 inches wide at the broader end and 1 inch at the narrower.⁶¹

The Process of Iron Smelting

The important part of this discussion is the process of iron smelting by the Agarias. Hence, at first, we need to focus on the smithy. Verrier Elwin mentioned that in Mandla the Agaria smithy was a rough rectangular hut, roofed with a grass thatch and unwalled, varying in size but always small, and in Raipur and Bilaspur, the smithy was often out-of-doors and the smelting was done at night.⁶² The furnace, as B. Prakash mentioned, was generally constructed at two locations—either the back yard of the house or most commonly near the site of the iron ore deposit in the forest.⁶³ Apart from men, the Agaria women also took an active part in several important activities such as the furnace operation and other specific jobs allotted to them. Generally, the head of the family and his wife controlled the entire operation of iron smelting and the technology of making iron was maintained as a secret passed on from generation to generation. Apart from the head of the family and his wife, the younger generation also provided a helping hand

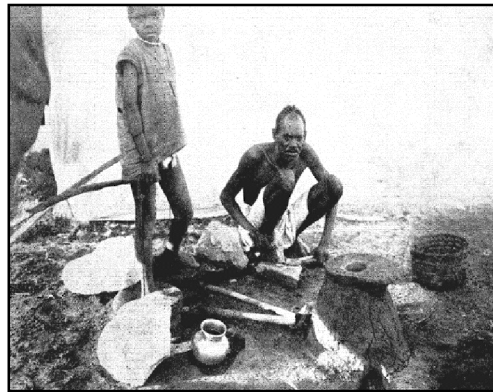
from a very young age and they were allowed to learn the technology of iron smelting.⁶⁴ In the evening, the women of the house prepared the smithy for the morrow's work. They usually removed the lumps of ore from the baskets (*dadu* and *tukna*) and broke them up into small pieces and cleaned them and they roasted them in an ordinary fire of wood and bark.⁶⁵ Then a girl generally brought a basketful of *kodon* chaff and emptied it on the left side of the furnace, made a pile of *nari* clay near it, and to the right side of the furnace made piles of sand, earth and the red dust from the broken ore. A basket of white *chirona* clay was placed near the forge, and a pile of cow-dung ash was kept handy.⁶⁶ There were already piles of charcoal near the furnace and the forge. The iron tools were put in place and everything was prepared with great exactness. When the heavy workers arrived in the morning, they found everything at hand.⁶⁷ Then water was poured over the skin covers of the bellows, and they were placed before the furnace. Now a woman, generally an older and experienced woman, proceeded to repair the 'mouth' with *nari* clay. She also plastered the top and the waste flue. Thereafter, she took the *kodon* chaff and pushed it into the mouth of the furnace and pressed it down firmly with a useful little stick known as *tokna-lathi*.⁶⁸ Then the woman mixed the sand with water, and made a wall about an inch high across the front of the 'mouth'. On this little wall, the woman placed the tuyere in position, so that its wider mouth could appear at the edge of the wall.⁶⁹ Then she put the broken bits of charcoal into a winnowing fan and poured these bits into the furnace right up to the top. The woman used to mount the bellows and another woman put some fire in the mouth of the clay tuyere.⁷⁰ The second woman took the charge of ore out of a winnowing-fan onto the *machan* stage, and this gradually slipped down into the feed-hole and mixed with the charcoal.⁷¹ After five or ten minutes, she lighted the smoke with a blazing stick and afterward red and blue flames played fantastically above the kiln. Thus the iron smelting was begun.

When they judged the iron to be ready, a man usually came forward and the bellows were removed. It may be noted that for ten minutes before the completion of the process, the supply of ore and fuel from the top was stopped, and the bellows were worked with extra vigour.⁷² After that, the clay luting of the hearth was then broken down, and a *giri*, or ball of semi-molten iron, including slag and half-burnt charcoal, was taken out and immediately hammered.⁷³ By the immediate hammering, a considerable proportion of the included slag was squeezed out and the ball or *giri* was then half-cut in two to show the quality of the iron. In some cases by several re-heating in open furnaces and by hammering, the Agarias refined this into iron fit for the market.⁷⁴ Valentine Ball had mentioned the price of these *giris*. During the late nineteenth century, the common price was four annas for one *giri*, which represented the outcome, not only of the labour of several persons for six hours at the furnace but also the labour of collecting ore and fuel.⁷⁵

The iron smelting at the furnace was a long-time process. Verrier Elwin

described that the work of iron smelting generally continued from two to five hours.⁷⁶ K. K. Leuva mentioned that the blast was kept up steadily without intermission for more than five hours.⁷⁷ In the process of iron smelting, the important task was to maintain a proper ratio between iron ore and charcoal. In these types of furnaces, as B. Prakash mentioned, iron ore and charcoal were charged in the ratio of 1:2 to 1:4 in alternate layers.⁷⁸ Now, it would be interesting to know the requirement of iron ore and charcoal in one heat. Generally, 10 to 15 kg of ore and 35 to 40 kg of charcoal were required for one heat of the furnace.⁷⁹ But the terrible shortcoming was that of flux was not generally added during the smelting process to remove the properties of the slag. H. C. Bhardwaj described that, in these types of small furnaces, the blast was introduced by a single tuyere which consisted of a hollow bamboo set with clay. The air was forced through a pair of goatskin bellows or sometimes bullock hides were used. The bellows were worked by hand by a person squatting on the ground.⁸⁰

Fig.3. Mirzapur, Agaria at work in the forge.



[Source- Verrier Elwin, *The Agaria*, H.M. Oxford University Press, Calcutta, 1942. This photograph has been placed in the extra pages between page no, 220 and 221]

Reflection of Religious Beliefs and Rituals Through Iron Smelting

The Agarias have their unique religious beliefs and rituals regarding iron smelting. These religious beliefs and rituals have been often reflected through their iron smelting. It has been already mentioned that the deity who presided over their profession (iron smelting) was Lohasur. The Agarias worshiped Lohasur or Kalabhairao as their tribal God and the whole family including women and children were engaged in this traditional trade. Moreover, this indigenous technology of making iron was maintained as a family trade secret by the Agarias. The Agarias used to perform a prayer before firing the furnace and this prayer was followed by a Tantric *pooja*. In this ritual, the Agarias and other Asur tribes pleased their Devota (God) by sacrificing a hen or cock by holding the head with *sansi* and strike it with an iron hammer.⁸¹ During this ritual, they also offered wine to their deity Lohasur and Agyasur, thereafter performed a *havan* with prayers.⁸² According to their religious beliefs, this *havan* was very crucial for the successful operation of the furnace because, as B. Prakash described, 'the furnace was ignited by inserting a small piece of burning charcoal picked from the *havan*'.⁸³ During the successful operation of

the furnace, twelve Agaria brothers, thirteen Tamasur brothers and fourteen Kansasur brothers were required for help. Once, the process of iron smelting was started, the Agarias used few *mantras* to working the furnace and to increase the iron. Verrier Elwin had recorded two *mantras*—one for working the furnace and another to increase the iron.

The *mantra* for working the furnace, so that good iron would come out, was-

“Go and see! O Agyasur! O Dhua Dharni! I take refuge in you! When Logundi Raja and his twelve brothers blew their bellows they did not honour you, but I honour you. Go and see. O Lohasur Baba I take refuge in you! Out of a little bring double, and then I'll worship you.”⁸⁴

The *mantra* to increase iron was-

“Victory to Lohasur Baba! My ancestors, I rely on you! Agyasur, I rely on you! Koelasur, I rely on you! Our babies and our children are yours ! Out of little may there come much! Then will I praise and remember you.”⁸⁵

The Agarias used to pray before their god for successful operation in the furnace. The prayer (folklore) offered to Asura God by the Agaria of Mandla for the successful iron smelting, is quoted below-

“Lohasur baba we take refuge in thee go and see,
Baghasur pah, Nagbansi pah go before and stop
the enemy in the way.

Go lohasur baba O twelve Agaria brothers
O thirteen Tamasur brothers, O fourteen Kansasur
brothers, we come to thee.

Victory to Lohasur , accept this Dhartimata, Lohasur Bhawani.
Help us Dhartimata, Banaspati Maharaj.”⁸⁶

B. Prakash described that in this folklore the mention of words like ‘Nagbansi’ and ‘Tamasur’ indicated the relation to Lord Mahadeva (Siva) and the prayer was made to mother Earth from which iron ore was obtained and to Banaspati Maharaj, i.e., the tree from which charcoal could be made—these were the two most important raw materials for iron smelting.⁸⁷ B. Prakash described the rituals in detail which were performed during the iron smelting as he had an opportunity to observe the operation of iron smelting furnaces by Agaria in 1993 during *Swadesi Vigyan Karyasala* organized at Gandhi Vidya Sansthan, Rajghat, Varanasi.⁸⁸ According to B. Prakash—before lighting the furnace—the master smelters pleased their deity by sacrificing a cock and by offering wine, turmeric and rice. Thereafter, they performed a Tantric *pooja* and only after completion the *pooja*, the furnace was lighted with the sacred *havan* fire to start the operation of the furnace.⁸⁹ So, from the above discussion, we can get a clear idea about the religious beliefs and rituals of the Agarias

through iron smelting. It may also be understood that the Agarias used to follow several rituals to please their deity before starting the process of iron smelting.



3. Another disadvantage of the Agaria smithy was that it was so constructed that it couldn't be used during the rains and thus four months' work was lost every year. A proper building, with some method of storing ore and charcoal, would increase the out-turn of the furnace by one-third.
4. The Britishers started flooding the Indian market with cheap iron produced in Britain on large scale. The import of iron and steel from Britain forced the Agarias to quit their traditional profession (iron smelting) for survival.
5. The development of iron and steel plants (such as TISCO, IISCO and the Bengal Iron Company) in the eastern zones of British India affected the production of the Agaria.

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24. *Ibid.*
25. *Ibid.*, p. 145.
26. *Ibid.*, p. 162.
27. *Ibid.*, p. 145.
28. *Ibid.*, p. 149.
29. *Ibid.*
30. *Ibid.*, p. 161.
31. *Ibid.*, p. 158
32. *Ibid.*
33. A. K. Biswas, 'Iron and Steel in Pre-modern India- A Critical Review', *Indian Journal of History of Science*, 29(4), 1994, pp. 579-610 (see p. 584.).
34. Cited in A. K. Biswas, *Op. Cit.*, pp. 584-85.
35. Richard Mather, 'The Iron and Steel Industry in India', *Journal of the Royal Society of Arts, Indian Section*, Vol. 75, No. 3886, 13th May 1927, pp. 599-624
36. Verrier Elwin, *op. cit.*, p. 173.
37. B. Prakash, 'Ancient Iron Making In India', *Iron and Steel Heritage of India*, IIM & Tata Steel, 1997, pp. 29-59
38. Verrier Elwin had mentioned that, in Mandla, women could accompanied the men in digging but in Bilaspur women were not allowed in such work. Verrier Elwin, *Op. Cit.*, p. 174 and 186.
39. Verrier Elwin, *Op. Cit.*, p. 175.
40. *Ibid.*, p. 121.
41. B. Prakash (1997), *Op. Cit.*, p. 42.
42. A *ghandri* basket was made of bamboo and it was 2½ by 1¼ ft. or even larger with an open mesh.
43. Verrier Elwin, *Op. Cit.*, pp. 121-23.
44. B. Prakash (1997), *Op. Cit.*, p. 42.
45. H. C. Bhardwaj, 'Development of Iron and Steel Technology in India during 18th and 19th Centuries', *Indian Journal of History of Science*, 17 (2), 1982, pp. 223-233
46. Valentine Ball, *Op. Cit.*, p. 380.
47. Verrier Elwin, *Op. Cit.*, p. 181.
48. *Ibid.*
49. *Ibid.*, p. 182.
50. Valentine Ball, *Op. Cit.*, p. 380; see also A. K. Biswas, *Op. Cit.*, pp. 588-89.

51. Verrier Elwin, *Op. Cit.*, p. 182.
52. *Ibid.*
53. *Ibid.*, pp. 182-83.
54. *Ibid.*, p. 183.
55. B. Prakash (1997), *Op. Cit.*, p. 48.
56. Verrier Elwin, *Op. Cit.*, p. 184.
57. *Ibid.*, p. 183.
58. *Ibid.*, p. 186.
59. B. Prakash (1997), *Op. Cit.*, p. 47.
60. Verrier Elwin, *Op. Cit.*, p. 186.
61. *Ibid.*
62. *Ibid.*, p. 177.
63. B. Prakash (1997), *Op. Cit.*, p. 41.
64. *Ibid.*
65. Verrier Elwin, *Op. Cit.*, p. 186.
66. *Ibid.*, pp. 186-87.
67. *Ibid.*, p. 187.
68. *Ibid.*
69. *Ibid.*, p. 188.
70. *Ibid.*, p. 189.
71. *Ibid.*
72. Valentine Ball, *Op. Cit.*, p. 380.
73. *Ibid.*
74. *Ibid.*
75. *Ibid.*, p. 381.
76. Verrier Elwin, *Op. Cit.*, p. 190.
77. K. K. Leuva, *The Asur- A Study of Primitive Iron Smelters*, Bhartiya Adimjati Sevak Sangh, New Delhi, 1963, p.151.
78. B. Prakash (1997), *Op. Cit.*, p. 48.
79. *Ibid.*, p. 49.
80. H. C. Bhardwaj, *Op. Cit.*, p. 225.
81. B. Prakash, 'Religious Traditions of Ancient Iron and Steel Craftsmen of India and Japan', *IJHS*, 44.1 (2009) pp. 47-71
82. B. Prakash (1997), *Op. Cit.*, p. 48.
83. *Ibid.*
84. Verrier Elwin, *Op. Cit.*, pp. 188-89.
85. *Ibid.*, p. 189.
86. B. Prakash, (2009), *Op. Cit.*, p. 53.
87. *Ibid.*
88. *Ibid.*
89. *Ibid.*