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Archaeology of Iron in Southern Rajasthan: An Ethno-Archaeological Perspective

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Abstract: The Aravalli Range is one of the oldest rock formations in the world and has been a major source of copper, iron, zinc, and silver. Archaeological evidence suggests that the use of iron by people of the Painted Grey Ware (PGW) Culture in northern Rajasthan began around the first millennium BCE. In contrast, in southern Rajasthan, it was adopted approximately in the third century BCE. The iron used in these regions was largely derived from the Aravalli hills**.** Cultural continuity can be seen in this region from the PGW period to the present. At present, many communities still practice traditional methods of iron-making. This paper examines the history of iron production in southern Rajasthan, based on archaeological evidence from excavated sites and ethnographic data.

Keywords: Early historical site, Ethno-archaeology, Iron-smith communities, Sources of iron, Intangible heritage.

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INTRODUCTION

Rajasthan is characterised by a great variety of geographical features, and the Aravalli Range, one of the oldest mountain ranges in the world, divides Rajasthan into two unequal halves and runs in a northeast–southwest direction from Delhi to the plains of Gujarat, for a length of about 700 km. The Aravalli is rich in a variety of metal deposits. The antiquity of metal production in the Aravalli region dates back to the fourth to third millennium BCE, when Chalcolithic cultures such as the Ganeshwar and Ahar emerged. It appears that they were also familiar with the concept of alloying. There are numerous ancient mining and smelting sites associated with these cultures (Agarwal & Kharakwal 2003; Sankalia 1962; Law 2011). However, iron was first introduced in Rajasthan during the first millennium BCE by the PGW culture. Sites of PGW culture are mostly found in the northern and northeastern part of this state; these include Noh, Jodhpura, and Chak 86.

This paper focuses on iron and its associated aspects and discusses the antiquity of iron in southern Rajasthan, which appears to date back to iron-level deposits from the site of Ahar in the third century BCE (Sankalia 1969: 5-6). The districts of Sirohi, Udaipur, Rajsamand, Chittorgarh, Pratapgarh, Banswara, and Dungarpur form the southern part of Rajasthan. The presence of metal artefacts and the

remains of tuyeres and furnaces bear testimony to this. It is important to examine archaeometallurgical data from southern Rajasthan to understand the context and chronology of its initial occurrence.

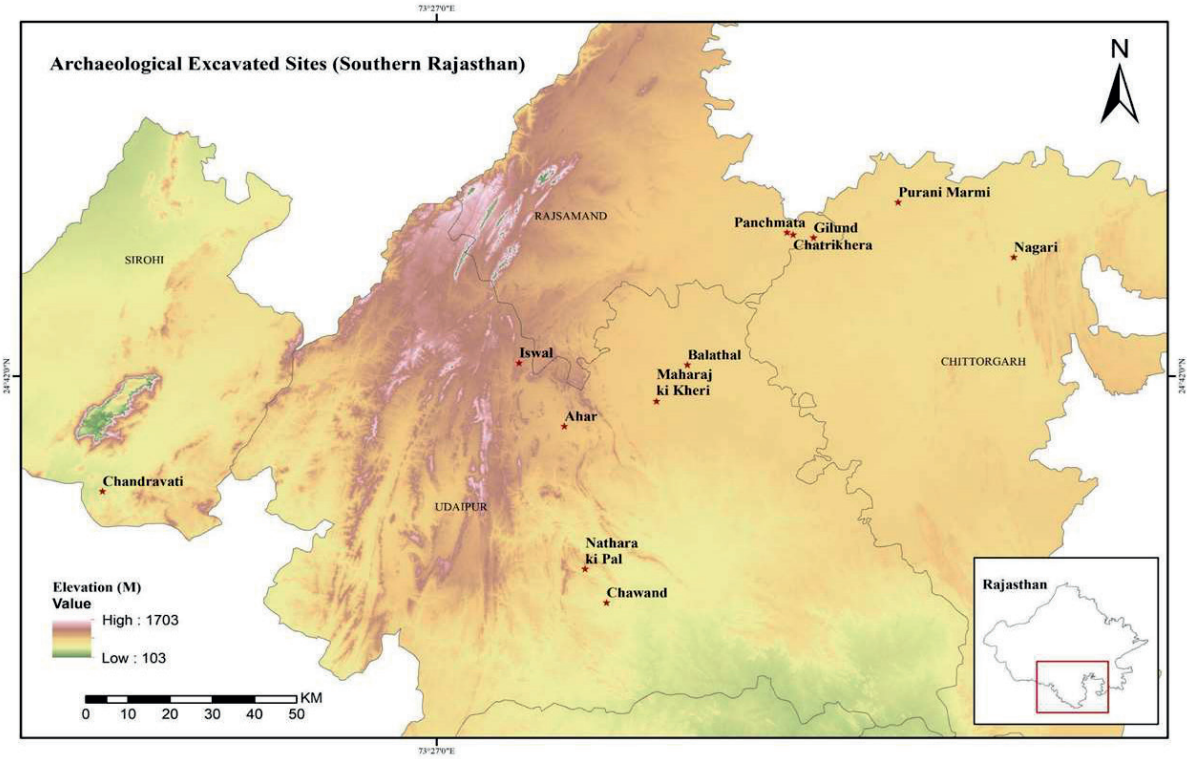

Figure 1: Excavated sites in southern Rajasthan bearing iron deposits

EXCAVATED SITES

Several sites in southern Rajasthan have been excavated, including Ahar, Balathal, Gilund, Purani Marmi, Chatrikhera, Maharaj ki Kheri, Chawand, Chandrawati, Nathara ki Pal, and Iswal.

Ahar (24°35'11"N; 73°43'20"E)

Ahar is located on the left bank of the Ahar River in the heart of Udaipur city. The site was known as Tamravati and Aghatpur during the medieval period. It is also locally called *Dhoolkot (Fort of Dust)*, and the iron-smith community living here is called *Dhool Kutia* (one who forges in dust). The site was first excavated by Akshay Kirti Vyas in 1952 (Sharma 1952), followed by excavations conducted by R. C. Agrawal (IAR 1954-55: 14-15; 1955-56: 11) and H.D Sanklia (Sankalia *et al.,* 1969). The earliest occurrence of iron at Ahar dates to period II, which is dated to the third century BCE. The Potteries associated with this period include Red Ware, Black and Red Ware, and Grey Ware. The excavation yielded 79 iron objects, including fragmented and unidentified objects, arrowheads, axes, nails, and chisels (Sankalia *et al.* 1969: 203).

Balathal (24°43'31"N; 73°59'04"E)

Balathal is located in the Udaipur district, approx. 42 km east of the type site Ahar. The major river flowing near the site is the Berach River, approximately. 8kms right of it. The site was discovered and excavated by V.N Misra from 1993 to 2000 (IAR 1962-63:18; Misra 1997; Misra *et al*., 1995, 1997). It was excavated in joint collaboration between JRN Rajasthan Vidyapeeth, Udaipur and

Figure 2: General view of trench excavated by H.D Sankalia at the Ahar archaeological mound

Deccan College, Pune. Two cultural periods were noticed at the site. Period II here is represented by the historical period with occurrences of iron dating back to 200 BCE-200 CE. Furnace remains were unearthed from Balathal by V.N Misra, although the site did not yield any slags. Iron objects such as rods, daggers, blades, swords, adzes, and door clamps (IAR 1993-94: 96). Misra (1996-97: 98-100) stated that during the course of excavation, an extensive survey was conducted which let to locating of two important iron smelting sites, namely Iswal and Bhoiyonki Panchol in the radius of 50kms. These sites could possibly the iron source for Balathal during early historical period. The site is also surrounded by old iron working such as Karanpur, Kikawar, Chhipikhera, Iswal, Nathara-Ki-Pal, Devagarh, and Lohariya (Kumar 2021: 75).

a. b.

Figure 3: a. **adzes, arrowheads, blades, knives (courtesy: Sahitya Sansthan, JRNRV, Udaipur) b. dish and figurine (courtesy: Sahitya Sansthan, JRNRV, Udaipur)**

Chandrawati (24°26'16"N; 72°44'26"E)

The site is located near the confluence of the Sevarni and the West Banas rivers in the Sirohi district. It was excavated from 2014-2017 by JRN Rajasthan Vidyapeeth, Udaipur and the state department of archaeology, Jaipur. The site belongs to the Late historical to medieval period. Iron antiquities include nails, arrowheads, rods, and sheet fragments recovered from the sites (Kharakwal *et al*. 2016: 34).

a.

b.

c.

Figure 4: a. Aerial view of Chandravati archaeological site (courtesy: Google Earth)
b. Iron nails from the 3rd phase (Devra phase) from the site;
c. Chisel and Bell (Source: Sahitya Sansthan, JRNRV, Udaipur)

Chattri-Khera (25° 1'13"N; 74°12'34"E)

The site is located in Rajsamand District on the right bank of the Banas River. It was discovered by K.N. Puri (IAR 1957-58:44-45), and later, under the salvage excavation project to document this site before further destruction, it was excavated by a joint team of JRN Rajasthan Vidyapeeth, Udaipur; Deccan College, Pune; Kennesaw State University (USA) and City College of New York City from 2009 to 2011. Excavation has revealed four cultural periods: Chalcolithic, Iron Age (second-first millennium BCE), Early Historical, and Medieval. A very limited number of iron objects were unearthed during the excavation. It may have been a satellite settlement of Gilund. A total of 12 Iron antiquities were documented by the excavator, among which 4 are rods, 2 Nails, some fragmented objects, one arrowhead, and a few pieces of slag (source of Info.: Sahitya Sansthan, JRNRV, Udaipur)

a.

b.

Figure 5: a. General view of Chattrikhera archaeological mound; b. Iron nail (courtesy: Sahitya Sansthan, JRNRV, Udaipur)

Chawand (24°11'12"N; 73°48'43"E)

Maharana Pratap established his capital at Chawand in 1585. The site is located in the Udaipur district, near the Gargal River. It was excavated by B.R. Singh of the Archaeological Survey of India in 2004 (IAR 2003-04:243), although he reported no iron antiquities. Later, in 2009, a team of JRN Rajasthan Vidyapeeth, Udaipur, conducted a field survey at the site and reported slag from it (Kharakwal *et al.* 2019). The site clearly shows evidence of iron smelting and might yield iron artefacts in the event of excavation.

Figure 6: Chawand Site

Gilund (25° 0'49"N; 74°15'10"E)

The site is situated on the right bank of the Banas River in Rajsamand District. The site was first excavated by B.B. Lal in 1959-60 (IAR 1959-60:41-46), and later by G. Possehl and Vasant Shinde from Pennsylvania University and Deccan College from 1999-2005 (Shinde and Raczek 2014). Gilund is the largest known site of the Ahar Chalcolithic culture and consists of twin mounds. Three cultural

periods were recognised from the site: Chalcolithic, Early Historic, and Medieval. The Excavation yielded 109 iron objects, of which 45 were intact iron objects and 54 iron fragments. Iron antiquity includes points, nails, hoes, axes, bells, bowls, chisels, daggers, etc (Hanlon 2014).

Iswal (24°43'48.26"N 73°37'32.37"E)

The site is located approximately 20 km northwest of Udaipur. It is a smelting-cum habitation site. The site was excavated over five seasons from 2003 to 2007 by JRN Rajasthan Vidyapeeth, Udaipur, and Deccan College, Pune (IAR 2006-07:92-98). Huge slag deposits are present on the surface of the site. The site, in fact, is situated in the periphery of an old iron mining area. The smelting activities at the site commenced around the third century BCE and persisted until the 18th century CE (Kharakwal 2014: 62). The site spans the early historic, historic, and medieval periods. 53 iron objects are reported from the site, including 10 nails, 5 rods, 6 rings, 3 knives, 2 sheets, 6 arrowheads, 3 hooks, 4 chisels, 1 ball, 2 door handles, 1 clamp, 1 musical instrument, 1 bangle, 1 triangular object and 3 fragment pieces (Pandey *et al.* 2008; Udayakumar 2016).

a.

b.

Figure 7: a. Iron smelted slag at the mound

Iron antiquities from Iswal, including a bimetallic object with a handle and base of Copper-Zinc alloy and a blade attached to it, is made of Iron (encircled). (Courtesy: Sahitya Sansthan, JRNRV, Udaipur)

Maharaj-Ki-Kheri (24°38′36″ N; 73°55′06″ E)

The site is located in the Udaipur district near the Berach River. V.N. Misra first discovered it in 1962-63 (IAR 1962-63:19), and later, in 2012-13, an excavation was conducted by Vasant Swarnkar and his team. Two cultural periods were revealed during this excavation: period I belongs to the Chalcolithic and period II belongs to the Medieval period (IAR 2012-13:116). Unfortunately, data on Iron antiquities is not available from the site.

Figure 8: General view of the Maharaj Ki Kheri archaeological mound

Nagari (24°58'10"N; 74°40'46"E)

The site is located in the Chittorgarh district, on the bank of the Berach River. The site was discovered by A. C. L. Carlleyle, an assistant to Alexander Cunningham, in 1872. It was excavated by D. R. Bhandarkar in 1920 and, in 1962-1963, by K.V. Soundara Rajan (IAR 1962-63: 19-20). The site is identified as Majhimika (Madhyamika), as indicated by the coin legends, and was part of the Sibi Mahajanapada. A total of ten iron objects were reported, including arrowheads, spearheads, two hollow copper tubes, three bells, and one nail (Bhandarkar 1920: 144-145).

Figure 9: General view of the Nagari archaeological mound

Nathara-Ki-Pal (NTKP): (24°15'47.80"N; 73°46'0.09"E)

The site is located in the foothills of the Aravalli in the Udaipur district, close to the Gargal River. The site was discovered by L.C patel in 1994. It was excavated by JRN Rajasthan Vidyapeeth, Udaipur, and Deccan College, Pune (IAR 2008-09: 95-97). It is a major centre of metallurgical activities. An extensive slag deposit is clearly visible on the surface of the mound. The site is located in close proximity to good-quality iron ore. NTKP has significant iron deposits, and the ore contains 48% to 62% iron. Furnace and retorts were also recovered during the excavation. NKP belongs to the Early Historic and Medieval period (IAR 2008-09: 96; Udayakumar 2016).

a. b.

Figure 10: a. General view of NTKP excavated site; b. Ancient mining site of NTKP

Pachmata (25°01'32"N; 74°11'47"E)

The site is located in the Rajsamand district near the river Banas. It was first discovered by K.N. Puri (IAR 1957-58:45). Later, the site was excavated for two seasons, 2015-2016, by a joint team of JRN Rajasthan Vidyapeeth, Udaipur; Deccan College, Pune and Kennesaw State University (USA) (Shirvalkar *et al.* 2025). Two cultural periods were uncovered during the excavation: the chalcolithic and the historical. Two iron fragments, along with a few iron bars and wire, are documented from the excavation (source of Info.: Sahitya Sansthan, JRNRV, Udaipur). Regrettably, not much information is provided about the iron antiquities at the site.

Figure 11: Iron bar (courtesy: Sahitya Sansthan, JRNRV, Udaipur)

Purani Marmi (25° 5'38"N; 74°25'59"E)

This site is located approximately 30 km northwest of the Chittorgarh district, on the right bank of the Banas River. The site was discovered by K.N. Puri in 1957 (IAR 1957-58) and has been inhabited from the Chalcolithic to the medieval period. Later, in 1999–2000, a small-scale salvage excavation was conducted at the site by R.K. Mohanty and his team, revealing two cultural phases: Chalcolithic and Early Historic. The survey yielded early historic pottery and iron slag; in contrast, no iron antiquities were reported from the site (Hooja 1988: 210; Mohanty *et al.* 2000: 132).

POSSIBLE SOURCES OF IRON

Rajasthan is a semi-arid and arid region with meagre agricultural and forest resources; on the other hand, the mineral-rich Aravalli region plays a very important role in the state's economic development. The principal minerals we find in the Aravalli range are lead, zinc, silver and cadmium ores, manganese ore, wolframite (tungsten ore) and iron ore among the metallic group and asbestos, barytes, calcite, china-clay dolomite, emerald, felspar, fireclay, fluorite, garnet, fullers-earth, gypsum, limestone, marble, Mica quartz, silica-sand, soapstone, pyrophyllite and vermiculite in the non-Metallic field (Rajasthan's mineral 1970: 1-2).

Iron Slag is cherry red to brownish black in colour and displays more flowage or melt-flow features (due to its less viscous nature or high temperature at the time of melting) as compared to copper slag. The reddish tinge in its colour is due to the abundance and oxidation of iron minerals (Bharadwaj *et al.* 2017). During the Bronze Age, while smelting Copper, ferrous minerals were used as flux from which iron pigs were produced. Initially, it was discarded, but over time, the metallic properties of iron were understood, and it was smelted separately. The principal ores of iron are haematite and magnetite (oxides), pyrite (sulfide), limonite and goethite (hydroxides), and siderite (carbonate), which occur in the sedimentary and igneous rocks. Before haematite/*Geru* was known for its metallic properties, it was used as a colouring agent by prehistoric people (Mathpal 1978: 395).

Modern geologists have reported iron deposits from various spots of Rajasthan, such as Chomu-Morija-Neemala (Jaipur), Lalsot (Dausa), Rampura, Dabla (Sikar), Taonda (Jhunjhunu), Pur-Banera, Bigod (Bhilwara), Nathara-Ki-Pal, Thur (Udaipur), Indergarh, Mohanpura (Bundi), Dedrauli, Liloti, Todupura, Khora (Karauli) (Grover 2004: 267-294; Kumar 2021: 68).

TRADITIONAL IRON-MAKING

In the early portion of this paper, we have discussed the early iron-occurring sites in this zone and the possible source of the early settlers. Over time, this technology has been surpassed from one generation to the next. At present, three prominent iron-smith communities reside in southern Rajasthan: Malviya, Shikligar, and Gadoliya. They are still practising iron-making in a traditional way, with some modern transformations. In this section, we shall discuss these communities to better understand the continuity of iron making since its discovery. Even though Malviya, Shikligar, and Gadoliya share the same technological traits, they don't go well together. Although Gadoliya lohar has been studied by many scholars in the past, Malviya and Shikligar lohar have not yet been a part of any scholarly work. While several newspaper columns do mention the swords of Sirohi as a dying craft, its craftsmen, the Malviya lohars, are highly unacknowledged. Similarly, Shikligars and their craft of inlaying in war weaponry have been neglected for ages.

Malviya Lohar

Malviya Lohar, who are said to have originated in the Malwa region, hence the name Malviya, are known for manufacturing rust-resistant tools, especially swords of different kinds. The authors conducted an ethnographic interview with Malviya Lohars in the Sirohi and Udaipur districts of southern Rajasthan. According to the interview with Mahendra Pal Ji, they migrated from Malwa to the Sirohi district 4-6 generations back. Interestingly, he further stated that they were once settled in Chandravati town, which is also an early historic settlement. He also mentioned that his ancestor used to make war weapons for the *darbar* (royal community) of Sirohi. Pyarelal Ji listed different kinds of swords produced by their community since medieval times. These swords are classified as *rothi, asil, and sankela* based on their weight, design, size, and techniques. According to the interviewees, their ancestors brought iron balls from Malwa. Mahendra Pal Ji remembers that the swords were being washed with water from an ancient well near Neelkanth Mahadev Temple in Sirohi. They also exploited that water for tempering during the manufacturing process. He believes that this water might contain a rust-resistant element. Besides, the interviewees added that *kada (made from high-carbon steel)* is used for polishing, thereby preventing corrosion of the finished implements.

Unfortunately, most of the Malviya families have left their ancestral work in iron-making and have forgotten the craft's specialty. The author of this paper is still trying to locate all the Malviya families involved in the iron-making process and document their traditions and technologies.

a. **b.**

Figure 12: a. Workshop of Malviya Lohar, Sirohi; b. Workshop of Malviya lohar, Udaipur

SHIKLIGAR/SIKLIGAR LOHAR

Shikligars are said to have originated in the Marwar region of Rajasthan and later settled in Mewar. They were once known by the name '*maru lohar*' (ironsmiths of Marwar). Shikligars are known for making Damascus-pattern tools or *faulad*. (high carbon steel), which is also known as 'ukku' or 'wootz' in southern India. Arabs used to transport ingots of wootz steel from India to Damascus. They made war weapons from it, which gained popularity under the name of the place (Ranganathan and Srinivasan 2006). An interview with the shikligars was conducted in order to learn their technology for producing dasacus pattern tools. Anil Ji Shikligar, a resident of Udaipur city, gave a detailed preview of their technology. He described the ancient method for making *fauladi loha,* in which a furnace is

built outside of the village approx. 5ft long and 3 ft wide walls of the furnace are made with cow dung and clay soil. The furnace was ignited with dried dung cakes and husk at dawn so the temperature could be properly monitored by observing the flames. The process of manufacturing Damascus pattern or *fauladi loha* is two-fold: first, alternate sheets of iron and steel are layered and placed in a furnace; once leather-hard, they are hammered together to fuse. They are then cut into two equal halves, joined, placed in the furnace, and later hammered together until completely fused. This entire process is repeated until satisfactory results are obtained. The second step of this process is *Juhar niakala,* meaning bringing out the water pattern/damascus pattern. In this step, the stripped sheets of metal are washed with a chemical, usually alum*/fitakari* powder, then washed in hot water, and treated with oil.

At present, this community is known for *koftgiri* work (fig. 13). *Koftgiri* is an intricate inlaying of thin silver or gold wires on the surface of an object, featuring various motifs and designs.

a. **b.**

Figure 13: a. Damascus dagger decorated with Koftgiri work; b. Koftgiri decoration in process

GADOLIYA LOHAR

Known for their mobility patterns and traditional iron-making, this community once resided on Chittorgarh Fort alongside the royal family of Mewar until 1568 A.D., when the Mughal army captured Chittorgarh Fort (Misra 1977). After the Mughal attack, they flew from Chittor and took 5 oaths: Not to go up to the fort, not to live in a house, not to sleep on a bed (cot), not to use lamps (light), not to use ropes for drawing water from wells (Misra 1977). For many centuries, they followed these oaths strictly and kept moving from one place to another along with their cart or Gadi, the reknown of which has given them the name *Gadi lohar/Gadoliya lohar.* Recently, we can see families of this community settled in one place, and many have changed their occupations.

According to folklore, this community once made weaponry only for the royal family of Chittor and fought alongside them in wars; hence, they claim a Rajput origin.

Gadoliya lohar are mostly found in the Rajastha, Haryana, Gujarat, and Madhya Pradesh. They carry their household items and a workshop in their cart; nowadays, they make agricultural tools

and household objects such as agricultural tools such as *Pharias* (Plough blade), *Kulharis* (Axe blades of various sizes), *Basulas* (Adzes), *Kussis* (Blades for weeding implement), *Kurchas* (Cooking implement), *Chinpiyas* (Small pincers for extracting thorns), *Nahinis* (Used for paring nails). They make these tools for the villagers and sell them in exchange for goods or money.

Although these three communities practice different forms of tool-making, they share common cultural, traditional, and belief systems. They worship the same kuldevi, Arbuda devi, in Mount Abu (Sirohi) and believe that they are sons of Vishwakarma. They don't practice tool-making on Amavasya (new-moon day). Interestingly, even though they are believed to be of the same origin and practice the same cultural traditions, they don't encourage exogamy among themselves.

a.

b.

c.

Figure 14: a. Settlement of Gadoliya lohar, Udaipur; b. Open-air workshop of Gadoliya Lohar, Udaipur; c. Cart of Gadoliya Lohar, Udaipur

DISCUSSION

In India, early evidence of iron comes from sites like Malhar (Tewari *et al.* 2000), Dadupur (Tewari *et al.* 2002), Raja Nal Ka Tila (Tewari & Srivastava 1997), Noh (IAR 1966-67: 30-31), Jhusi (IAR 1994-95: 69-71), and Hallur (Nagarajarao 1971). Based on these records, the antiquity of iron in the Indian subcontinent can be traced back to the early second millennium BCE. However, iron as a metal and its smelting technology were understood gradually over the decades. The introduction of iron and its widespread adoption made it easier to clear forests for farming and settlement, leading to

the expansion of agriculture and the widespread use of iron technology, especially during the second urbanisation. A great amount of weaponry and cannons were built during medieval times; massive defence structures were erected, and to secure them, iron clamps were used, which are still found intact. During all these periods, iron-smiths and their craft of producing rust-free iron remained the backbone of every community. With technological advancement and the advent of the industrialisation era, the long tradition of ironsmithy began to decline. The introduction of the blast furnace and the imposition of laws on the ethnic iron-smith communities by Europeans changed the landscape. It was only in the late 19th century that the iron-smith communities were recognised as a significant part of society, yet the shadow of colonial marginalisation still hangs over them. It is, therefore, our role to protect and document the craft of these communities for future generations.

The earliest occurrence of Iron in Rajasthan dates back to the early first millennium BCE from the middle phase of Noh (900 ± 225 BCE; Lal 1986: 83-100) and Jodhpura (900 ± 150 BCE; Lal 1986:83-100). However, its adaptation in southern Rajasthan dates back no later than the third century BCE. The technological gap between the two parts of the region is significant to understand. All the excavated sites from southern Rajasthan clearly demonstrate that iron technology in this region was not merely accidental, but a well-practised craft that has persisted for many centuries and is still practised. It is a matter of discussion that, despite the availability of iron ore and other resources in the southern Aravalli, it took a long time for iron technology to reach here, although the same resources are available in northern Rajasthan as well, where the technology has reached centuries earlier. This is not a vast regional gap that would explain such a delay in technological and other material exchange. Proper excavation of the smelting and melting site is one way to fill this gap. Understanding the continuity of metallurgical tradition from the early historic period to the present is crucial, as it helps explain how technological transmission occurred from one generation to another. The archaeological record, when combined with ethnographic data, provides a more holistic picture of this continuity.

CONCLUSION

Many iron smelting and mining sites have been recorded in the southern Aravalli, including Lohariya, Ghatol, Karanpura, Gasiar, Bambora, Iswal, and Nathara-ki-pal (Kharakwal and Saini 2026). The existence of numerous mine sites, waste dumps, slag heaps, and furnaces or retort remains testifies to the region's long-standing tradition of metal mining.

In this region, evidence of the PGW and Northern Black Polished Ware (NBPW) cultures is notably absent, and, consequently, the early date of iron production is in question. This contrasts with the Ganga Valley, where such evidence is present. In this region, the earliest indications of iron working date to the early Historical period, especially the latter half of the first millennium BCE. Of course, the story of iron-making is very long, going back much further in time. Further excavation and proper dating of the archaeological sites are significant for understanding the chronology of iron technology in the southern Aravalli. In addition, a further ethno-archaeological survey is necessary to determine and interpret the existing archaeological data.

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