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Author/s:

Skopal, N;Bounxaythip, S;O'Reilly, D;Shewan, L;Luangkhoth, T;Van Den Bergh, J

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A field work report on newly discovered and documented megalithic jar sites in the Lao People's Democratic Republic

Nicholas Skopal¹ · Souliya Bounxaythip² · Dougald O'Reilly¹ · Louise Shewan³ · Thonglith Luangkhoth² · Julie Van Den Bergh⁴

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Abstract

Xieng Khouang and neighboring provinces in Central Laos are home to a vast megalithic landscape featuring large stone jars, discs, and imported boulders located in elevated positions. Sites were first noted in the late nineteenth century, with systematic recording commencing in the 1930s. Continuing on from the 2019 field survey by the Plain of Jars Archaeological Research Project, this paper presents the results of a 2020 survey across Xieng Khouang Province, Lao People's Democratic Republic (PDR) which led to the documentation of 27 previously unreported megalithic sites, growing the Lao PDR Government database from 102 to 127 known jar sites, with 124 geo-located. In addition, a preliminary analysis of the known jar sites to date is conducted regarding distribution and jar characteristics providing a basis for further investigation.

Keywords Megalithic jar · Plain of jars · Survey · Laos · Southeast Asia

1 Introduction

In 2020, the Plain of Jars Archaeological Research Project (hereafter PJARP), a joint effort between the Australian National University, the University of Melbourne and the Lao Ministry of Information, Culture and Tourism, Department of Heritage (DoH), undertook a survey with the aim of documenting previously unreported megalithic sites across Xieng Khouang Province, in the north of the Lao People's Democratic Republic (Laos). The author's anticipate this

paper will serve as a foundation for future studies on the megalithic sites of Laos as the most recent tally of known and geolocated sites. Here we outline the aims of the project followed by the methodologies employed, a presentation of the survey findings, and a discussion on the wider implications of the research supplemented by previous survey results [12–15, 21].

Laos is located at a strategic juncture within Mainland Southeast Asia, bordering China, Vietnam, Cambodia, Thailand and Myanmar (Fig. 1). The Mekong River flows along the north west of the country feeding numerous tributaries and minor watercourses. Laos was a centre for long range population interactions and movements during Southeast Asia's major chronological divisions (Mesolithic-Neolithic ca. 1800 BC, Neolithic-Bronze ca. 1000 BC, Bronze to Iron ca. 500 BC and Iron to Historic ca. 500 AD) [2, 7, 8, 28].

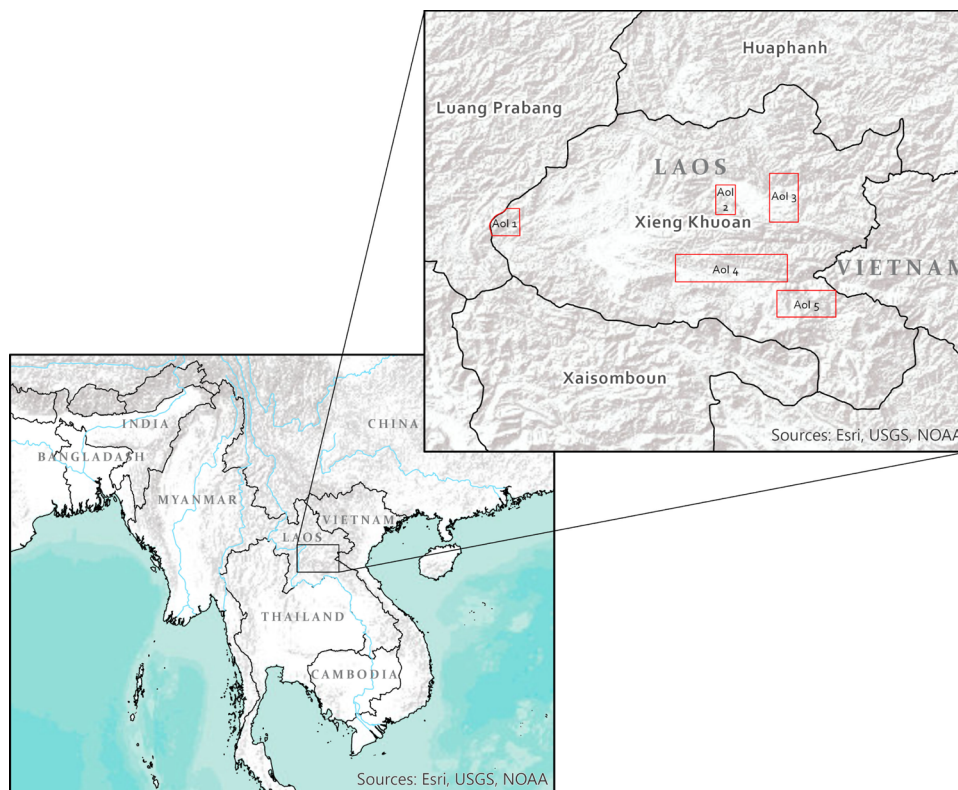
In northern Laos, throughout Xieng Khouang, Luang Prabang, and Xaisomboun provinces, there exists multiple megalithic jar sites that together form the Plain of Jars. These are amongst the most significant prehistoric stone monument landscapes of Mainland Southeast Asia [7, 24]. The large number and widespread distribution of the sites throughout the mountains and lower foothills within and around the central plain of the Xieng Khouang Plateau represent a unique

Nicholas Skopal and Souliya Bounxaythip contributed equally to this paper.

✉ Nicholas Skopal
nicholas.skopal@anu.edu.au

- ¹ School of Archaeology and Anthropology, Australian National University, 44 Linneaus Way, Canberra, Australia
- ² Department of Heritage, Ministry of Information Culture and Tourism, Vientiane, Laos
- ³ School of Geography, Earth and Atmospheric Sciences, University of Melbourne, 253-283 Elgin Street, Victoria, Australia
- ⁴ Archaeological Assessments Ltd., Lamma Island, Hong Kong

Fig. 1 Map of Lao People's Democratic Republic with target survey Areas of Interest (AoI)



archaeological culture frequently accepted to date between ca. 500 BC-AD 500, aligning with the Southeast Asian Iron Age [6, 9, 20]. More recent analyses (radiocarbon and OSL) suggests placement of the jars at one of the sites commenced potentially as early as the late second millennium BC, with ritual activity continuing into ninth to thirteenth centuries AD [22].

Formal research into the jars began in the 1930's when French archaeologist, Madeleine Colani ([610] [20]) interpreted the sites as having some role in mortuary practice. Subsequent investigations have largely supported Colani's conclusions and expanded the number of known sites [4, 11, 12, 14, 15, 19, 27]. Despite efforts to date, there is still uncertainty regarding the geographic extent of the jar culture, and modern sampling and dating methods have been used only in limited instances. As a result, there have been ongoing obstacles to interpreting the socio-political organisation of the society that created the enigmatic megalithic landscape. The majority of investigations have primarily focused on central or more easily accessed sites, with less attention given to those on the periphery or in more difficult to reach locations. Additionally, attempts have been limited, not least because of the presence of unexploded ordnance (UXO) dating to the conflict in Indo-China in the 1960s and 1970s [5]. Further systematic research into sites beyond these is needed, to provide more holistic investigations into topics some of which include the spatial distribution of sites, material and morpho-

logical variations across the jars, and motivations behind site selection.

2 Project aims

The primary aim of PJARP's 2020 survey was to document unreported jars and associated features in previously unsurveyed areas within Xieng Khouang Province in order to increase the archaeological data available for interpretation which includes an accurate understanding of the distribution of jar sites across the province. This was a continuation of PJARP's 2016 and 2019 survey efforts [13, 23]. All of PJARP's findings will be integrated with the survey data within the (DoH) jar site database that was created for the DoH. This database is the most comprehensive available and has been adopted for use by all levels of the Lao PDR Government to manage the archaeological heritage of jar sites (DoH 2019).

3 Archaeological background

The identification and recording of jar sites in Laos began in the late nineteenth century when early French [3, 17, 18, 20] and British explorers [10] and later Colani [20] reported a total of 32 sites. More recently, in 2002, the Safeguarding the Plain of Jars Project (SPJP), a collaborative effort between the Xieng Khouang Provincial Government

(XKPG) and the United Nations Educational, Scientific and Cultural Organization (UNESCO), recorded 58 jar sites. From 2008, the XKPG catalogued an additional 21 sites. The majority of these sites have been included within the DoH jar site database. However, due to difficulties in confirming the location of multiple jar sites recorded by Colani and early explorers, overlaps likely exist between the various records. As of 2015, the DoH database contained 83 jar sites.

During PJARP 2016 and 2019 field seasons, the DoH database continued to be expanded focusing on sites in peripheral areas of Xieng Khouang Province or those in locations more difficult to access due to rugged terrain. During this period, the PJARP added 19 further sites and one potential habitation site [13, 23], bringing the database total to 102 known, of which 100 had been geo-located, as of 2019 (DoH 2019).

4 Jar site characteristics

Several types of megalithic jar sites have been identified but most are either destination sites or quarries. The former comprise collections of megalithic jars, most of which are complete/finished examples, while the latter demonstrate evidence for the manufacture of stone jars and often comprise collections of partially finished megaliths with an associated stone source. Some sites have been identified which appear to be quarries but have complete jars *in situ* and these have been labelled as quarry-sites [27]. It is possible that the jars at these sites were completed and awaited transportation or that they were both ‘destination sites’ and quarries. Scholars agree that in most circumstances the jars were worked on remotely and then transported to their respective sites [1, 20]. This agreement is based on the presence of unfinished jars and debitage found primarily at quarry sites ([25] [4]). There is also some evidence that suggests that finishing touches to the jars may have been made at the final destination [1, 4, 20].

Other sites have been identified as ‘transit sites’ where collections of partially completed jars have been found far from any recognisable quarry [27]. The supposition is that these jars were abandoned while being transported from the quarry to the destination site. For the purposes of this paper we refer only to destination sites and quarry sites as further research is required to distinguish transit sites. Each of the sites comprises between one to several hundred stone jars,

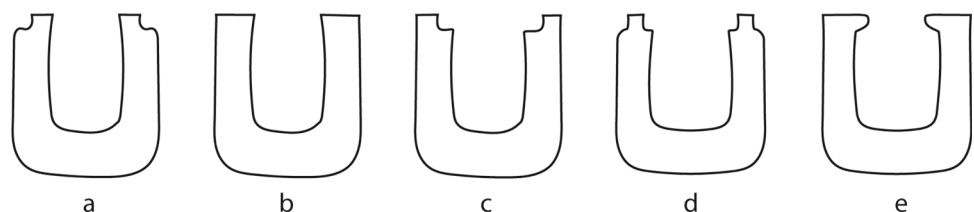
sometimes distributed across multiple groups. Additionally, sites may also feature stone discs, apparent lids, sub-spherical stones and imported boulders [13].

The jars vary in size, decoration, stone type, morphology, completeness and placement of the individual jar. They can range from ca. 60 cm to 3 m in height and 0.85 m to 2 m in diameter ([105] [19]), with some potentially weighing up to 31 metric tons ([147] [1]). Decoration on the body of the jars is rare with only three known examples bearing carved anthropomorphic figures ([18] [23]). The rims of the jars are varied and in some cases have received artisanal attention. The various styles of rim include: flat rims, recessed inner rims, outer rims, raised and flat inwards rim (Fig. 2). Sandstone is the most common material used to form the jars followed by limestone, granite, conglomerate and breccia. The majority of jars are cylindrical in shape, with some also presenting a more bulbous form. There is some variation in the size of apertures in relation to the total diameter of the jar, the majority displaying larger apertures averaging ca. 80cm, whereas others display narrow apertures averaging ca. 30cm. The jars can also vary in completion status, with unfinished jars usually presenting no or a minimal cavity and or unpolished surfaces. The majority of jars are intentionally placed in a standing position, however there are instances where they are recumbent or buried to the rim [13, 16]. Discs, sub spherical stones, and imported boulders are in some instances found associated with the jars ([168] [20]; [27]; [14]).

5 Location, Materials, and Methods

Xieng Khouang Province has been the focus of previous research into the jar sites [13, 23]. The province is divided into seven administrative districts which include Pek, Kham, Nong Het, Khoun, Mok May, Phou Kout and Phaxay (Fig. 2). The geography of the province comprises a central broad grassland plateau, ca. 600 m asl, surrounded by heavily wooded highlands up to 2,600 m asl and a low lying basin (Kham District) in the northeast of the province. Only a small portion of primary forest now exists in the highlands due to long term human activity. The province comprises mainly sedimentary rock with limestone and shale deposits dominating the valleys, and deposits of limestone, conglomerate, shale, and sandstone forming the higher ground. Khoun District alone features predominantly granite or granodiorite deposits [1].

Fig. 2 Cross-section illustration showing rim forms: a is Outer, b is Flat, c is Recessed Inner, d is Raised, e is Flat Inward



Based on perceived gaps in the distribution of sites registered in the DoH database, five areas of interest (AoI) were selected for survey within Xieng Khouang Province by the authors (Fig. 1). A targeted on-ground intensive survey method was applied due to the presence of UXO from the Vietnam war (Leary 2007), which restricts the application of large scale field walking surveys. The targeted method involved the selection of villages within the AoIs to serve as points of disembarkation for each of the surveys. The local inhabitants were generally able to provide information on the location of previously unrecorded jar sites and guide us via the safest routes. On arrival at each of the sites the authors would conduct further field walking in the surrounding area to document chance finds.

In an effort to facilitate the integration of our data with that contained within the DoH database, we followed the methodology used by previous researchers when mapping and documenting the individual jars and associated features. The only exception was the classification of site types, with potential transit sites still classed as destination sites. Once a site was reached, jar and associated features positions were recorded with a TDK 100 Global Navigation Satellite System (GNSS) receiver. This was followed by the documentation of jar attributes such as evidence of decoration, dimensions and whether they were standing or buried. Within a site, jar groups were designated at 30 m intervals or where there was significant topological variation. The sites were allocated names in accordance with the UNESCO naming convention when ‘in-field’, whereby site names are based on the closest village, mountain, or area. These jar sites were then later assigned a

sequential number by the DoH for formal integration in the DoH database.

6 Results

Over three weeks in February 2020, a combined area of ca. 85 km² across five different AoIs were surveyed. In total, the authors identified and recorded 27 previously unreported megalithic jar sites (Figs. 2 and 3). Table 1 presents an overview of each of these sites which includes details on number of jars and associated features, site type, position in the landscape, stone types, rim types, morphology and individual jar placement. This is followed by a summary of the key findings.

Our research has expanded the area of known jar sites across Laos. Of the 27 previously unreported sites, all but two are located in the districts of Phoukoot, Khoun, Nong Het and Kham in Xieng Khouang Province, with the two sites of Say Udom ‘A’ (Nam Thom Area) and Say Udom ‘B’ (Nam Kho Area) located in Phoukoun District, Luang Prabang Province. The team’s geolocation of Phou Mon in Mok May District presents the closest recorded site to Vietnam to date, ca. 6 kms east from the border. Although not confirmed by the authors, authorities in Mok May District reported that further jar sites are located across the border in neighbouring Vietnam.

Twenty four of the identified sites were classified as destination sites, with the maximum number of jars recorded at any one site being 17. Ten of the sites comprised only one jar, but it was noted that these singular megaliths were of

Fig. 3 Map of 2020 PJARP surveyed jar sites

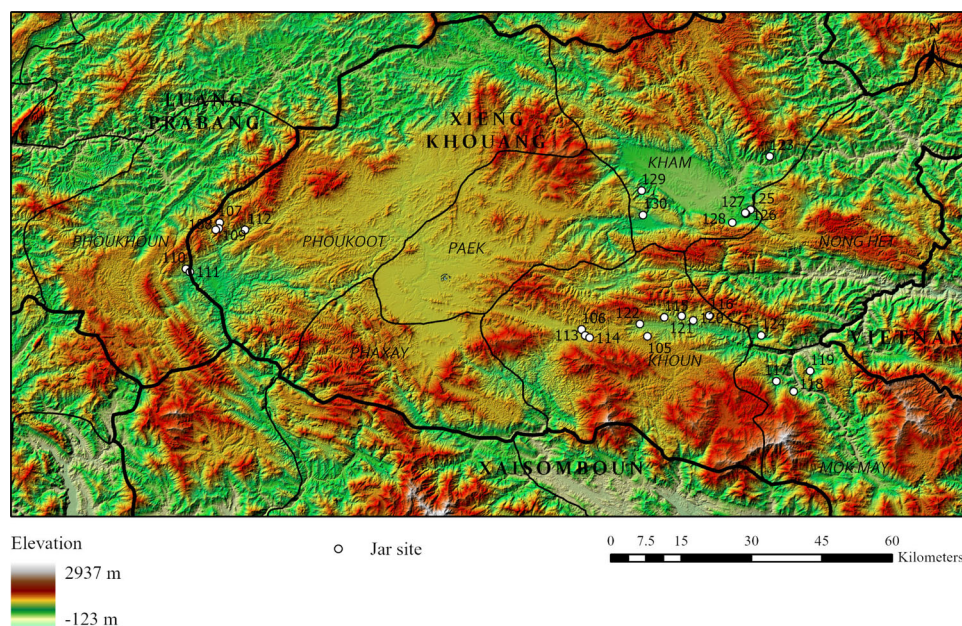


Table 1 Description summary of 2020 sites surveyed. Abbreviations: S-Site; S+Q-Site plus a quarry; F-Flat; RI-Recessed Inner; R-Raised Rim; OR-Outer Rim; S-Sandstone; G-Granite; L-Limestone; C-Conglomerate; B-Breccia; UD-Undeterminable

Site No./Name	Site type	Jar No.	Disc No.	Buried jars identified	Rim type	Stone type	Sub-spherical stone
103/Phou Tin Xang B,	S	4	0	No	RI	C	No
104/Na Lam	S	4	0	No	F, RI	G	No
105/Ban Napho	S	2	0	Yes	RI	S	No
106/Nam Chat A	S	18	0	No	RI	S	Yes
107/Nam Chat B	S+Q	4	2	No	F, RI	S	Yes
108/Nam Chat C	Q	3	0	No	UD	S	Yes
109/Say Udom A (Nam Thom Area)	S	1	0	No	RI	S	No
110/Say Udom B (Nam Kho Area)	Q	1	0	No	RI	S	No
111/Na Pung	S	1	0	No	R	S	No
112/Napho A	Q	5	0	No	F	S	No
113/Napho B	Q	1	0	No	F	S	No
114/Than Thong B	S	1	0	No	UD	S	No
115/Ban Pha Khao	S	1	0	No	UD	S	No
116/Nam Sao	S+Q	2	0	No	F	G	No
117/Phou Phak Hin Pan	S+Q	1	0	Yes	F	G	No
118/Phou Mon	S	1	0	No	UD	L	No
119/Houy Loun A	S	9	0	No	F, RI	L	No
120/Houy Loun B	S	2	0	No	UD	L	No
121/Houy Lan	S	1	0	No	UD	C	No
122/Phou Hai Choung (Pha Mao)	S	3	0	No	UD	L	No
123/Thane San	S	1	0	No	UD	L	No
124/Nam Paen	S+Q	9	0	No	OR	B	No
125/Nam Tieng	S	1	0	No	UD	B	No
126/Phou Tat Lom	S	2	0	No	RI	C, L	No
127/Nong Khiew	S	1	0	No	RI	C	No
128/Phou Hai Choung (San)	S	7	0	No	RI	S	No
129/Phon Kham B	S+Q	13	0	No	RI	L	No
A/Ban Pha Tai Pottery Scatter	-	-	-	-	-	-	-

Fig. 4 Jar sites mentioned in the text



(a) Na Pung jar



(b) Nam Chat B disc



(c) Napho A unfinished jars



(d) Nam Chat A jar



(e) Nam Chat B jar



(f) Phou Phak Hin Pan buried jar

substantial size. For example, at Na Pung site (Fig. 4a), the lone jar measured 2.10 meters in length and 1.30 meters in diameter, which is at the upper limits of recorded jar sizes to date.

Five of the destination sites were found associated with a quarry. At each of the sites, the distance between the finished jars and the source of stone extraction to form the jars, varied. At Nam Chat B, Phon Kam B and Phou Phak Hin Pan

the stone source was located next to the finished and unfinished jars. Whereas at Nam Paen and Nam Sao, the stone source was located ca. 250 m south and 180 m north respectively of the finished jars. The quarry at Nam Paen, displayed rough outs where the boulders were removed to form the jars.

Three sites were classified as quarries, comprising only unfinished jars. The quarry of Napho 'A' was unique in that

it contained four small groups of unfinished jars spread along a stream bed containing large sandstone boulders. The site contained clear evidence of the jar makers working the large sandstone boulders within the stream bed to form the jars, which is previously unseen (Fig. 4b).

The majority of the 27 surveyed jar sites are positioned in prominent topographical settings, such as on spurs, saddles, and ridge lines. Many of the sites afforded expansive views over the lowlands surrounding their locations. There are some notable exceptions to this, as at the sites of Houy Lan and Na Pung which are instead positioned on relatively flat land in present day rice fields. Views of the surrounding landscape are, however, still apparent. Additionally, Nam Chat B, a site with an associated quarry, which presents both unfinished and finished jars and discs, is positioned at the end of a gully with no observable view. However, it is possible that this site has been misidentified due to the inherent difficulties in classifying a ‘finished jar’, and may indeed be a quarry.

Eighteen of the 27 sites had identifiable rim types, with Recessed Inner and Flat types the most common. The authors observed Raised and Outer rim types at only two sites. Fifteen of the sites had only one rim type present. At the three sites of Na Lam, Houy Loun A and Nam Chat B, two rim types recorded together.

Sandstone was recorded at 11 of the sites and is the most common material used to form the jars across the 27 sites. This is followed by limestone (7 sites), granite (4 sites), conglomerate (3 sites) and breccia (2 sites). Phou Tat Lom contained both conglomerate and limestone jars. Further research is needed to confirm these observations due to the difficulty of identifying stone type in the field.

Discs, sub-spherical stones and imported boulders were recorded across two sites. Sub-spherical stones and imported boulders were documented at Nam Chat A and B surrounding the jars, some of which were partially buried. Two discs were also recorded at Nam Chat B (Figure 4b).

The presence of buried and recumbent jars were recorded across a number of sites: two sites contained evidence of buried jars; and one site displayed recumbent jars. At Ban Napho, the authors located a single jar buried to the rim, with a reported second buried jar a few meters away which could not be located during fieldwork. Locals had uncovered the buried jars during the Indochina war when digging defensive entrenchments. The second site, Phou Phak Hin Pan, comprised a lone jar buried to the rim (Figure 4f). At Nam Chat A, two large jars were recorded in the recumbent position. It was difficult to determine if this was intentional, although the narrow proportion of the jars would have likely made it difficult to position them standing. Additionally, at Nam Chat A and B the jars displayed a narrow cavity in relation to their total diameter, when compared to the remaining sites surveyed in 2020.

7 Discussion

The survey undertaken in 2020 expands the DoH database from 102 to 127 known sites, of which 124 have been geo-located, presenting the most complete picture to date regarding the distribution and characteristics of the sites (Figure 5). It further addresses a large proportion of previously unsurveyed areas across the provinces of Xieng Khouang, providing

Fig. 5 Map of 124 geo-located DoH database sites out of the total 127 DoH database catalogued sites. Table 2 reflect site names (The SPJP omitted sites between 5 and 7, and 82 and 84)

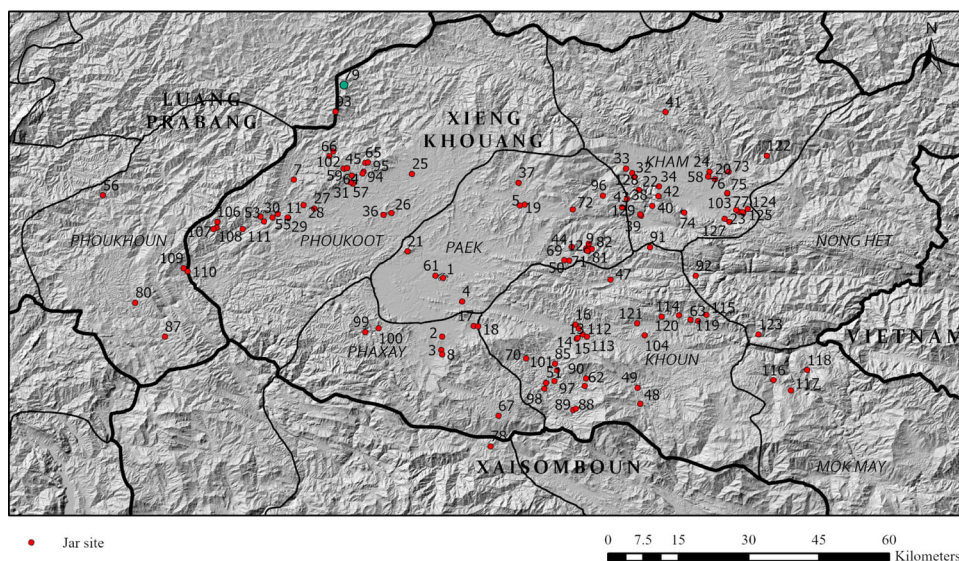
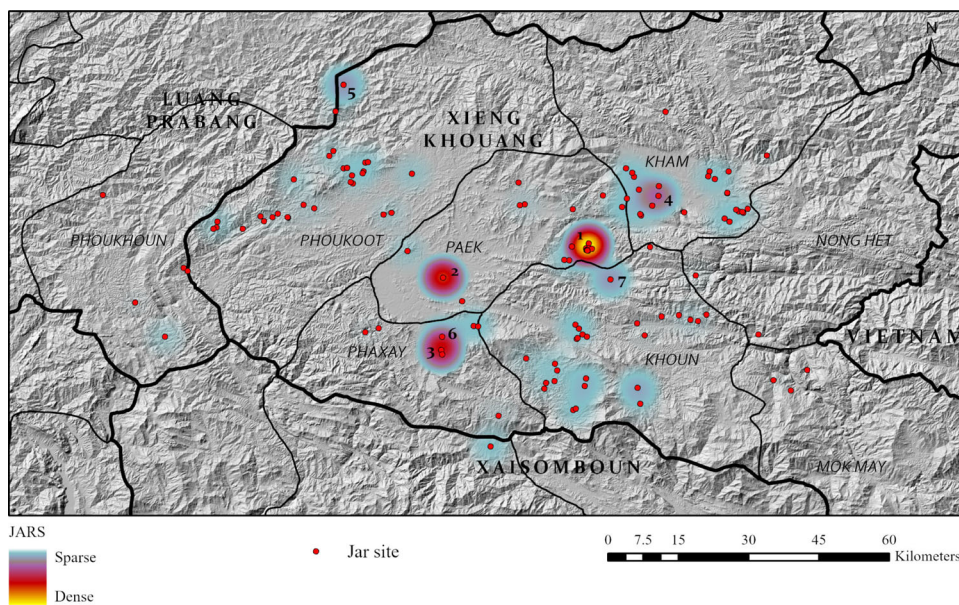


Fig. 6 Heat map of DoH geolocated jar sites. Seven largest sites include: 1. Ban Phakeo (415 jars); 2. Ban Ang (316 jars); 3. Ban Xiengdi (234 jars); 4. Phu Xang (132 jars); 5. Phu Hai Chuong (88 jars); 6. Ban Nakho (86 jars); and 7. Ban Thalin (85 jars)



some certainty that the presently mapped distribution broadly reflects the past distribution of sites in this area. Additionally, it highlights the notable presence of buried jars throughout the sites. Here we will present some preliminary observations on the jar culture using the expanded database. A more detailed systematic analysis is out side the scope of this paper.

The 124 geo-located jar sites are spread over an approximate area of 8000km² across the provinces of Xieng Khouang, Xaisomboun and Luang Prabang, comprising 2488 jars in total. Figure 6 presents a heat map which graphically represents this distribution, highlighting areas where there is a concentration of jars, known as hot spots. As per the observed hot spots, the seven largest sites include: Site 52,

Ban Phakeo (415 jars); Site 1, Ban Ang (316 jars); Site 3, Ban Xiengdi (234 jars); Site 42 Phu Xang (132 jars); Site 79, Phu Hai Chuong (88 jars); Site 2, Ban Nakho (86 jars); and Site 47, Ban Thalin (85 jars). These seven sites comprise ca. 50 percent of all jars across the 124 geo-located sites. The remaining 117 sites contain fewer jars, with the average number of jars per site being ca. nine. Across the geo-located jar sites, ca. 80 percent appear to be destination sites with the remaining 20 percent identified as quarries.

There are 14 sites containing evidence of buried jars which appear to be generally confined to the southeast area of the distribution, despite a small number of outliers (Fig. 7). This regionality could possibly represent or suggest the existence

Fig. 7 Map of DoH geolocated jar sites highlighting buried jars

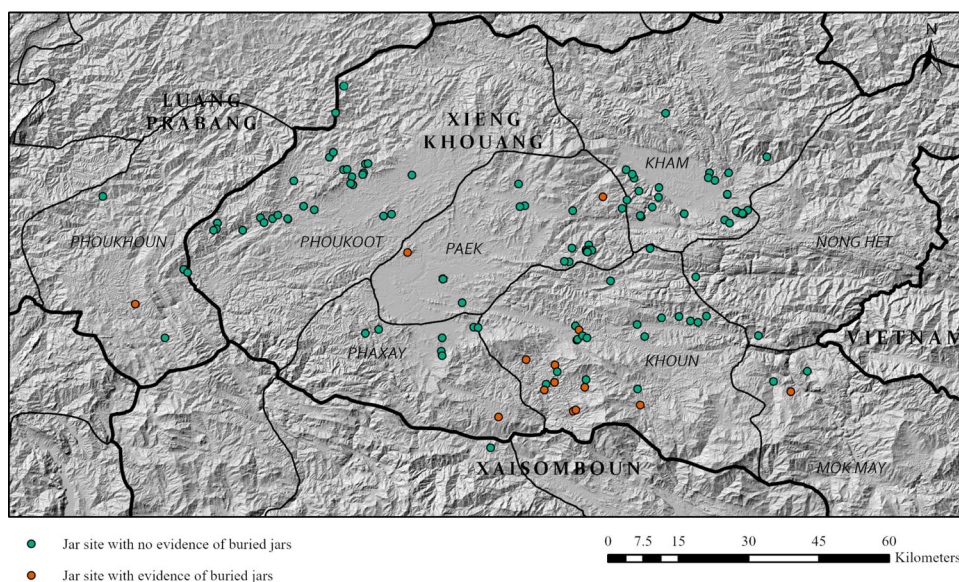


Table 2 Table of 127 known jar sites

1	Ban Na O	316	45	Ban Nasal, San Phou Huathum	6	89	Old Village B	31
2	Ban Nakho	86	46	Ban Ang, Phu Nasan	2	90	Phu Hai Hin	27
3	Ban Xiengdi	242	47	Ban Thalim	85	91	San Choc	1
4	Ban Lathong	3	48	Ban Nam Nai	17	92	Pha Hai	6
5	Ban Phaignam	11	49	Ban Phiang Na Phoi	61	93	Keo Hai Hin	9
6	UNASSIGNED	NA	50	Ban Huayhok	23	94	Phu Seo (Nakham Area)	3
7	Ban Xot	21	51	Ban Sang Luang	15	95	Phou Soung B (Nakham Area)	7
8	Ban Xiengdi	17	52	Ban Phakeo	428	96	Ban Na Sala	1
9	Ban Phakeo	10	53	Ban Phu Niathau	1	97	Ban Pha Pheung	1
10	Ban Phakeo	28	54	Ban Vangkham	1	98	Phu Sang	2
11	Ban Phakeo	2	55	Ban Chomsy, Khum Vangkham	2	99	Ban Khong (Phun Area)	3
12	Ban Phakeo	43	56	Phu Biac	1	100	Ban Phonxay	1
13	Ban Thoume, San Phou Naluang	3	57	Ban Ang	1	101	Keo Koang	2
14	Ban Nattad	1	58	Ban Phiangxai	9	102	Ban Buoc Nam B (Phu Huang Chon)	4
15	Huay Far Par	1	59	Ban Nasel	1	103	Phou Tin Xang B	4
16	Ban Phai	36	60	UNCONFIRMED	NA	104	Na Lam	4
17	Ban Boutai	38	61	Ban Ang	2	105	Ban Napho	2
18	Ban Boutai, Phou Him Mong	8	62	Ban Nong	31	106	Nam Chat A	18
19	Ban Khangvieng	1	63	Ban Khap	2	107	Nam Chat B	4
20	Ban Hai	21	64	Phu Buoc Kuong (Nakham Area)	12	108	Nam Chat C	3
21	Phu Keng	23	65	Phu Soung	17	109	Say Udom A (Nam Thom Area)	1
22	Ban Hin, Phou Tham Hua	10	66	Ban Buoc Nam (Phu Huang Chon)	14	110	Say Udom B (Nam Kho Area)	1

Table 2 continued

23	Ban Nam Hom	32	67	Ban Pha Tai	9	111	Na Pung	1
24	Ban Phiangxai	5	68	UNCONFIRMED	NA	112	Napho A	5
25	Ban Songhak	25	69	San Phu Huang Hok	9	113	Napho B	1
26	Ban Phouvien (Nameng)	13	70	Na Mon (Phung Village)	16	114	Than Thong B	1
27	Ban Sack	11	71	Ban Phakeo	9	115	Ban Pha Khao	1
28	Ban Nakuan	1	72	Ban Khang Don	6	116	Nam Sao	2
29	Ban Nam Oc Hou	3	73	Ban Na Phiang	6	117	Phou Phak Hin Pan	1
30	Ban Chomsy, San Phou Ten Yang	4	74	Phu Huang Sang	1	118	Phou Mon	1
31	Ban Ang, Phu Nabung	11	75	Pha Thang A (Phou Kong King Area)	7	119	Houy Loun A	9
32	Ban Xiengkieu, San Phou Getlin	31	76	Pha Thang B (Phou Kong King Area)	1	120	Houy Loun B	2
33	Ban Hok, San Phou Hok	9	77	Phu Tin Xang A	2	121	Houy Lan	1
34	Ban Xang, Nam Oun	7	78	Tham Ang	37	122	Phou Hai Choung (Pha Mao)	3
35	Ban Nathong, San Phou Kokhe	3	79	Phu Hai Chuong (Lang Jong Village)	88	123	Thane San	1
36	Ban Sai	3	80	Ban Chim	11	124	Nam Paen	9
37	Ban Sikhoun	1	81	Site 52 Q1	21	125	Nam Tieng	1
38	Phu Biac	3	82	Site 52 Q2	20	126	Phou Tat Lom	2
39	Ban Phonekham	11	83	UNASSIGNED	NA	127	Nong Khiew	1
40	Ban Namthoum	9	84	Ban Nanan Nam Phat	14	128	Phou Hai Choung (San)	7
41	Ban Tha, Phou En Kha	1	85	Naho	24	129	Phon Kham B	13
42	Phu Xang	132	86	UNCONFIRMED	NA			
43	Phakhom Phu Hai Hin	36	87	Phu Da Phor	21			
44	Phu Namkhun, Sangniac Noingpek	13	88	Old Village A	5			

of sub-cultures or an evolution in cultural practices. Indeed, dates from Ban Pha Tai (Site 67) [16], could suggest that the buried jars date to ca. the 12 to 13th century AD, representing a change in mortuary practice within the Plain of Jars complex. Furthermore, there are likely many more unreported buried jars throughout the Laos landscape.

Only 20 of the 92 destination sites are positioned at or in close proximity to the source of the quarried stone to form the jars. The prominence of sites not directly associated with a quarry or stone source suggests that the society behind the creation of the jars were likely transporting stone blocks and jars from sources further afield [1]. Therefore, a site's proximity to a stone source appears to not be a key motivating factor behind site selection Table 2.

Across all of the known sites, sandstone is the most common material used, followed by granite, conglomerate, limestone and breccia. This largely reflects the geology of the region which comprises mainly sedimentary rock [1]. Although an exception to this is Khun District, which predominantly holds granite or granodiorite. These rock types range in hardness per the Mohs scale (1 being the softest and 10 being the hardest); conglomerate (2-3), limestone (3-4), sandstone (6-7), granite (6-7) and breccia (7). The majority of sites display jars formed from a single stone type, however, at least four sites have been recorded to contain up to three different stone types [1, 23]. The types of stone selected across all the sites as well as the variability of stone type displayed at the aforementioned four sites, suggests that the selection of stone by the carver was a one of practicality. Indeed, stone chosen to form the jar was based on what was available and accessible in the surrounding region. The malleability of the rock seems to only have played a minor role in stone selected, i.e. sandstone is more difficult to carve than conglomerate or limestone, yet is the most common material used.

Visual observations from the field suggest that the majority of the sites identified as the final destination of the jars are positioned on prominent topographical settings within the surrounding landscape, such as spurs, saddles, and ridge lines, although these locations are not necessarily the highest points in each sites respective area. The elevation of destination sites ranges from 534 m to 1419 m, with the median height 1033 m. There are instances where sites are positioned in relatively flat areas such as at Houy Lan and Na Pung, although they still hold views over the surrounding area. There are a number of instances where sites appear to be connected along the same pathway, whether this is along the same ridgeline as at Ban Buoc Nam A and B or the most suitable path through difficult terrain as at Namchat A, B and C. Colani ([601] [20]) also notes a relationship between the jars, paths and mountain passes. This draws parallels with Tilley's [25, 26] observations of the Neolithic monuments of Pembrokeshire and Black Mountains in Wales as well as the chalk downland of Cranbourne Chase in southern England, where

stone monuments or, in some cases, stone tombs, appear to have been situated so as to be used as meeting-places on paths of movements. Further investigation is required to confirm if the jars are similarly placed on such paths of movement.

Although only 88 of the 127 sites have identifiable rims due to either being unconfirmed, or unidentifiable due to damage or weathering, the jar sites display a significant degree of rim type variability. The Flat and Flat Inward rim types are the most common, followed by a Recessed Inner, Outer and Raised types. At 41 of the sites, only a one of the five rim types are present, with each of the remaining 47 sites containing at least two or more. This may suggest that perhaps the rim type is purely reflective of an artistic decision made by the carver for the deceased, and not necessarily associated with any particular social group.

Based on fieldwork observations, approximately 14 percent of the known sites contain jars which display narrow cavities in relation to the total diameter of the jar. Further, the majority of these jar types are located in Phoukoot District [20, 27]. Additional research is required to confirm these observations.

There is variability in the number of discs and sub-spherical stones found associated with the jars. Approximately 26 percent of the sites contain discs. The majority of these sites have significantly fewer discs than jars. Five sites featured sub-spherical stones, which are all located in Phoukoot District, and are all associated with sites that contain jars with narrow cavities (Figure 8). These sub-spherical stones are likely those described by Colani at the sites she



Fig. 8 Sub-spherical stone with jar containing a narrow cavity at Namchat A)

referred to as “Kilometre 469, 200”, Ban Sieng Kieu, Ban Hin, Na Nong, Ban Xot, and the Eleven jars ([167] [20]). The purpose of these sub-spherical stones remains unknown.

Based on the above observations, it is evident how varied the Plain of Jars culture was, with significant differences in jar decoration, morphology, placement and the features commonly found associated with the megaliths. Perhaps these differences were indicative of regional variations in cultural practices linked to varying sub-cultures existing at the same time, noting the presence of buried jars or those with narrow cavities. Alternatively, the variation may be a product of changing practice due to unknown influences over time.

8 Conclusion

The extensive database of 127 known megalithic jar sites in Laos increases our understanding of the distribution of jar sites across Xieng Khouang Province. It further lays the foundation for more systematic studies into the spatial distribution, material, morphology and placement of the jars, with the aim to better comprehend this enigmatic jar culture. Additional surveys in Laos are required in the southwest corner of Xieng Khouang Province, and more broadly Luang Prabang and Xaisomboun Provinces to confirm sites reported but not yet geo-located. Additionally, surveys are required to confirm the likely presence of jar sites in the central west of Vietnam, expanding the known presence of jars further east. Estimating the period of emplacement of the jars and associated material culture is required to better classify them chronologically, helping to understand the regional differences apparent across this megalithic distribution.

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Declarations

Conflicts of interest None.

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