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Hidden in Plain Sight: The Unrecognized Contribution of the Survey of India in the Documentation of Ancient Settlements in Pakistan and India

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ABSTRACT

The earliest documentation of hundreds of ancient settlements in South Asia, including some of the most famous and significant sites, lies in largely unacknowledged subaltern hands. Operating during the British colonial period, teams employed by the Survey of India systematically mapped the colonial dominions and produced high-quality maps that depicted topography and land use across vast areas. Systematic analysis of these map sheets combined with ground-truthing is demonstrating that these teams documented thousands of mound features, and a significant number of these are (or sadly in many cases *were*) archaeological sites. Members of the original survey teams were for the most part not in a position to contribute their thoughts to the historical narrative, but the legacy of what they documented has long been hidden in plain sight. The collaborative *Mapping Archaeological Heritage in South Asia* (MAHSA) project is systematically documenting this archaeological heritage. Its work is demonstrating that the teams carrying out the Survey of India topographic surveys incidentally conducted the first systematic survey of archaeological sites in South Asia. This was potentially the world's most extensive (albeit incidental) archaeological survey.

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Introduction

The large-scale imperial mapping projects carried out in many parts of the world in the 18th, 19th, and 20th centuries A.D. were integral to processes of political, military, economic, and social subjugation (e.g. Jacob 1992, 2006; Rondelli, Stride, and García-Granero 2013; Petrie et al. 2019; see also Godwin-Austin 1928; Chadha 1990, 1991; Edney 1997; Barrow 2003; Chester 2009; Foliard 2017). These surveys did not set out to document archaeology, but the surveyors of institutions like the Ordnance Survey and the Survey of India (SoI) definitely encountered and documented archaeological remains. It is notable that the (initially colonial) Archaeological Survey of India (ASI) was established in A.D. 1861 under the direction of Colonel (later Sir) Alexander Cunningham, over 20 years before the United Kingdom's Ancient Monuments Protection Act of 1882 and almost 50 years before the establishment of the Royal Commissions on the Historic Monuments of Scotland, Wales, and England in A.D. 1908 (Petrie et al. 2019). The ASI set out with lofty aims, and in the introduction to his first report, Cunningham (1872, iv) argued that, "Hitherto the Government has been chiefly occupied with the extension and consolidation of empire, but the establishment of the Trigonometrical Survey shews that it has not been unmindful of the claims of science. It would redound equally to the honour of the British Government to institute a careful and systematic investigation of all existing monuments of ancient India."

In the first decades of the ASI's existence, Cunningham and a small coterie of senior officers (e.g. Carlleyle, Beglar, and Garrick) published reports on a range of archaeological sites (*Archaeological Survey of India Reports* Volumes I–XXIII, 1862–1884). Their focus was on settlements mentioned in historical documents, including the narratives of the Chinese pilgrims Faxian, Xuanzang, and Song Yun and the works of Classical historians like Arrian, Quintus Curtius, Strabo, Pliny the Elder, and Ptolemy (see Petrie et al. 2019). They also made use of South Asian sources, including Vedic texts, epics such as the Ramayana and Mahabharata, and sutras and astronomical works (Cunningham 1871), and much of the attention was devoted to Buddhist heritage (Allen 2002; Lahiri 2005). The process of early "re-discovery" in the 19th century A.D. was exclusively credited to the British Colonial officers at the time and also in the subsequent academic narrative. Although South Asian individuals were involved, their names and words are conspicuously absent from this earliest phase of archaeological documentation.

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There is an often-repeated narrative about the earliest visits—and by extension the "discovery" or "re-discovery"—of archaeological sites related to the Indus civilization. Descriptions of the history of Indus archaeology and the re-discovery of Indus cities typically begin with the visits to Harappa made by Charles Masson (in A.D. 1829), (later Sir) Alexander Burnes (in A.D. 1831) and Cunningham (in A.D. 1853 and 1872), before mention is made of visits by Hirananda Sastri (A.D. 1909) and discussion of the first formal excavations lead by Daya Ram Sahni (A.D. 1921) (e.g. Pande 1982; Possehl 1982a; 1999, 44ff.; 2002; Thapar 1984; Chakrabarti 1988; Kenoyer 1998; Lahiri 2005; Danino 2010; Wright 2010; also Ratnagar 2016). That narrative has been augmented by recognition that (mostly British) military officers and surveyors involved in imperial administration or documentation projects visited a number of other Indus or contemporaneous sites. For example, the Indus site of Sutkagendor was visited and excavated by the administrator Major E. Mockler (1877) before it was explored in more detail by the explorer (later Sir) M. Aurel Stein (1931; see Possehl 1999, 53–56). Mounds such as Dabar Kot, Rana Ghundai, Periano Ghundai, and Sur Jangal were visited by Dr. Fritz Noetling (1898a, 1898b, 1899; Pedde 1993; Petrie et al. 2010) as part of his work for the Geological Survey of India, before they were revisited by Stein and others. Parts of this history have been repeated for almost 100 years (e.g. Hargreaves 1929, iii; Stein 1929, 2), and its colonial context has been assessed directly several times (e.g. Chakrabarti 1988, 1995, 1997; Lahiri 2005; Ray 2008).

Similarly, the early 20th century A.D. saw the "discovery" or "re-discovery" of other sites related to the Indus civilization. In keeping with the request for a general assessment of monuments made by Viceroy Lord Curzon, the tenure of (later Sir) John Marshall as Director General saw more systematic attempts at archaeological documentation in various parts of South Asia. This period also saw a range of South Asian archaeologists occupying more prominent roles, and their appearance in the acknowledged workforce and published record was likely part of the new approach resulting from Curzon's revival of the ASI and the appointment of Marshall in A.D. 1901. Lahiri (2005, 55–61, 64, 79) has shown that pandits, subordinates, and assistants like Hirananda Sastri were dispatched to survey archaeological sites from as early as A.D. 1903, and they produced now-lost reports that were referred to by later researchers. Scholarships for training South Asian students in archaeology were also established, with recipients including Daya Ram Sahni (Lahiri 2005, 98, 159–161). Other South Asian archaeologists were involved as direct employees.

Devadatta Ramkrishna Bhandarkar, who was Superintending Archaeologist of the Western Circle, is credited with the first visit to and description of Mohenjo-daro in A.D. 1911, but, significantly, his report mentions that he "had received glowing accounts of this spot" (Bhandarkar 1912; Possehl 1999, 61; 2002, 12; Lahiri 2005, 211). This wording is telling, as it indicates that someone had visited the site earlier and recognized its potential significance, though who this may have been was not recorded. Bhandarkar's account was followed by a visit in A.D. 1919–1920 and subsequent excavation in A.D. 1922–1923 by Rakhal Das Banerji, which in turn led to the major excavations at the site under Marshall in the following season (see Possehl 1999, 62–67; 2002; Lahiri 2005). Many other Indus sites were documented during these initial phases of reconnaissance, and the list of such "discoveries" or "re-discoveries" has already been recounted in detail (e.g. Possehl 1999, 57–58; Lahiri 2005).

Much of the archaeological research carried out in the Indus River Basin and the surrounding regions has focused on the period of the Indus civilization. However, there is also an extensive swathe of archaeological heritage spanning from the mid-2nd millennium B.C. up to the present, much of which is known through excavations at a small number of major city-scale sites, including Taxila (Marshall 1951; Bahadur Khan et al. 2002; see Petrie 2013b), Charsadda (Wheeler 1962; Coningham and Ali 2007; see Petrie 2013a), Tulamba (Mughal 1967), Pirak (Jarrige and Santoni 1979), Barikot (Olivieri et al. 2019), Gor Kuttree (Durrani, Ali, and Rehman 1997), Sanghol (Ray 2010; Margabandhu and Pandey 2014), and Akra (Petrie 2020).

It is notable that most of the archaeological sites dating to the Indus civilization and later periods identified in the earliest phases of archaeological reconnaissance were particularly large and/or high mounds with a degree of physical prominence. Such sites that have elevation are the most visible type of archaeological remains in the Indus River Basin and reflect the fact that the ancient settlements in much of India and Pakistan were typically made using mudbrick or fired brick, with new buildings being constructed on top of the leveled remains of older structures (Petrie et al. 2019).

Most late 20th and early 21st century A.D. archaeological surveys conducted in various parts of the Indus River Basin and the surrounding areas have focused on the sites of the Indus civilization (e.g. Joshi, Bala, and Jassu 1984; Possehl 1999; Green and Petrie 2018), often to the exclusion of the later period occupation that is more abundant (see Singh et al. 2010, 2011). A number of large-scale surveys have, however, set out to present true assessments of multi-period archaeological site distribution of specific regions (e.g. Mughal et al. 1996; Ali 2003). While the current state of research is advanced, it presents a far from a complete picture. The surveys that have been published since 1999 show that there were a vast number of archaeological sites that were not identified or documented formally during earlier decades. However, a substantial number of these archaeological sites were not being overlooked entirely—and it is now clear that the account of early archaeological research has been missing an essential layer of its history. Thousands of mound features, which have been shown to have a high probability of being archaeological sites of various periods, were documented and their locations published on historic SoI map sheets. The true nature of these mounds has remained unrecognized for years and, in many cases, decades. They have been hidden in plain sight.

Research by the *Land, Water and Settlement* (2007–2014), *TwoRains* (2015–2021), and *Mapping Archaeological Heritage in South Asia* (MAHSA: 2020–2029) projects has demonstrated that the earliest documentation of thousands of ancient sites, including some of the most famous and significant settlements relating to the Indus civilization, was carried out by subaltern members of the teams employed by the SoI. These individuals were assigned with documenting topographic features in the landscapes they surveyed, and their critical contribution to archaeology has not been acknowledged. Teams employed by the SoI were involved with the systematic mapping of the British colonial dominions from the mid-19th century A.D. onwards, with the work of revenue and topographic surveys building on the

foundational work of the Great Trigonometrical Survey (Edney 1997; Barrow 2003; Simpson 2021). Minimally colored maps were produced from the late 19th century A.D. onwards, and often these maps credited a range of individuals involved in their production—both British and South Asian. Starting in the earliest years of the 20th century A.D., high-quality four-color maps that depicted topography and land use across vast areas of South Asia began to be published, but from that point on, credit lay solely with the current Surveyor General of the SoI (see Petrie et al. 2019; also Chadha 1991; Sarkar 2020). Several of the authors of the present paper have drawn attention to the fact that these map sheets documented the location of a multitude of "historical map mound features" incidentally (Green et al. 2019, 2; also Petrie et al. 2019). Systematic analysis of these maps combined with ground-truthing has demonstrated that SoI survey teams documented thousands of elevated mound features, and a significant number of these mound features are (or in many cases, sadly, were) archaeological sites (e.g. Garcia et al. 2019; Green et al. 2019; Petrie et al. 2019; Garcia-Molsosa, Orengo, and Petrie 2023).

To understand how this under-recognized process came about, it is necessary to recapitulate some of the history of imperial surveying in South Asia and to follow that with a description of the structure of the teams engaged in SoI operations and the work that they carried out. Taken together, this information provides insights into why elevated mound features were documented and who was involved in that process. There is of course a significant difference between the basic documentation of a mound's existence by a topographical survey team and its recognition as an archaeological site and subsequent formal analysis of its size, date, and cultural affiliation. However, it has become clear that an entire narrative of subaltern discovery has long lain unrecognized and unacknowledged.

This paper highlights two significant findings. Firstly, although their work was not an intentional contribution to archaeological knowledge, in a substantial number of cases, the SoI teams documented archaeological sites years and in some cases decades before archaeologists made their discoveries. This realization includes famous sites like Mohenjodaro and is a major contribution to our understanding of the role of subalterns in early archaeological practice in South Asia. This paper thus outlines the imperial context of knowledge creation in British India. It draws attention to the foundational contribution of the unheralded survey teams and asserts recognition of the contribution to our knowledge of the archaeology of South Asia and particularly of the Indus civilization that was made by the thousands of subaltern members of teams employed by the colonial institution of the SoI.

Secondly, and adding to the significance of the first assertion, the spatial scale of the SoI documentation provides the foundation for a more complete documentation of archaeological site distribution than is currently available from the focused surveys undertaken by archaeologists. Systematic assessment of map data, which reconsiders these mound features in geospatial terms and attempts to visit them on the ground to situate them chronologically and document their current state, is currently underway. This work has the potential to transform the field—revolutionizing our understanding of the entire sweep of archaeology of the Indus River Basin by demonstrating that, beyond the thousands of known archaeological sites documented during the 20th and early 21st centuries A.D., there were many thousands of additional mounded sites, documented yet hidden in plain sight on SoI historical maps.

Mapping Archaeology while Mapping an Empire: a Recapitulation

Starting at the beginning of the 19th century A.D., the *Great Trigonometrical Survey* set out to measure the entire South Asian subcontinent (Edney 1997; Barrow 2003; Petrie et al. 2019). This work provided the framework for the more detailed mapping of topography and revenue that started in A.D. 1831 and took place concurrently with the compilation of the *Gazetteers of British India: District Series* (A.D. 1833 onwards) and *The Imperial Gazetteer of India* (Hunter 1881; Scholberg 1970; Chadha 1991; Edney 1997; Simpson 2021; also Phillimore 1945, 1950, 1954, 1958, 1968). Edney (1997, 165ff.; also Chadha 1990, 1991; Barrow 2003) has described the initial phase of work as "cartographic anarchy," which was followed by a period of consolidation and comprehensive survey from A.D. 1843–1904. The progressive expansion of the territory controlled by the British colonial authorities saw the implementation of measures to systematically document the subcontinent district-by-district in order to maximize opportunities of resource and revenue extraction.

The maps produced by the SoI were a critical component of British imperial strategy and included map series produced at scales of 1" to 1-mile, 1" to 2-mile and 1" to 4-mile, which were issued on the basis of a grid of quadrangles that spanned South Asia and the surrounding regions (Figure 1; see also Edney 1997). Maps using this grid were first published in the 19th century A.D., and there was a lack of standardization in symbology and inconsistent use of color, though many map sheets listed the individuals involved in their production, including assistants, sub-surveyors, and drawers. A dramatic improvement in the quality of the maps produced in the early 20th century A.D. resulted from complaints from the military authorities in A.D. 1905 that saw the establishment of a committee to formulate a policy on map production in A.D. 1905–1906 (Indian Survey Committee 1906; Chadha 1990, 1990; Petrie et al. 2019; Sarkar 2020). This policy included devising a specific layout, symbology, and colors for these maps so that they would be consistent, though it is notable that the legends became increasingly lengthy and detailed and the acknowledgement of those involved was suppressed and all credit was given to the Surveyor General at the time of the maps' production (Figure 2; Petrie et al. 2019). During the Second World War, there was a deterioration in the quality of the maps published, with sheets previously published in color being reproduced in black and white and new grid systems superimposed (Figure 3).

Two editions of *The Manual of Surveying in India* (Smyth and Thuillier 1851; Thuillier and Smyth 1875) outline how the topographic surveys that provided the base data for these map series were conducted. Specific guidelines were in place for documenting hills and elevated areas, including the use of radiating hachure lines or contours and form-lines (Thuillier and Smyth 1875, 297–300; Petrie et al. 2019), which is relevant given the substantial number of archaeological sites in South Asia that are preserved as elevated mounds. The manuals suggest that surveyors were granted a degree of agency in

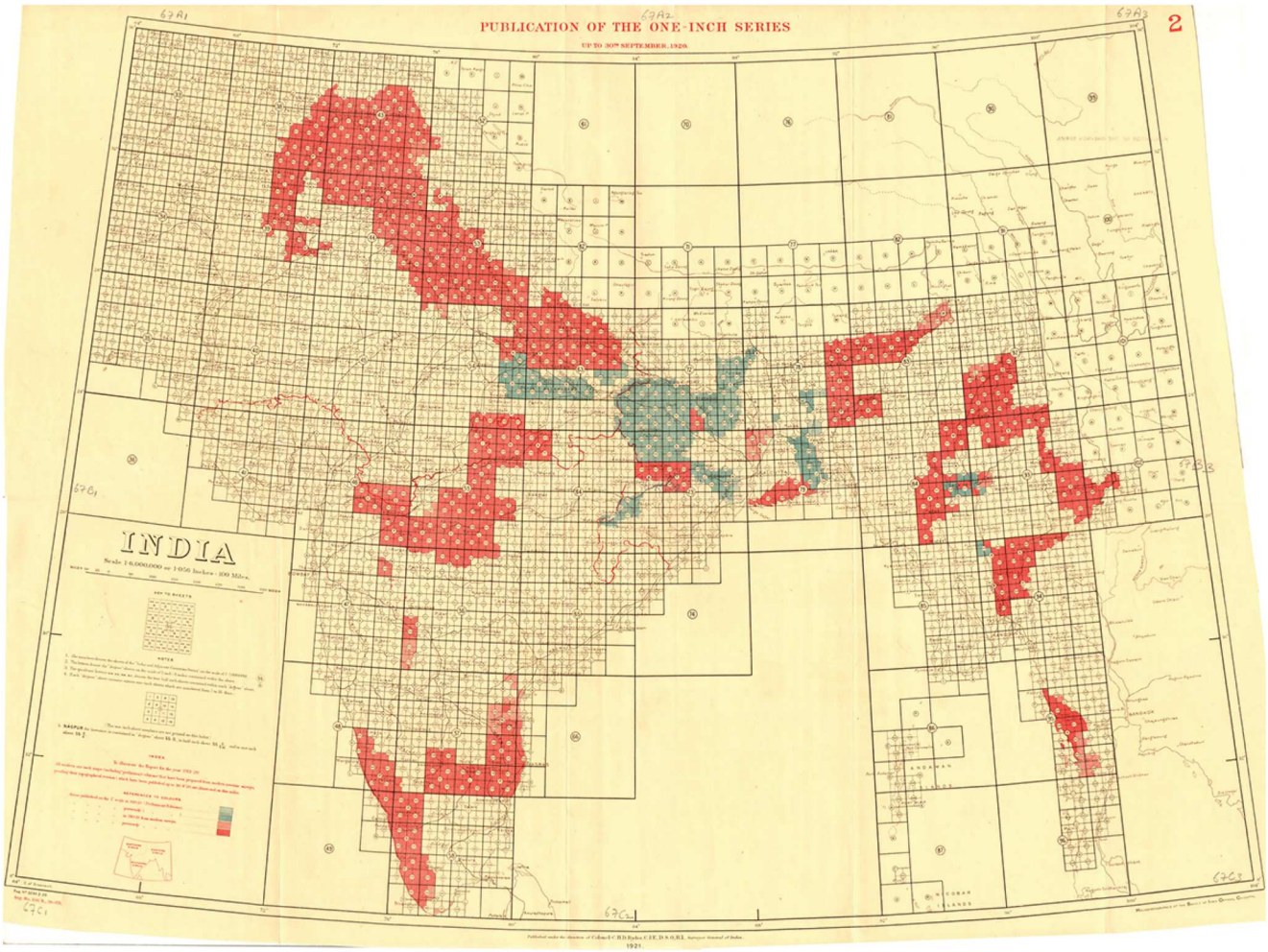

Figure 1. Map showing the progress of the survey and publication of the 1" to 1-mile map series in A.D. 1920 (image Pahar.in; Public Domain; after Petrie et al. 2019, fig. 2a).

how they chose to depict elevated ground and stipulated that "hilly features should invariably be put in, *by the Surveyor* himself, after a careful study of the ground, and without this personal examination in the field, it must be vain to attempt to give even an approximation to truth" (Thuillier and Smyth 1875, 300; cited by Petrie et al. 2019).

It is clear that there was some general awareness amongst the surveyors of the SoI that there were major archaeological sites worthy of attention, as the 1" to 1-mile series maps and gazetteers document a range of archaeological and heritage sites (Petrie et al. 2019). The archaeological sites that are marked on the map sheets are indicated through the use of

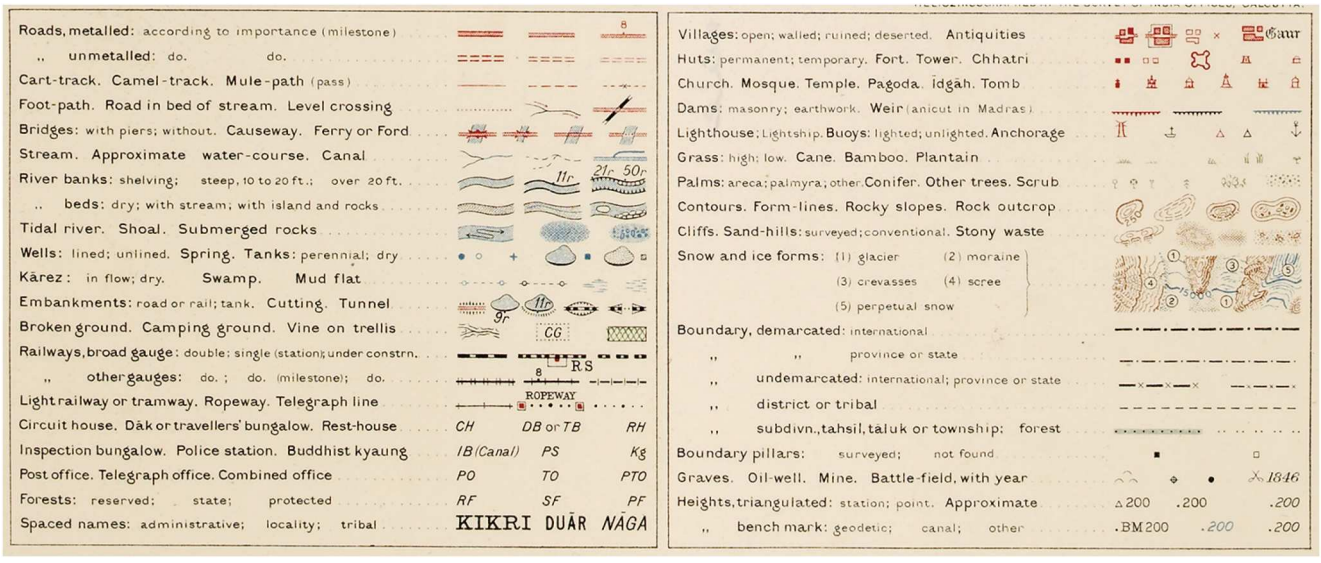

Figure 2. Reproduction of the legend from a Survey of India map from A.D. 1936 (53/D9/1936) showing the symbology for, amongst other things, ruined villages, deserted villages, Antiquities, form-lines, sand-hills, and graves (image courtesy of Cambridge University Library; after Petrie et al. 2019, fig. 4b).

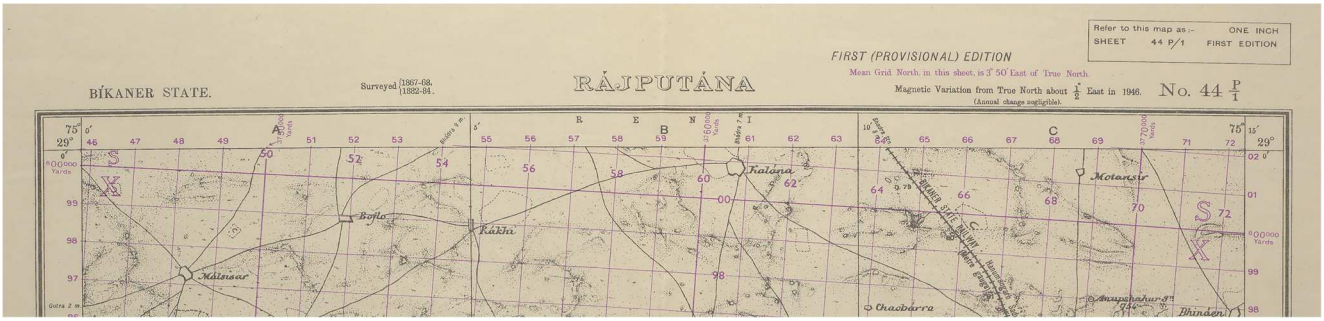

Figure 3. Example of single color map sheet produced during the Second World War (44/P1/1946) based on surveys conducted in A.D. 1867–1868 and 1882–1884, with new grid superimposed in purple. Courtesy of the University Library, Cambridge.

gothic script (Petrie et al. 2019, fig. 5a) and include the ancient sites documented by the ASI up to that time. It is also notable that relatively modern structures such as Nicholson's Obelisk, which was erected in A.D. 1868 (Figure 4), were also recorded, emphasizing that the colonial authorities were conscious of the heritage value of their own monuments.

Petrie and colleagues (2019, figs. 5A, 6A) have shown that a number of well-known archaeological sites comprised of elevated mounds were depicted through the use of form-lines or "lines drawn on a map to indicate the estimated configuration or elevation between the contour lines" (*Oxford English Dictionary*, n.d.). Importantly, form-lines and associated symbology was used to document elevated mound features that were not recognized as archaeological sites at the time the surveys were carried out but which are now known to be so (Petrie et al. 2019). Research conducted for the *Land, Water and Settlement* and *TwoRains* projects demonstrated that the SoI 1" to 1-mile maps from northwestern India in fact used a range of symbols to depict the elevated ground that has the potential to be archaeological mound sites. These symbols include form-lines, sand-hills shown with stippling, vertical hachures, and areas of graves that are marked with semi-circles which are often visible on top of areas demarcated by form-lines (Petrie et al. 2019, fig. 4b). Maps from other regions also use an X symbol to depict deserted villages, and these are sometimes accompanied by a note stipulating "(old site)" or "(abandoned)" (Petrie et al. 2019). Ground-truthing has shown that a high proportion of mound features marked as form-lines or hachures are archaeological sites (Green et al. 2019).

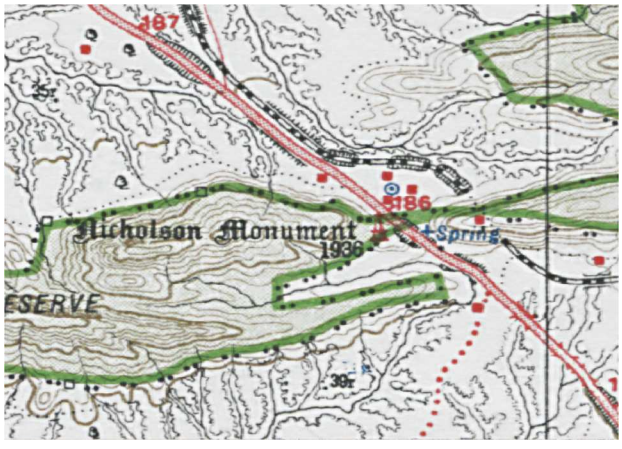

Figure 4. Historical map image showing the Nicholson Monument (43/C14/1910). Courtesy of the British Library, London.

It is not clear whether the surveying teams, and the administrators who superintended them, were aware of the archaeological significance of these small, elevated features that were being recorded, but Bhandarkar's (1912; Possehl 1999, 61) reference to the fact that he "had received glowing accounts of this spot" (i.e. Mohenjo-daro) suggests that they did not assume that they were all natural features. Petrie and colleagues (2019) pointed out that the SoI 1" to 1-mile maps provide a major data source for identifying and locating mound shaped features that might be archaeological mound sites. However, they did not consider the significance that this realization has for understanding the history of "discovery"/"re-discovery" of archaeological sites at an extensive scale nor the possibility that a clearer understanding of who it was that was carrying out the documentation and thus making the "discoveries" might be gained.

The Nature of the SoI Surveys

The SoI was divided into a number of major branches, which were involved with trigonometric and revenue (essentially cadastral) surveys, the latter also being involved in topographic surveying (Kain and Baigent 1992, 325; Edney 1997, 334). The collection of topographic information as part of Revenue surveys was of fundamental importance for being able to document the distribution of land boundaries, particularly land under cultivation, forest, and the like. The nature of each branch, and the equipment that they used, is described in some detail in two editions of *The Manual of Surveying in India* (Smyth and Thuillier 1851; Thuillier and Smyth 1875). It is important to acknowledge that the language used in these manuals reflects the imperial context within which they were created, and there is phrasing that is directly or indirectly racist. This language will be repeated here, as it provides insights into the structures of the survey teams and the racialized administrative structures that they were nested in.

Composition of the survey teams

The Manual of Surveying in India describes the organization of Survey Parties in some detail, outlining the roles and budget and stipulating the duties of the component parts of each team, which is a structure that appears to have been in place following the first regular organization of the Survey Department of India carried out in A.D. 1866 (Thuillier and Smyth 1875, 248, 251). Revenue and Topographical Survey Parties each included similar roles, with the Surveyor being

"permitted to adapt his establishment to the emergencies of his work, and the seasons of the year" (Thuillier and Smyth 1875, 248). According to the manual, the difference was that Topographical Survey used a smaller proportion of "Native Agency" in comparison to "European Agency" (Thuillier and Smyth 1875, 250), with the racialized implication being that the latter work was more technical in nature.

Each survey establishment was separated into Senior and Junior Departments who held the positions of authority and included a number of specific roles and a complement of assistants in other roles (Thuillier and Smyth 1875, 251). The Senior Department included Deputy Superintendents (1st, 2nd, and 3rd grade), Assistant Superintendents (1st and 2nd grades), and Probationers, while the Junior Department included Surveyors (1st, 2nd, 3rd, and 4th grades), Assistant surveyors (1st, 2nd, 3rd, and 4th grades), and Probationers (Thuillier and Smyth 1875, 251). Each Survey Party would have a complement of what is referred to in the manual as "Native establishment," which might include Surveyors, Sub-Surveyors, Draftsmen, Tindals, Classies, Signallers, or Measurers and Carriers (Thuillier and Smyth 1875, 248–249). Of these positions, Classies or Measurers might be engaged in specific roles including Main-circuit and Village Line-cutters, Chain men, Offset men, and Flag men, as well as instrument carriers (Thuillier and Smyth 1875, 256–260).

Survey methods

Field survey was typically carried out from October–June, though there was some variation depending on the region, with the objective being "to prosecute the survey operations to the best advantage, devoting only such time to the elements of the computations as tend to leave no doubt as to the accuracy and entire confidence in the Field observations and measurements" (Thuillier and Smyth 1875, 253). Each survey establishment was divided into as many working parties "as strength permitted" and formed into three–four independent camps "under a competent European or East Indian Assistant," and the work was overseen by a Surveyor or Assistant Surveyor who conducted the survey of topography and its relationship to land boundaries. They specifically worked to complete main or Pergunnah circuits (Thuillier and Smyth 1875, 253)—with a pergunnah (or pargana/parganah) being an old administrative unit that persisted into the period of British control as a geographical term used for land surveys (Hunter 1881; also Phillimore 1945, 1950, 1954, 1958, 1968).

Survey using optical instruments and chains requires the establishment of stations that can be used for triangulation and measurement and is very reliant on clear lines of sight. *The Manual of Surveying in India* notes that in the field, "In addition to a full complement of Classies or Measurers for each Assistant and Native Sub-Surveyor, a considerable number of men of the same class are required for preparing the station lines preparatory to survey; this preliminary duty is most important, and requires much time and skill in its efficient performance, and without all the stations are so marked out ready for the survey party, the valuable time of the Assistant would be lost, and an undue cost thus thrown on the work; frequently there is a vast deal of jungle to be cut through, occupying a line-cutting party several weeks; distinct sets of men are told off for the main circuit and the village circuits" (Thuillier and Smyth 1875, 256).

The Tindal who was "selected from the most expert and intelligent of the Classies" was responsible for placing stations, and Main-circuit and Village Line-cutters cleared the way and put in the stations so that the surveys could be undertaken (Thuillier and Smyth 1875, 256, 273). Main-circuit Line-cutters demarcated larger units, while Village Line-cutters completed smaller circuits of villages (Thuillier and Smyth 1875, 257). As *The Manual of Surveying in India* points out, "Line-cutters' duties are very troublesome and laborious, for they act as pioneers and prepare the country for survey, and have many difficulties to overcome, not only from the nature of the country, but from the delays caused by the non-attendance of village authorities, and the difficulty of procuring the information they require to enable them to carry on their work" (Thuillier and Smyth 1875, 256).

Given that Tindals and Line-cutters were working directly to traverse the landscape, it is likely that the individuals in these roles and the Classies working for them would have been the first to encounter the areas of elevated land that we now know are often archaeological sites. It is also likely that it was the Tindals and Line-cutters who were marking these locations so that they could be documented as topographical features by the Surveyors. Indeed, as is highlighted below, the elevation of some archaeological sites meant that these high-points were used as triangulation stations for trigonometric and topographic surveys or were marked as elevated points with a spot height.

The section of *The Manual of Surveying in India* entitled "The Methods of Preparing and Surveying Village Circuits, and Filling in Topographical Details" outlines how once the Main and Village circuits were laid out, the topographical details were documented, and it was noted that "the stations of which form so many convenient bases, on which this part of the operations may be laid down with very great facility and precision. […] For topographical work generally, and filling in triangles of any extent or for details generally, the Plane Table is now in general use, and is the best contrivance for the purpose, but for details confined within such narrow limits as village circuits of 400 or 500 acres it is not essential, and the practice therefore on the Revenue Surveys was to employ a simple Drawing Board and T Square […], which is far more portable, can be carried in the hand, and with the aid of the common rectangular or circular Protractor enables the Assistant to draw the whole of the topography in the field with great despatch, and is peculiarly suited for Native Agency" (Thuillier and Smyth 1875, 279).

The interior detailing within a village circuit appears to have been in the hands of a Native Sub-Surveyor, who made use of the station lines and laid down topographical items in an order: starting with conspicuous objects, all geographical item were laid down, and the different descriptions of the land were separated, including "cultivation, waste, fallow, village locations, land for different purposes" (Thuillier and Smyth 1875, 279, 281). "With such an extent of Native Agency as is employed on all the surveys in India, it is a great object to plot all work in the field—it saves an immensity of labor, and the chances of accuracy are greatly increased; by the aid of the drawing board much can be sketched in, and the first impression of a locality is not

lost, but at once represented on the plan" (Thuillier and Smyth 1875, 282).

The Manual of Surveying in India makes it clear that a significant if not overwhelming proportion of the detailed information that appears to have made its way onto SoI maps was being documented by South Asians. Credit for this contribution, however, is minimized by the racialized and de-personalized language used in the descriptions, and opportunities to denigrate are taken frequently. For example: "Field-books kept by Natives ignorant of English may better be imagined than described. It is always difficult for any Surveyor to understand fully a Field-book kept by another person, but where novices on 10 or 15 rupees per mensem attempt to keep such records, and hurry on at the railroad pace of a Revenue Survey in the present age, we do not envy the person who has to protract from them. The Native Sub-Surveyor who brings in his board well filled, displays at once what amount of work he has done, and a Superintending Officer is able to see at a glance what confidence is to be placed on the topography so defined" (Thuillier and Smyth 1875, 282). Or: "To ensure the greatest amount of accuracy in surveying and mapping the topographical features of a country, a certain percentage of the interior details must be duly checked by competent hands. Especially where a large amount of native agency is employed, the 'Purtal' or check resurvey of certain lines of country, as directed by the head of the party, is always carried out by European Agency, and these check surveys are sent in for comparison with the original field sections. Plane Table Boards are taken into the field and examined in situ and also traces or route lines with Theodolite and Chain, where practicable, are run across the board so that the general accuracy of the features, as laid down by the surveyor, may be tested. Without such 'Purtal' or check over completed work, no confidence is placed in the survey as rendered" (Thuillier and Smyth 1875, 284–285).

It is clear that great importance was placed on accuracy, and this extended to hills, and by association areas of elevated land that were documented as mound features: "In sketching hilly ground great care and superior judgment are necessary. Small ranges of hills, when met with, generally form the boundary of some pergunnah or other local subdivision, and therefore come under the immediate cognizance of the Deputy Superintendent or his European assistants and are properly intersected and laid down by triangulation in connection with the angular work of the main circuit. This duty should, on no account, be entrusted to any Native Sub-Surveyors, who are only qualified to follow a simple routine course, which has been duly prepared and marked out for them, and who perform mechanical duties very well without understanding the reasons. Unless the officer in responsible charge himself is careful to superintend personally this the most difficult part of his operations, the faithfulness and style of his general maps will be inevitably damaged. The operation of sketching the features of ground cannot be rendered intelligible by description alone, nothing but a matured judgment and experience on the part of a Surveyor will enable him to attain to any degree of accuracy in this respect. We defer all remarks on the shading and delineation of hills for another chapter" (Thuillier and Smyth 1875, 285). The racist language is extremely unpalatable, and it adds an element of ambiguity to our understanding of which roles were responsible for recording actual hills as opposed to elevated mound features. The former were potentially always the responsibility of Surveyors, but the latter may well have been recorded by Native Sub-Surveyors, which is significant for the arguments being developed here.

Production of final maps

Once the groundwork for the surveys was completed, there was considerable work required to compile and draw individual maps, which started with placement of survey stations, the main/exterior circuit, the village stations, and the interior circuit (Thuillier and Smyth 1875, 292–293). Once the "skeleton map" was completed, details were added in color and a special place was given to hill-shading (Thuillier and Smyth 1875, 296). Although the text is primarily discussing higher elevations and ranges, the description of the approach to hill shading is relevant to our understanding of the documentation of elevated mound features and is worth quoting in detail: "There are two methods of describing hills, both in the field and in the drawing room. One called the vertical, and the other the horizontal style, which are, or rather should be, peculiar to the pencil or pen; for there is no absolute necessity for having recourse to any touches on an Indian ink plan, if the irregularities of surface are properly described by shade. In the first method the shade is formed by strokes of the pencil or pen radiating from or converging into any curved part of a hill, according as it projects or re-enters:—they are supposed to describe the same course as water would do, if it could trickle in streams down the slopes, and are darker or lighter according to the steepness of the slope. The other method has the shade formed by lines parallel, or nearly so, to the horizon. It is much more easy to apply, and more natural than the former, and has some claim to particular notice from its easy application in sketching, and the facility with which it may be demonstrated and acquired. The horizontal manner marks the contours of hills by waving lines, each line continuing on the same level, while following every undulation of the ground. In practice, either or both of the styles may be used at the pleasure of the draftsman, or as may be best suited to the nature of the ground he wishes to portray" (Thuillier and Smyth 1875, 298–299).

The Manual of Surveying in India describes the production of maps in some detail and notes that the Native Establishment of each survey team included Surveyors, Sub-Surveyors, Draftsmen, Tindals, Classies, Signallers, or Measurers and Carriers (Thuillier and Smyth 1875, 248–249; see above). Assessment of a large number of SoI map sheets has shown that in many instances before A.D. 1905, the draftsmen and typographers are named and include both European and South Asians (see below). This detailed assessment is intended to show that what was referred to as the "Native establishment" not only played a critical role in the execution of the SoI topographic and revenue surveys, but they were also very likely involved in the identification and documentation of mound features, many of which we now know are archaeological sites.

Recasting the Process of Early Discovery

The earliest phases of South Asian archaeological research were certainly carried out in the context of a period of imperial domination, but it is becoming increasingly clear that the processes of "rediscovery" were far more nuanced and

layered than previously thought. The description of the execution of the work of the SoI suggests that in addition to Surveyor and Sub-Surveyors, the documentation of the topography that was being surveyed involved large numbers of other individuals, including Tindals and Line-cutters who are likely to have been the first people to traverse the ground and pick out areas of elevation to facilitate the work of each survey team. It is notable that the work of these individuals is reflected in the documentation of heights on the maps through a specific type of notation, where "r" means "relative height," measuring, in feet, the height of a feature relative to the surrounding ground level. The explanation shown in Figure 5 is only visible on some maps. Such measurements are found on many of the mound features identified as archaeological sites because of their notable elevation.

In the following sections, we have compiled brief accounts of the history of archaeological discovery of a selection of sites related to the Indus civilization, and we have added newly revealed information garnered from the SoI maps, which demonstrates that many well-known sites were documented years, if not decades, before they were "discovered"/"re-discovered" by archaeologists (Figures 6–16). It should be noted that where they are shown on the original maps, we have documented the names of the agents involved in the survey and map production, including Assistants, Sub-Surveyors, drawers, and typists.

Harappa

Harappa was one of the only Indus sites known to surveyors in the early stages of the topographic survey and was marked as an "Antiquity" or ancient city. The mounds at Harappa had been described by Charles Masson and Alexander Burnes in the 19th century A.D. and were thought, incorrectly, by Cunningham (1871, 241), to be "another city of *Malii*," referring to Arrian's *History of Alexander's Expedition* (Petrie et al. 2019, 9). By the time the A.D. 1933 SoI map was created (see Figure 6), Harappa was well known and even had a museum on-site (labeled as such on the map). The site itself has been depicted as two form-line mounds that align roughly with the known, excavated part of the city, and the area is also clearly marked as the Sites of Ancient Cities of Harappa in the gothic script used to mark Antiquities. Red X symbols also indicate the presence of a "deserted village" to the northwest of these mounds and small, semi-circular symbols on the western mounds also suggest an area of burials, though both symbols can be used for archaeological and relatively modern features interchangeably. There is also an area marked with hachures. The site, then and now, lies in the vicinity of the modern town of Harappa, and as such, some of the modern houses were also built on the mounds. This may have been the reason why no triangulation station is visible in the immediate vicinity on the map, though a number of different relative heights were recorded on the map.

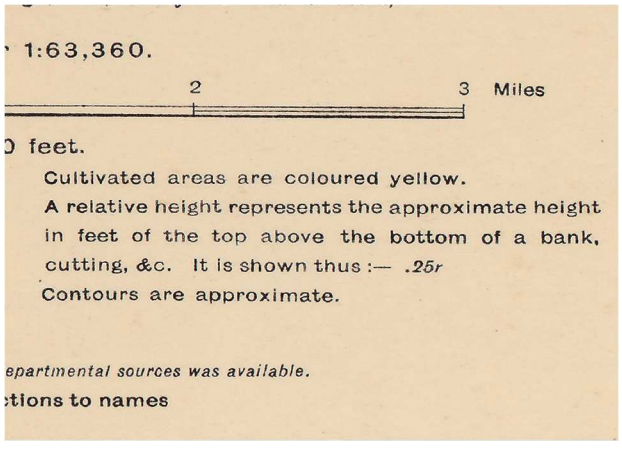

Figure 5. Notation recorded on Map No. 53 C 3 (Punjab). Courtesy of the University Library, Cambridge.

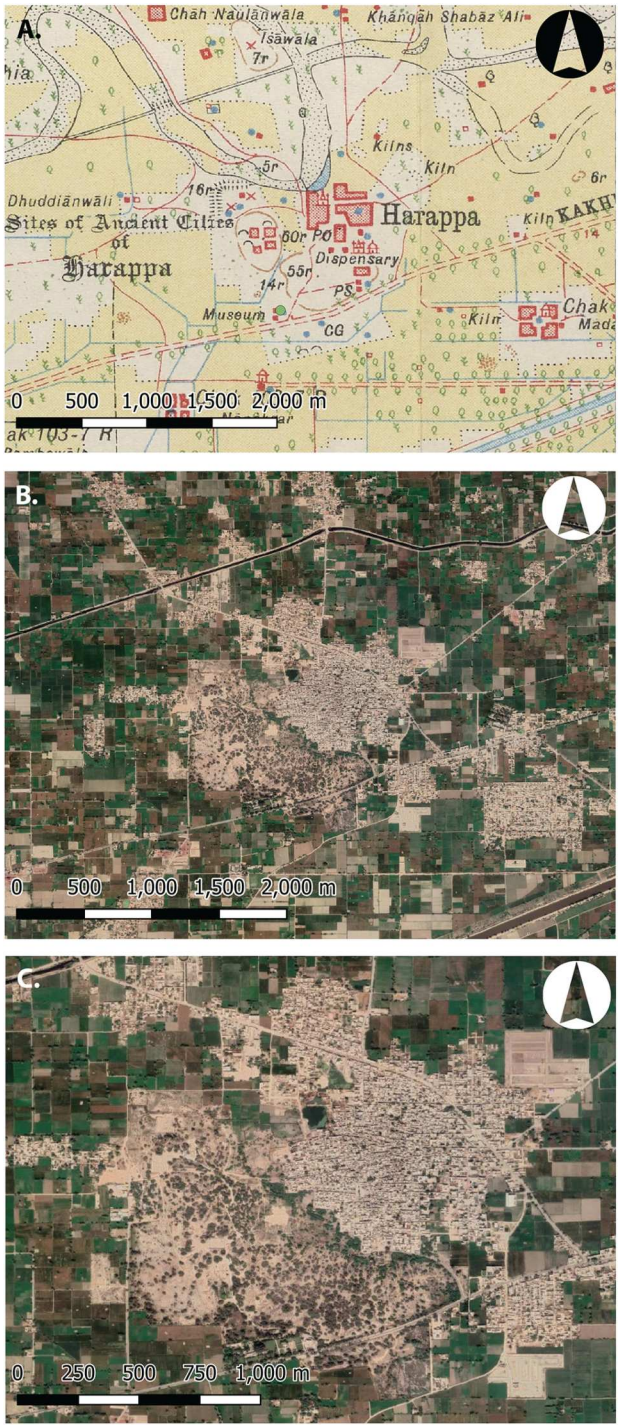

Figure 6. Harappa. A) Historic map image of Harappa (44/B14/1933, published A.D. 1933); year surveyed: A.D. 1931–1932; Surveyor: not mentioned; Surveyor General: Brigadier R. H. Thomas, D. S. O.; additional information about agents: nothing additional; indications of elevation: spot heights of 55r, 50r, 16r, 14r; symbology style: form-lines, graves, x signifying deserted village(s), hachures, and gothic script; courtesy of the University Library, Cambridge. B) Harappa shown on a modern satellite image at the same scale. C) Harappa shown on a modern satellite image in close up.

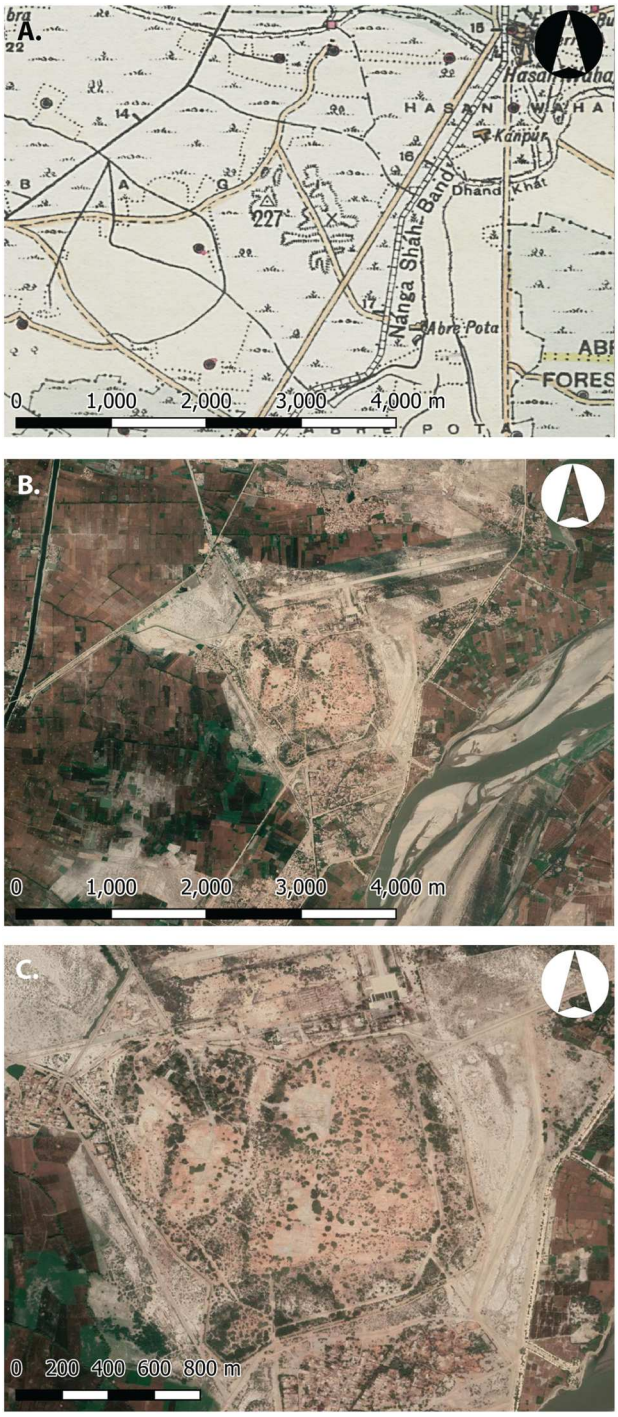

Figure 7. Mohenjo-daro. A) Historic map image of Mohenjo-daro (Sind Sheet 41/1903; equivalent of 40/A3/1903 and 40/A7/1903, published A.D. 1903 [August]); year surveyed: A.D. 1901–1902; Surveyor: Major S. G. Burrard, Superintendent Trigonometrical Surveys by Mr. C. F. Erskine; Surveyor General: Colonel St. G. C. Gore, C. S. I., R. E.; additional information about agents: survey assisted by Mr. R. Warwick, Munshi Rahmatullah, Babu Dhani Ram, and Sub-Surveyors. Drawn by Abdul Wahid and Alay Ahmad II. Typed by Anwar Ali and Alay Ahmad I.; indications of elevation: triangulation station 227; symbology style: hachures mound, X deserted village; courtesy of the British Library, London. B) Mohenjo-daro shown on a modern satellite image at the same scale. C) Mohenjo-daro shown on a modern satellite image in close up.

Mohenjo-daro

The first visit and description of Mohenjo-daro is typically credited to Devadatta Ramkrishna Bhandarkar in A.D. 1911 (1912; Possehl 1999, 61; 2002, 12; Lahiri 2005, 211; see above), but the mounds were first surveyed in A.D. 1901–1902 and published on a map in A.D. 1903—nine to ten years earlier (see Figure 7). The depiction on the SoI map sheet suggests that the "stupa" on the Mound of the Great Bath might have been used as a triangulation station, while the lower mounded areas are marked with an x, representing a deserted village. The map depiction also suggests that the site was recognizable as a multi-mounded entity, though no specific or separate mound heights were included. The map shows a road cutting through the center of the mounds of the site, but otherwise they were relatively untouched by urban development at the time. This map was produced before the standardized symbology and four-color printing was being used for maps of Sindh.

Rakhigarhi/Rakhi Khas and Rakhi Shapur

Rakhigarhi was first documented archaeologically by Suraj Bhan (1968; 1975, 95–102; also *Indian Archaeology 1963–64: A Review*, 90; Joshi, Bala, and Jassu 1984, 521; Possehl 1999, 813), who was first shown the site in 1964 by Acharya Bhagwar Dev ji, and Suraj Bhan (1975, 95) revisited it in 1973 after urging from "certain fellows of the Archaeological Society of India at the annual conference held at Kurukshetra in 1972." Mounds at this location had actually been documented 50 years earlier in a SoI map sheet published in A.D. 1915, which was based on surveys in A.D. 1913–1914. Rakhigarhi is distinct from other major Indus sites in that the largest of the mounds is the highest (see Figure 8; Petrie 2019). The highest part of the site appears to have been used as a triangulation station, and a number of different mound heights were recorded on the map. As with Harappa, the modern towns of Rakhi Khas and Rakhi Shahpur, as they were at the time of the survey, lie on top of much of the mounds. The northern mounds, of which the largest was used as a triangulation station, are the location of the currently excavated area at the site. Excavations have been carried out under the direction of Amarendra Nath from 1997–2000 (Nath 1998, 1999, 2001, n.d.) and Vasant Shinde from 2013–2016 (Shinde et al. 2013, 2018, 2019), and new excavations are underway as of 2024.

Dholavira/Kodadi/Khadir

An archaeological site near the village of Dholavira (Khadir) was reported as a site named Kodadi (text) and Kotadi (map, figure caption) in *Indian Archaeology 1967–68: A Review* as part of a survey of Kutch carried out by J. P. Joshi with assistance by K. P. Gupta, K. D. Tripathi, and N. C. Shah (*Indian Archaeology 1967–68: A Review*, 17, fig. 4). No specific comments were made about the significance of the site in that report, but it was subsequently mentioned by Possehl (1982b, 97; 1999, 754), Joshi, Bala, and Jassu (1984, 529), and Bisht (1989, 1991). Excavations were carried out from 1989–1990 to 2004–2005 (Bisht 1997, 1999, n.d.). Mounds at this location had actually been documented over 70 years earlier on a SoI map sheet published in A.D. 1886, which was based on surveys in A.D. 1883–1884 (see Figure 9). The location appears to have a triangulation station number and is named Kotada. The map depiction suggests that the site was marked by complex topography, though no specific mound heights were included. The delineation of the site is not entirely clear, but the highest part of the site (The Citadel) appears to have been used as a triangulation station.

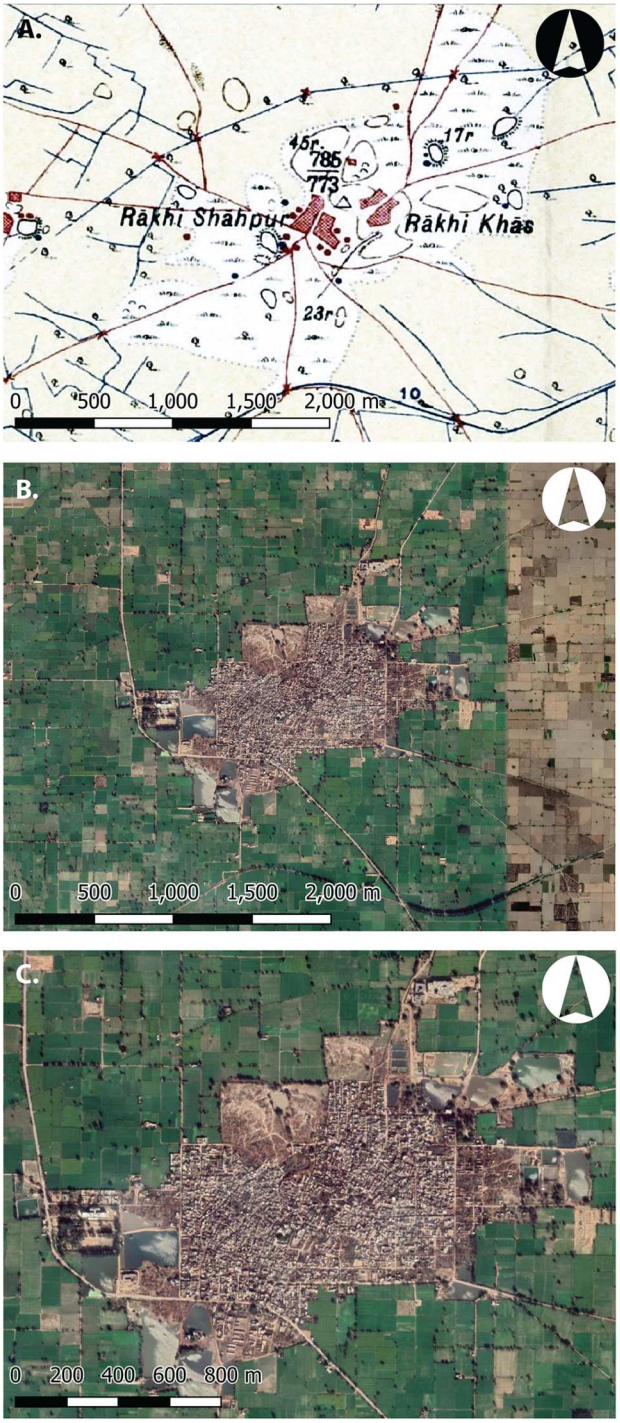

Figure 8. Rakhigarhi/Rakhi Khas and Rakhi Shapur. A) Historic map image of Rakhigarhi (53/C3/1915, published A.D. 1915); year surveyed: A.D. 1913–1914; Surveyor: not mentioned; Surveyor General: Colonel Sir S. G. Burrard; additional information about agents: nothing additional; indications of elevation: triangulation station 785/773; spot heights of 45r, 23r, 17r; symbology style: formlines, graves; courtesy of the University Library, Cambridge. B) Rakhigarhi shown on a modern satellite image at the same scale. C) Rakhigarhi shown on a modern satellite image in close up.

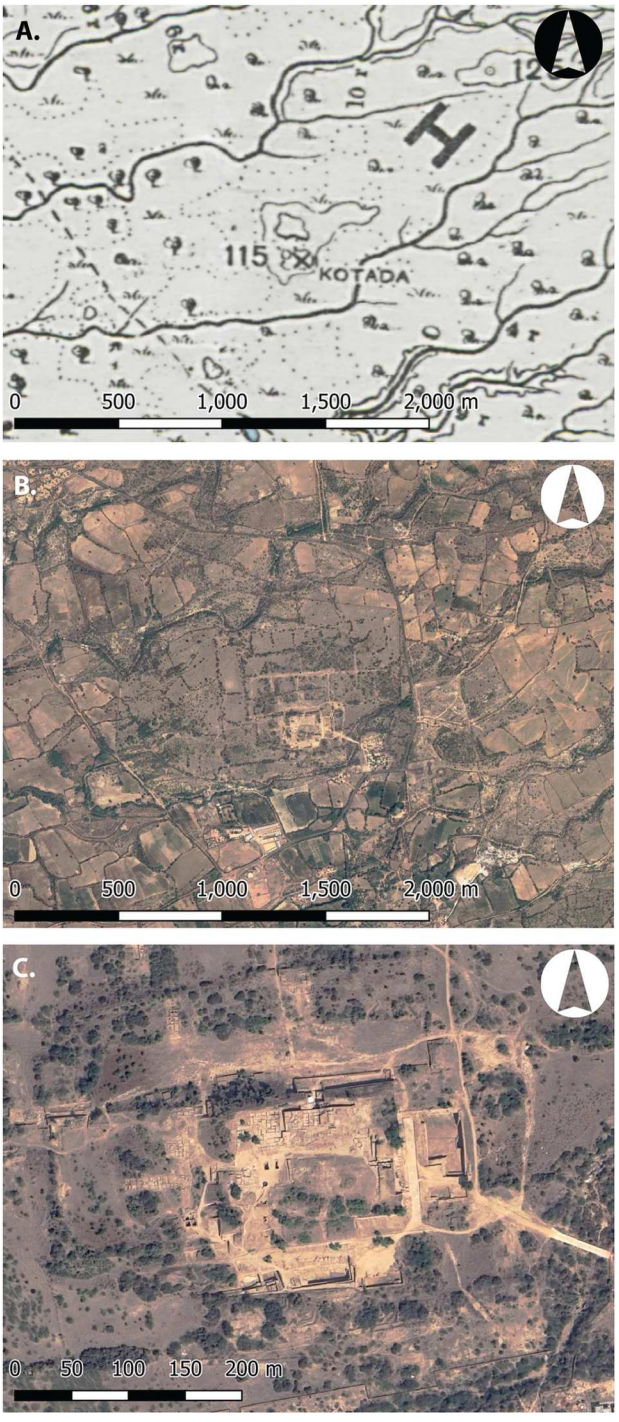

Figure 9. Dholavira/Kodadi/Khadir. A) Historic map image of Dholavira (Sheet No. 26 of Cutch [or 41I01], published A.D. 1886); Surveyor: Mr. N. C. Gwynne; Surveyor General: Colonel G. C. DePree, S. C.; additional information about agents: topographical details by Messrs G. T. Hall and P. F. Prunty, Assistant surveyors, and Sub-surveyors G. R. Bhopatkar, K. V. Kolarkar, M. D. Patwardhan, and R. V. Joshi. Traversing by T. G. Chowdri. Mapping by Messrs. G. T. Hall and P. F. Prunty, Assistant Surveyors, and Sub-surveyors G. R. Bhopatkar, and S. Khanduji. Hill Shading by Lieut.-Colonel A. Pullman, S. C.; indications of elevation: triangulation station 115; courtesy of the British Library, London. B) Dholavira shown on a modern satellite image at the same scale. C) Dholavira shown on a modern satellite image in close up.

Ganweriwala/Ganwaree Thair

An archaeological mound site identified as Ganweriwala was first reported by Prof. M. R. Mughal, and its discovery was one of the major finds of the survey of Cholistan that was carried out under Mughal's direction in the 1970s and subsequently presented in multiple publications (Mughal 1981, 1982, 1984, 1990a, 1990b, 1992, 1994) and a final definitive volume (Mughal 1997, 49–50). Assessment of the Punjab Revenue Survey map sheets has shown that one or potentially two connected mounds labeled Gawaree Thair were recorded at this location during the A.D. 1872–1874 survey seasons, almost 100 years earlier (see Figure 10). The map depiction uses stippling to demarcate an area of elevation, and it is differentiated from the surrounding sand dunes only through the use of two x symbols to indicate that it was a deserted village. The basis for the identification is not made clear, but it is technically correct. The mound is not labeled as having been used as a triangulation station. The site has been resurveyed

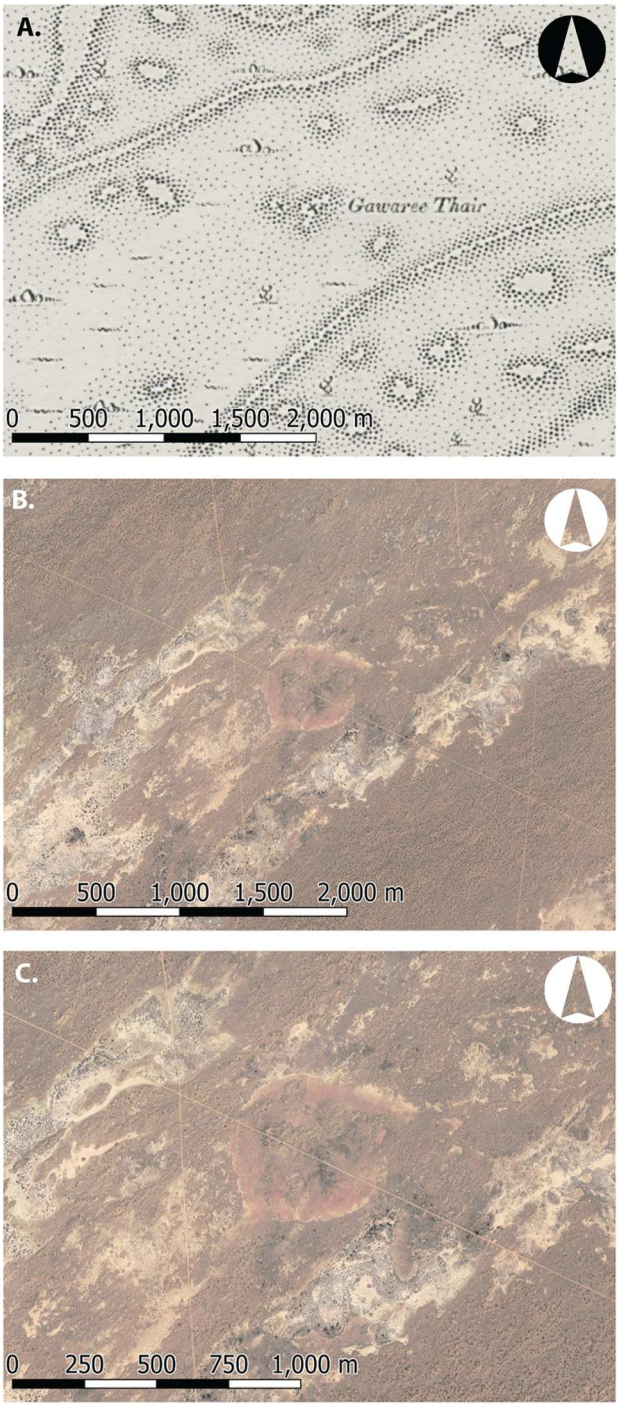

Figure 10. Ganweriwala/Ganwaree Thair. A) Historic map image of Ganweriwala (Punjab Revenue Survey Sheet No. 30, published A.D. 1876); year surveyed: A.D. 1872–1874; Surveyor: Captain D. C. Andrew, Offg. Deputy Superintendent of Revenue Survey and Assistants; Surveyor General: Colonel H. L. Thuillier, C. S. I. F. R. S.; additional information about agents: Sheet of the Revenue Survey of India, under the Superintendence of Colonel J. E. Gastrell, F. R. G. S., Superintendent of Revenue Surveys, Upper Circle; indications of elevation: none; symbology style: stippling, two instances of X deserted village; courtesy of the British Library, London. B) Ganweriwala shown on a modern satellite image at the same scale. C) Ganweriwala shown on a modern satellite image in close up.

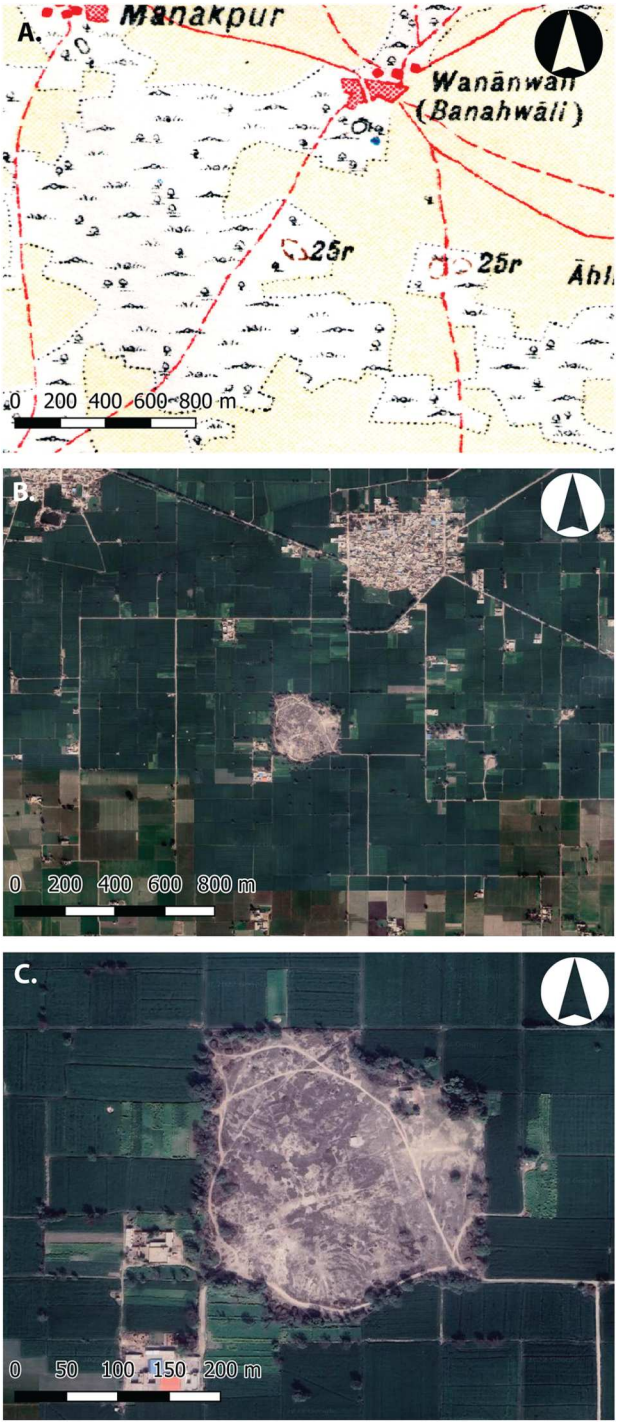

Figure 11. Banawali/Vanawali/Wananwali/Banahwali. A) Historic map image of Banawali (44/O6/1915, published A.D. 1915); year surveyed: A.D. 1913–1914; Surveyor: not mentioned; Surveyor General: Colonel Sir S. G. Burrard; additional information about agents: nothing additional; indications of elevation: spot height of 25r; symbology style: form line; courtesy of the University Library, Cambridge. B) Banawali shown on a modern satellite image at the same scale. C) Banawali shown on a modern satellite image in close up.

several times (e.g. Masih 2018), and formal excavations were commenced for the first time in 2024.

Banawali/Vanawali/Wananwali/Banahwali

The site of Banawali was originally documented as Vanawali and was discovered by Suraj Bhan in 1965 (Suraj Bhan 1975, 95, n. 2; Bisht 1982, 115; Joshi, Bala, and Jassu 1984, 519, 521; Possehl 1999, 735) and subsequently excavated under the direction of R. S. Bisht in 1974–1977 (Bisht 1976, 1977, 1978, 1982). Mounds at this location had been documented 50 years earlier in a SoI map sheet published in A.D. 1915, which was based on surveys carried out in A.D. 1913–1914. It is notable that the name Wananwali was used, with "Banahwali" listed in brackets below (see Figure 11). Suraj Bhan (1975, 95, n. 2) described it as a "twin mound" of unspecified size, though this was questioned by Bisht (1982, 115), who described the site as a single mound

extending across an area of 400 × 400 m in extent and standing 10 m in height. There is a single mound visible on both the A.D. 1915 map and the modern satellite imagery that corresponds spatially with the mound described by Bisht, but it is notably smaller than the 16 ha noted by him—and has an elevated mounded area of as little as 4–6 ha. It is possible that the "twin mound" noted by Suraj Bhan is represented by two separate elevated mound features shown on the A.D. 1915 map approximately 500 m to the east of the mound excavated by Bisht.

Bhirrana

A site at Bhirrana was first listed in the compilation of sites prepared by Joshi, Bala, and Jassu (1984, 519, 521; Possehl 1999, 740), and it was also published in *Indian Archaeology 1985–86: A Review* (26–29), which was a record of a village-to-village survey conducted by Dhoop Singh and Chander Pal Singh of the Department of Archaeology and Museums, Haryana. Mounds at this location had been documented 70 years earlier in a SoI map sheet published in A.D. 1915, which was based on surveys carried out in A.D. 1913–1914 (see Figure 12). Excavations were carried out at the site between 2003 and 2006 under the Saraswati Heritage Project of the ASI (Rao et al. 2004, 2005, 2006; Rao 2006; also Sarkar et al. 2016).

Chanhu-daro

This site was first discovered in A.D. 1931 by N. G. Majumdar, the Assistant Superintendent of the ASI, who described it as "three ancient mounds" and a "small site" when compared to sites such as Mohenjo-daro (Majumdar 1934; Possehl 1999, 746). A deserted village at this location had been documented 25 years earlier in a SoI map sheet published in A.D. 1906, which was based on surveys carried out between A.D. 1893 and 1904 (see Figure 13). The map does not define a mound in this area distinctly. Instead, a dotted line is used to demarcate the limit of cultivation, and a black X indicating the presence of a deserted village sits inside that line. This map is based on much earlier, pre-A.D. 1900s, surveys and was produced before the standardized symbology and four-color printing was being used for maps of Sindh. Though a distinct mound is not marked, the location of the deserted village and the limits of cultivation fall approximately in the area of the excavated site. This is perhaps a good example of the developing understanding and recording of mounds from the pre-A.D. 1900 surveys to the post-A.D. 1905 maps. Chanhu-daro was excavated in A.D. 1935–1936 by E. J. Mackay, of the first American Archaeological Expedition to India (Mackay 1943), and more recent excavations have been conducted by a collaborative Pakistani-French team (Didier et al. 2017). The extensive excavations revealed fired brick buildings, streets, and drain systems and planning systems comparable to some of the larger sites.

Kot Diji

Adjacent to the modern town of Kot Diji, this archaeological site is depicted on a SoI map from A.D. 1906 as a contour mound surrounded by a dotted line, and it continues to be quite visible in satellite imagery (see Figure 14). It appears to have been surveyed in A.D. 1900–1902 with the assistance

Figure 12. Bhirrana. A) Historic map image of Bhirrana (44/O10/1915, published A.D. 1915); year surveyed: A.D. 1913–1914; Surveyor: not mentioned; Surveyor General: Colonel Sir S. G. Burrard; additional information about agents: nothing additional; indications of elevation: spot height not recorded; symbology style: form-line and graves; courtesy of the University Library, Cambridge. B) Bhirrana shown on a modern satellite image at the same scale. C) Bhirrana shown on a modern satellite image in close up.

of Messrs. R. Warwick and E. Bond, along with Babn Dhani Rám and Sub-Surveyors. The first major report on the site does not record when it was first visited or recorded, but excavations were carried out at Kot Diji during two short seasons in 1955 and 1957 under the direction of F. A. Khan (1965, 14–15; Possehl 1999, 784).

Rehman Dheri

Rehman Dheri was formally identified in 1971 by Prof. Ahmad Hasan Dani (1970–1971, 28–31) and then

Figure 13. Chanhu-daro. A) Historic map image of Chanhu-daro (40/B4&B8/1906, published A.D. 1906); year surveyed: A.D. 1893–1894, 1898–1899, 1903–1904; Surveyor: not mentioned; Surveyor General: Colonel F. B. Longe; additional information about agents: nothing additional; indications of elevation: spot heights not recorded; symbology style: x signifying deserted village, dotted line limit of cultivation; courtesy of the British Library, London. B) Chanhu-daro shown on a modern satellite image at the same scale. C) Chanhu-daro shown on a modern satellite image in close up.

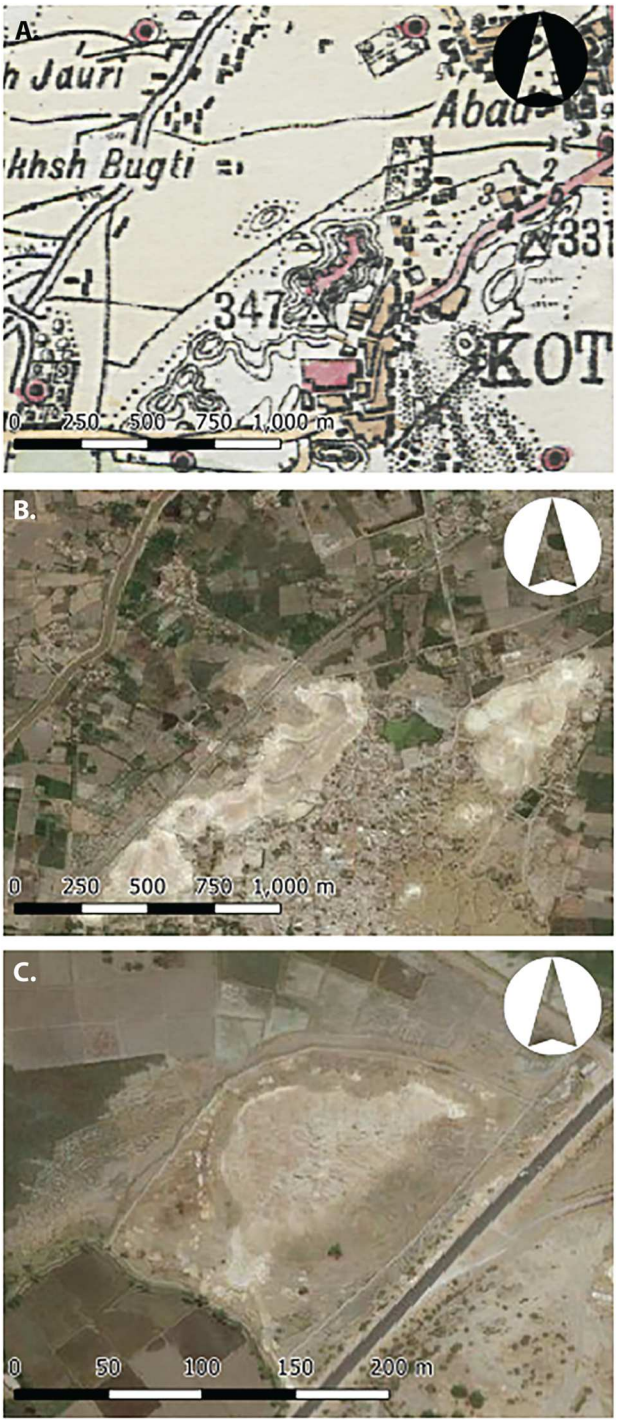

Figure 14. Kot Diji. A) Historic map image of Kot Diji (Sind Sheet No. 40/A11/1906; equivalent of 40/A11/1906 and 40/A15/1906, published A.D. 1906); year surveyed: A.D. 1900–1902; Surveyor: Major S. G Burrard, R. E., Superintendent Trigonometrical Surveys, by Mr. C. F. Erskine; Surveyor General: Colonel F. B. Longe, Surveyor General of India; additional information about agents: assisted by Messrs. R. Warwick and E. Bond and Babn Dhani Rám and Sub-Surveyors. Drawn by Mr. E. Bond and Babu Dhani Rám, Muhammad Akbar, and Abbás Ali. Typed by Lál Bihari Lál and Anwar Ali; indications of elevation: triangulation station 347; symbology style: contours; courtesy of the British Library, London. B) Kot Diji shown on a modern satellite image at the same scale. C) Kot Diji shown on a modern satellite image in close up.

excavated between 1976 and 1982 and again in 1991 by Prof. Farzand Ali Durrani (1981, 1986, 1988, 1991; Durrani, Ali, and Erdosy 1995). A mound at this location had been documented 60 years earlier in a SoI map sheet published in A.D. 1909, which was based on surveys carried out in A.D. 1907–1909 (see Figure 15). It is depicted on the map as an irregularly shaped double form-line mound: in other words, it has a form line inside another form line to indicate differing gradients of slopes. The very center of the mound is marked with a red X that indicates a deserted village. This mound was far from modern settlements and so sat relatively undisturbed, apart from a road running along its southwestern side. The mound is still clearly visible in satellite imagery, though it has been partially damaged and is surrounded by cultivated land. The excavations have shown that the site dates roughly from 3300–1900 B.C. and may have a regular grid of streets and structures (Zubair 2016).

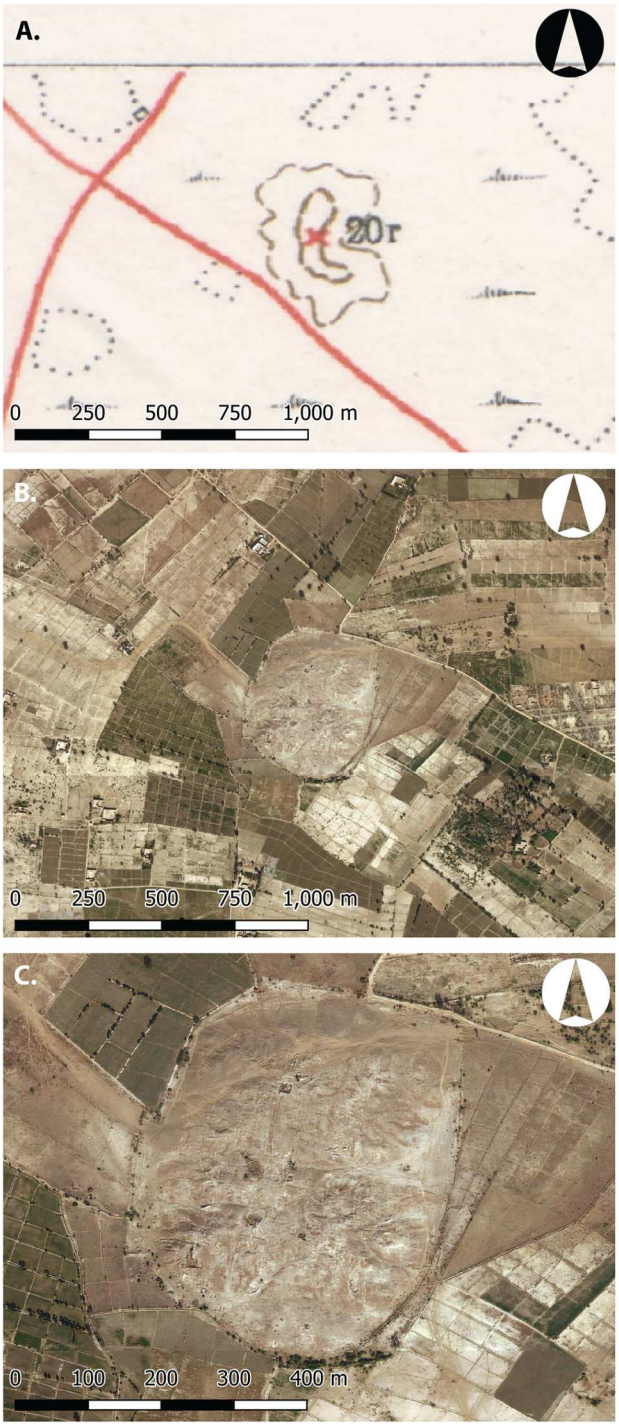

Figure 15. Rehman Dheri. A) Historic map image of Rehman Dheri (39/I13/1909, published A.D. 1909); year surveyed: A.D. 1907–1908; Surveyor: not mentioned; Surveyor General: Colonel F. B. Longe R. E.; additional information about agents: nothing additional; indications of elevation: spot height of 20r; symbology style: form-lines mounds, X deserted village; courtesy of the University Library, Cambridge. B) Rehman Dheri shown on a modern satellite image at the same scale. C) Rehman Dheri shown on a modern satellite image in close up.

Ropar/Rupar/Rupnagar

There are three prominent mounds at Ropar (now Rupar/Rupnagar), and the largest, which stands 21 m in height, was initially excavated under the direction of Y. D. Sharma in 1953–1954 and 1954–1955 (Sharma 1956, 121–129; also *Indian Archaeology 1953–54: A Review*, 6–7; *Indian Archaeology 1954–55: A Review*, 9). It was the first Indus civilization site excavated in independent India, and the initial excavations revealed six phases of occupation spanning from the Indus urban phase (Periods IA/IB) through the Painted Grey Ware period and up into the Early Historic period (Sharma 1956, 121–129; also *Indian Archaeology 1953–54: A Review*, 6–7; *Indian Archaeology 1954–55: A Review*, 9). The mound is protected by the ASI. New excavations in 2011–2012 were carried out under the direction of V. N. Prabhakar and Shahida Ansari (2015). The excavations by Sharma are significant for a range of reasons, but a mound at this location was documented 40 years before those initial excavations on a SoI map published in A.D. 1914, which was based on surveys carried out in A.D. 1912–1913 (see Figure 16). Even at that stage, the modern town was encroaching the main mound, and it now surrounds it entirely. It is notable that a full contour line is used to delimit the mound and also that its shape is similar to its current form. Only one adjacent mound is clearly visible on the historic map, though there are some areas where graves are indicated.

How Many Sites have been Hidden in Plain Sight?

To understand the significance of the systematic documentation of mound features by surveyors of the SoI, it is important to have some understanding of how many previously unidentified archaeological sites are documented as mound features on the SoI maps—though that is an exercise in trying to count "known unknowns." As part of its work of attempting to document all of the identified archaeological heritage in the Indus River Basin and surrounding areas, the MAHSA project (2020–2029) is working alongside collaborating institutions in both Pakistan and India, making use of integrated documentation protocols and workflows that employ all available data on site location in the public record and comparing that information to prospective site locations from the SoI maps.

Since the 1950s and 1960s, academic books and journals have published lists of archaeological sites discovered in western India and Pakistan ("legacy data"), and a number of scholars have attempted to compile these legacy data and use it to draw conclusions about the ancient societies in South Asia (e.g. Joshi, Bala, and Jassu 1984; Possehl 1999). As in many parts of the world, some documentation projects have occurred under the auspices of United Nations and UNESCO development programs (e.g. Meskell 2019; see also Luke and Meskell 2023; Olson and Luke 2023), but there have also been province-scale surveys by specific Departments of Archaeology and Museums (e.g. Mughal et al. 1996).

Since 2008, Cambridge-based researchers have progressively reviewed these published archaeological settlement data for the Indus River Basin. Subsequent collaborative ground-truthing in northwestern India has demonstrated that there is significant imprecision in much of the current primary site location data (see Singh et al. 2008; Petrie et al. 2017; Green and Petrie 2018). This imprecision in site locations is primarily due to the limitations of the methods used to locate sites spatially, and this has been exacerbated by inconsistent practices in site documentation and attribution, and as well as substantial gaps in spatial coverage (see Petrie et al. 2017). These factors limit understanding of the distribution of archaeological and cultural heritage in the region and make it difficult to manage and protect this resource.

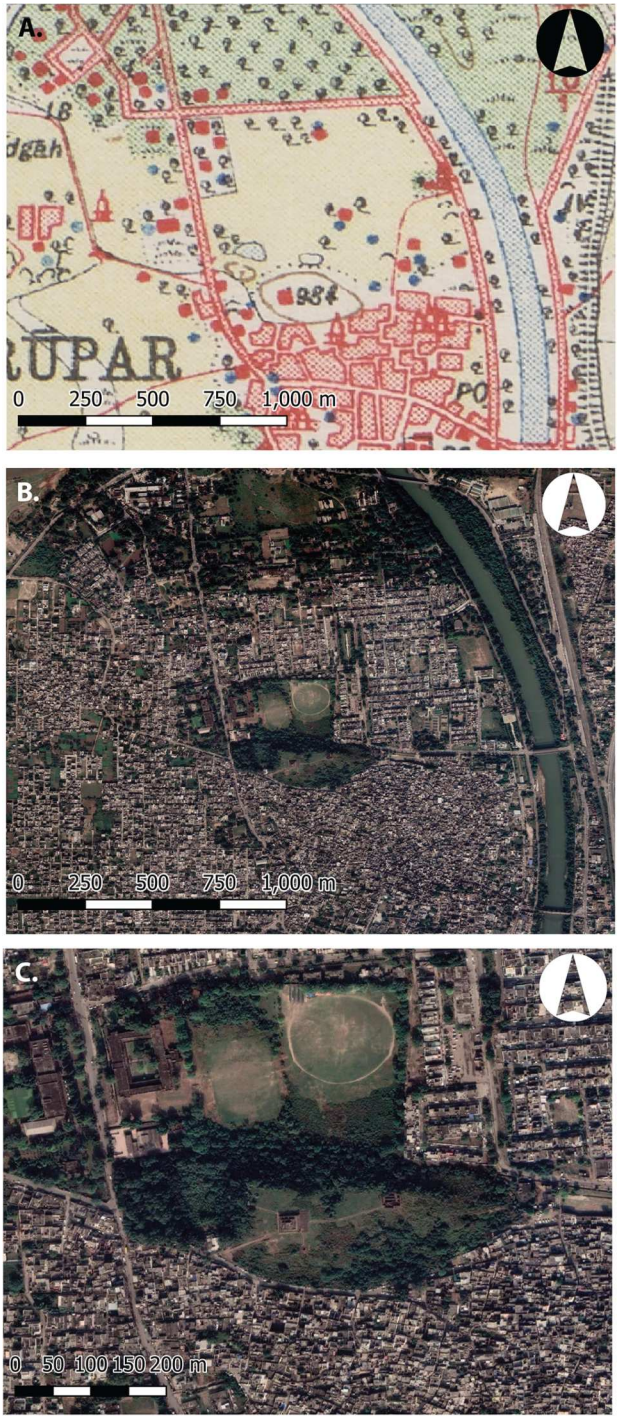

Figure 16. Ropar/Rupar/Rupnagar. A) Historic map image of Rupar (53/B9/1914, published A.D. 1914); Surveyor: not mentioned; Surveyor General: Colonel S. G. Burrard, C. S. I., R. E., F. R. S.; additional information about agents: nothing additional; indications of elevation: triangulation station 984; symbology style: form-lines mounds, village/building; courtesy of the University Library, Cambridge. B) Rupar shown on a modern satellite image at the same scale. C) Rupar shown on a modern satellite image in close up.

The MAHSA project is integrating three approaches to identify archaeological and cultural heritage sites: 1) collating and systematizing the existing published legacy data on archaeological and cultural heritage sites, 2) using georeferenced historic maps, remote sensing, and automated site detection methods to identify and document previously unidentified archaeological and cultural heritage sites, and 3) collaborating with stakeholders in India and Pakistan to use systematic methods of site detection, recording of sites on the ground, and documentation with the aim of publishing the information in a co-created open access geospatial database using the Arches heritage management software platform.[1]

The first element of this work involves the comprehensive assessment of the published data on archaeological site locations (legacy data) and the associated field data, research, and bibliographic information for all known archaeological sites in Pakistan and western India. The cleaning of a pilot database that includes published data on ca. 10,000 archaeological sites recorded in previous surveys in the Indus River Basin and surrounding regions is ongoing. These data are being mapped to the International Committee for Documentation (CIDOC) Conceptual Reference Model (CRM) ontological standard using a bespoke MAHSA PostgreSQL Centralized Database with tailored thesauri in preparation for final import into an online open access geospatial database.

These existing data on site locations are being expanded through the identification of the "signatures" of previously unidentified and unrecorded archaeological and cultural heritage sites being identified using the systematic analysis of: 1) historical maps, 2) publicly available satellite and remote sensing imagery, 3) digital elevation models provided by the German Space Agency (DLR), and 4) Open Access automatic site detection algorithms that have been and are being developed for the project.

SoI maps are not easy to access in South Asia, but copies are currently held by a number of UK institutions, including the British Library, the University Library in Cambridge, and the Bodleian in Oxford. Suitable maps from their collections have been scanned and georeferenced, and historical map mound feature locations and other relevant information is being digitized using both manual identification and deep learning digital procedures that automate this process (Berganzo-Besga et al. 2023). Scans of the maps held at the British Library and the University Library in Cambridge will be made available through the digital repositories of those institutions, and their metadata is already available open access and geospatially searchable through the MAHSA Arches instance that is accessible online.[2]

The work on historic maps is being complemented by innovative methods making use of remote sensing and digital elevation model data to carry out automated and more manual archaeological site detection and monitoring of risks from agricultural and urban expansion (Garcia et al. 2019; Orengo et al. 2020; Conesa et al. 2022; Garcia-Molsosa, Orengo, and Petrie 2023). These methods are being complemented by automated and more manual water channel detection that also makes use of remote sensing and the analysis of digital elevation model datasets obtained from the German Space Agency (DLR) (see Orengo and Petrie 2017, 2018; Garcia-Molsosa, Orengo, and Petrie 2023).

It is essential to confirm the veracity of these site signatures on the ground, and potential archaeological sites detected through the combined historic mapping, remote sensing, digital elevation, satellite photographs, and automatic site detection approaches are being checked and ground-truthed. While initial progress has been excellent, this is inevitably the most time-consuming element of the process. As might be expected, the extent to which we are dealing with gaps in our knowledge of archaeological site distribution is not fully clear at present, as there is a difference between identifying a potential archaeological site on a historic map or remote

sensing image and demonstrating that it is an actual archaeological site in the field. A more complete understanding will only come at the end of an extended process of large-scale field assessment that will need to match the scale of the original documentation carried out by the SoI teams.

Our preliminary analysis of 645 map sheets using a Region-based Convolutional Neural Network (R-CNN) segmentation (machine-learning) algorithm has detected almost 6000 mound features over an area covering 470,500 km^2 (Berganzo-Besga et al. 2023). When these results are compared to the distribution of uncleaned legacy data sites, it is evident that the data documented on SoI historical maps is spatially more extensive and has a notably higher density than the distribution of existing legacy data (Figure 17). This work is ongoing. The inaccuracy in the extant legacy data makes it challenging to produce a statistically robust assessment of the number of sites that were lying hidden in plain sight on the maps. The site distributions shown in Figure 17 do, however, reveal that the SoI topographic surveys incidentally conducted the first systematic survey of archaeological sites in South Asia, which was potentially the world's most extensive (albeit incidental) archaeological survey.

Discussion and Concluding Remarks

This paper has presented two significant findings: one in the area of subaltern studies and the second in the field of survey and landscape archaeology in South Asia, and to some extent those fields more globally. At a base level, the recognition that many sites were documented years if not decades before they were first visited by archaeologists is an important finding. The systematic approach to documentation that was used by the SoI makes it possible to provide further information about the roles and potentially the individuals involved in these initial phases of documentation. While most maps—particularly after the A.D. 1905 reforms to map standardization—list the Surveyor General at the time that a map sheet was issued, this information is readily available and is not particularly revealing. For earlier and some later map sheets, however, including those that documented Mohenjo-daro and Kot Diji, the name of the lead surveyor of that area, as well as a number of other subordinate surveyors is included, and many of these individuals were South Asian.

For Mohenjo-daro, working under the Surveyor Major S. G. Burrard and Superintendent Trigonometrical Surveys Mr. C. F. Erskine were Mr. R. Warwick, Munshi Rahmatullah, Babu Dhani Ram, and Sub-surveyors. One or other of these individuals potentially provided Bhandarkar (1912; Possehl 1999, 61; 2002, 12; Lahiri 2005, 211) with the "glowing accounts of this spot" that prompted his visit, but their name was omitted from the official reporting. These particular maps also list the names of the individuals who produced the final maps—in the case of the Sind Sheet 41/1903, it was drawn by Abdul Wahid and Alay Ahmad (II) and typed by Anwar Ali and Alay Ahmad (I). For Kot Diji, working under the Surveyor Major S. G. Burrard and Superintendent Trigonometrical Surveys Mr. C. F. Erskine were Messrs. R. Warwick and E. Bond and Babn Dhani Rám and Sub-Surveyors. Interestingly, Mr. E. Bond and Babu Dhani Rám also appear to have drawn the map along with Muhammad Akbar and Abbás Ali, and the typography was done by Lál Bihari Lál and Anwar Ali. The information provided on the map showing Dholarvira is even more revealing, as it lists the name of the individual who carried out the traversing—T. G. Chowdri, who may well have been the person that first walked onto the mounds and decided that they were a worthy location for establishing a triangulation station. The nomenclature used on these maps in particular exposes overt evidence for a racialized hierarchy, where only white/British team members are given the title of Mr./Mister, but in these maps, at least, the contribution of the "Native agency" is directly acknowledged, and in the case of T. G. Chowdri, an individual involved with traversing is identified. Although not shown on all of the maps, similar information for all of the regions surveyed and maps produced is presumably documented in record books, and we can only hope that this material has been preserved in the archives of the SoI and the India Office (UK). It is notable that the credit to such individuals disappears from the SoI map sheets soon after the increase in visibility of South Asian archaeologists in senior roles during the tenure of Sir John Marshall, suggesting inconsistency within the processes of the imperial authorities.

At present, it is not possible to identify the Sub-Surveyors, Draftsmen, Tindals, Classies, Signallers, and Measurers involved in the work on the ground, which is disappointing given that it would have been one of these individuals that was the first to walk across the ground surface with an eye ready to document changes in topography and elevation. As with the various people in authority that were not named on some map sheets, the individuals who carried out the vast range of subordinate roles are presumably documented in record books that have hopefully been preserved in archives, most likely the documents related to salaries. Although we cannot name them, we argue that it is essential that the contribution to the process of archaeological (re-)discovery that was made by these subalterns is acknowledged formally, and more work should be done to add their names to the historical record.

What will potentially not be recorded in the SoI archives are the names of "village authorities" who provided the "information they [i.e. the survey teams] require to enable them to carry on their work," which are mentioned by Thuillier and Smyth (1875, 256). Acquiring information from local informants seems to have lain at the core of SoI practice since the 19th century A.D., and speaking to local informants lies at the core of village-to-village archaeological survey practice up to the present. It is clear that the information that they provided has been made use of going back to the early surveys of Bhandarkar (1912; see above) and Fairservis (1956, 194), and in some cases the names of the informants has been directly acknowledged (e.g. Suraj Bhan 1975, 95). We argue that it is essential to act ethically and to consider privacy and related data protection, and modern archaeologists should continue their mission to document archaeological heritage with humility, including seeking permission, documenting with consent the names of the informants who point them in the direction of archaeological sites "discovered" during surveys, and acknowledging assistance in reporting and publications—even anonymously.

In addition to the information about the process of surveying and the identities of the surveyors doing that work, the extensive archive of historical SoI maps that was produced from the 19th century A.D. onwards represents a vast resource of information about archaeological and historical landscapes that remains relatively untapped. The recognition that mound features on historic maps might correlate with

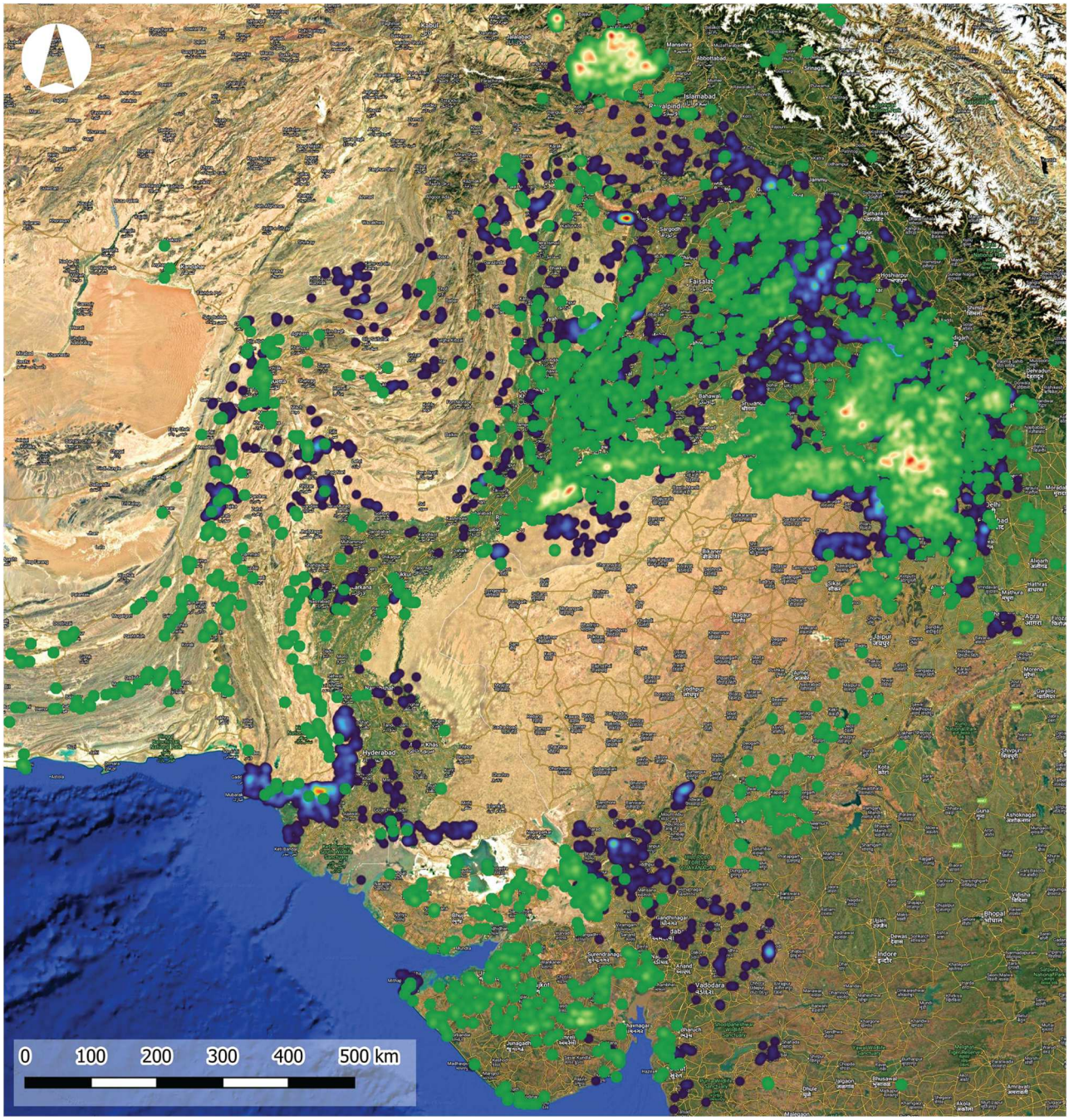

Figure 17. Map showing the distribution of legacy data site locations (in green) compared to the distribution of historical map mound features identified using machine learning (in blue) (Berganzo-Besga et al. 2023). Both datasets are shown as heatmaps with red indicating the highest density.

archaeological sites is not a completely novel discovery (e.g. Fairservis 1956, 194; Lal 1984; see Petrie et al. 2019, 2). In fact, as Hargreaves (1929, iii) noted: "In each of the twelve District Gazetteers of Baluchistan mention is made of artificial mounds locally called *dambs*, which everywhere dot the country and references to mounds occur also in the accounts of early travellers, but with little detailed information on which to base any conclusions as to their respective dates of comparative importance." Hargreaves' observation, made the best part of 100 years ago, remains equally valid today.

The historical SoI maps contain a mass of archaeological and other information that has been hidden in plain sight for decades, and it is timely that structured documentation of those data is being attempted. The extent to which known and hitherto unrecognized archaeological sites were documented in historical maps (and also Gazetteers) has not previously been explored systematically, and this paper and the work of the MAHSA project is a step toward the necessary systematic analysis. It emphasizes the potential that can come from a methodical attempt to assess historic map sheets in conjunction with remote sensing imagery and ultimately ground-truthing to document archaeological heritage. Of the known sites of the Indus civilization, Harappa justly stands as an early exception that was visited in the early–mid-19th century A.D. and documented in some detail, such that by the time it was recorded on a historic SoI map, it is not only marked as an Antiquity, but it also had a site museum. However, for the other sites discussed here, and for hundreds and likely thousands of others, the SoI maps are likely to be the first instance of recording.

Although they are two-dimensional, these maps record palimpsests that not only give us insights into landscapes of a century ago but also provide glimpses of settlement landscapes that have been occupied over more than 4000 years.

To extract archaeologically relevant information from these maps is a relatively straightforward task at one level, but given the size of the area occupied by the populations of the Indus civilization and the extent of the Indus River Basin as a whole, attempting to reconstruct long term settlement distribution at a substantial scale is an ambitious undertaking. The spatial scale of the SoI mapping program provides the foundation for a more complete documentation of archaeological site distribution than is currently available from the focused surveys undertaken by archaeologists. The systematic assessment of map data to reconsider these mound features in geospatial terms, linked to attempts to visit them on the ground to situate them chronologically and document their current state that is currently underway, has the potential to revolutionize understanding of the entire sweep of archaeology of the Indus River Basin.

Acknowledging the foundational contribution to knowledge production of the subaltern surveyors of the SoI, the MAHSA project is building on earlier work by the *Land, Water and Settlement*, *TwoRains*, and TIG2RESS (Transforming India's Green Revolution by Research and Empowerment for Sustainable Food Supplies) project. The team are under no illusions that they are chasing a monumental objective, which can only be achieved using a collaborative approach that centers on systematically co-creating the documentation of the archaeological heritage of the region together with colleagues based in universities and governmental agencies in Pakistan and India. The information that is generated will be transformational for our understanding of archaeological heritage, but we also hope that it will play a major role in supporting the documentation and potential preservation of this irreplaceable resource by archaeologists and other heritage professionals in India and Pakistan.

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Disclosure Statement

No potential conflict of interest was reported by the author(s).

Endnotes

1. www.archesproject.org.
2. www.databasemahsa.org.

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