The Stone Industry from Gua Sireh, Sarawak.

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The site of Gua Sireh in Sarawak, eastern Malaysia is significant in being one of only two in Sarawak that has produced lithic assemblages that can be compared with others from the region to establish a picture of human activity during the early Holocene. It was excavated by Solheim and Harrisson in 1959 and there have been subsequent campaigns by Zuraina Majid in 1977, Kurui in1980 and Datan in 1989. The lithic collection has been examined to identify technological and behavioural details and is compared with the material from Niah Cave, West Mouth.

The Stone Industry from Gua Sireh, Sarawak.

Gua Sireh is a cave of two chambers in the hill of Gunung Nambi at Lat. 10.10.9’ N Long. 110.27.7’ E. It is some 55 Km southeast of the State capital at Kuching (Figure 1). The site has been known for a long time but it was the excavations by W. Solheim II and Tom Harrisson in 1959 that brought it to archaeological attention. A limited season of work excavated a number of trenches and recovered a large collection of mid-Holocene earthenware, some metal and stone objects and a number of human burials. A collection of faunal material was also made. There were two trenches placed parallel to each other running south-west – north east. The southernmost was divided into two segments a c. 7m long section that ended against the rear of the cave wall and the second segment was 2m further east on the same alignment and ran for c.14m. The northern trench was c. 10 m long and 2m wide with a broader 3m wide element towards its western end. In addition to these main trenches a series of 2m x 2m test trenches were dug towards the rear wall of the cave (Figure 2). This work was never fully published as the original notebooks were lost until recently and not all the material has been studied. This report is centred upon the lithics from the site which have not been published before. In addition to the 1959 work, the cave was also examined by Zuraina Majid in 1977, by Edmund Kurui in 1980 and in 1989 by Ipoi Datan. The latter produced a report with an extensive study of the earthenwares (Datan 1993) and a limited account of the lithics. The lithics from this work have also been examined to gain a larger, more representative sample and more effectively reconstruct the role of stone artefact use in the cave. Materials from the other two investigations have not been located.

The excavations revealed a sequence of brief occupations beginning with one dated to c. 20 ka. This date is based upon a radiocarbon date of 21, 630+_ 80 years bp (ANU 7048) on freshwater Melania sp. shell from a depth of 0. 95 -1.0 m. This was represented by only a few flakes in chert and quartz but is significant in showing human presence inland in tropical rainforest environments at an early date. The site was estimated to be some 500Km inland at this time (Datan & Bellwood 1991).This occupation was followed by a hiatus and then occupation resumed in the Holocene some 5, 000 years ago when pottery using peoples (believed to be Austronesian) established a Neolithic settlement (Datan 1993). These people exploited wild resources including marine shellfish as well as pig and the remains of a domestic dog was present (Medway 1959). The pottery forms found at the site continue for a considerable period of time with little change and these have been well-described (Datan 1993; Solheim 1965, 1981, Solheim et al. 1959, 1961). A phase of human burial at the site began c. 2, 000 years ago which disturbed the stratigraphy considerably and activity continued at the site until the recent period. There are charcoal wall pictures that remain undated.

The present study of the lithic materials from Gua Sireh was undertaken to complement a study of the material from Niah as part of the Niah Cave Project. It was originally intended to publish this work along with the rest of the material from the Gua Sireh site in the Sarawak Museum Journal as a full site report following the rediscovery of the original site notebooks. Unfortunately, this publication has not come to fruitition and it has been decided to publish the lithic analysis separately. The downside to this is that the drawings of analysed material have been lost along with the rest of the material to be published and only the original data survive with the author.

Methodology.

The approach taken to study the collection was based upon those devised by the author for Southeast Asian materials which do not easily lend themselves to the traditional systems used elsewhere (Reynolds 1989, 1990, 1992) the reason for this is the generally unpatterned nature of Southeast Asian lithic technologies. The system was devised to be appropriate for addressing the various issues that face Stone Age studies in Southeast Asia (Reynolds 1993, 2007; Rabett et al. 2009). The approach used predates the more recent work by Brumm et al. (2006, 2010, Brumm 2010; Moore 2007; Moore & Brumm 2007, Moore et al. 2009) which applies a more metrically based and detailed study to investigate cognitive aspects of lithic technology. This latter work is extremely valuable, especially when dealing with a variety of human types but is more time consuming in the field. The approach adopted allows direct comparison with other assemblages from the region. The system to be used here is based upon techno-typology where a classification is produced that is based upon technologically defined categories in the first instance and once applied, subsequent patterns can be discerned and tools identified. This approach is compatible with other approaches such as those noted above and also the '*chaîne opératoire'* method which also uses technological analysis and looks for pattern in reduction forms (Forestier 2000).

Material was studied to examine the raw material, and for cores, number of platforms, flaking directions, number of removals, type of blanks removed, degree of cortication, and maximum length (measured longitudinally from the platform on the flaked surface) width (measured at right angles to maximum length) and thickness (measured at right angles to the former measurements). Additional notes were made about presence of other features such as burning, rejuvenation, crushing and battering of edges and degree of wear. The artefactual group was also studied for raw material, for the maximum length (down the flaking axis), maximum width and maximum thickness. The nature of the blank (flake, flake/blade, blade, bladelet, shatter, pebble fragment, pebble, etc) was recorded, as was whether the blank was whole or broken. The form of the platform of flaked material was recorded, whether the platform was plain, cortical, dihedral, prepared (facetted) or crushed. The degree of cortication of the piece was also recorded, primary (with the dorsal surface totally covered in cortex), secondary (where cortex was present on the dorsal surface) and tertiary (where cortex is lacking). Cortex in this case is taken to be the natural external surface of the material studied. Formal tool type was recorded (where present) as were traces of utilisation. Technological indicators such as siret breakage, plunging, hinging and edge damage were also noted. The presence of burning was recorded. Each piece was studied using the above criteria and an entry made on an MS Access database. Certain pieces were also drawn. A catalogue indicator of ‘s’ refers to the 1959 Gua Sireh work whilst ‘gs’ represents 1989. The grid square the sample comes from was recorded and where available, the depth is given (the depth recorded is the base of the spit from which it came, there is another field that records the spit range). Depths were measured in inches, sizes of trenches were given in feet and inches. A brief attempt to refit material from within a each square was made but no refits were identified (except where material had been broken in storage).

A total of 524 pieces was examined comprising 19 cores and 505 struck, flaked or pebble-based artefacts. This collection can be broken down into 420 pieces from the

1959 excavations and 104 from the 1989 work. All the cores were from the 1959 investigation.

Raw Material.

There was a limited range of raw materials present, the principle ones being local limestone (in varying degrees of silicification), quartz (from usually small river pebbles) and ‘shale’ a metamorphic mudstone which was sometimes layered and at others more homogenous and crystalline. There were a few cases of quartzite, sandstone and chert. Given the range of raw material exploited it would seem that there is little selection of raw materials for particular purposes and locally available materials are the standard choice. There is no difference in the treatment of different raw materials although the sample sizes for quartzite and chert are too small to generalise for them. Quartz was subjected to an anvil (or bipolar) technique which involves placing the pebble to be flaked on another to reflect back the forces of the hammer and increase the likelihood of the pebble breaking. This produces flakes with what appear to be two platforms (one often less developed than the other) and also a high frequency of transversely split flakes. More detailed comment on raw material use will follow under technology of blanks.

Typology.

There is no standard typology for prehistoric Southeast Asian lithics but a range of recognised types have been described. These comprise a number of scrapers, notches, burins and points. The large tool element was well described at Niah (Zuriana Majid 1982) and forms such as rubbers, hammers, quadrangular adzes, axes, and whetstones have been identified. There is a ‘sumtralith in the inventory – this is a pebble tool that has been flaked around most of its circumference and has been considered a type fossil of the Hoabinhian techno-complex. The ‘formal’ tool component is very low (as is often the case in Southeast Asia) and even the forms noted above include ‘post hoc’ tools – pieces with a recognisable functional form derived not from manufacture but from use. Notable amongst these are the hammers, whetstones and rubbers which are identified by patterns caused by use. Indeed, there are also a number of informal ‘axes’ where an axe-shaped pebble has simply been used and developed damage patterns associated with axe usage. The approach to lithic technology is minimalist with little formal input of ‘stylistic elements’ or conscious attempt to impose form. Notable in the tool industry is the presence of burins (or spalls from their manufacture) suggesting the use of stone artefacts to create other artefacts in bone and hard wood and the frequency of hammers when compared to the amount of flaked material. This ratio is very high (hammers are not so frequent in other sites and can even be lacking) which suggests that the hammers may not be for flaking but for tasks relating to pounding and also the working of wood. The chopper is also likely to have been a wood working tool. One of the scrapers has a small notch in its working edge where a quartz crystal has been pulled out during use suggesting working on a hard substrate.

Table 1. Tool Inventory.
Note where (?) is recorded the form of the piece suggests inclusion but the wear patterns were not well developed.

Tool Type	Raw Material	Grid Square
Axe (post hoc)	limestone	O/13:6”
Axe fragment	shale	Nambi Pit 2:12”
Burin	quartz	G/18:12”
Burin spall	quartz	A/18:42
Burin spall	quartz	O/13:12”
Burin spall	quartz	O/13:12”
Chisel (flaked & polished)	shale	A/8:9”
Axe (flaked)	shale	O/11:12”
Chopper	shale	O/12:9”
Hammer	limestone	F/8:12”
Hammer	quartz	H/8:18”
Hammer	limestone	N/10:12”
Hammer	quartz	N/8:24”
Hammer	limestone	N/8:18”
Hammer	shale	F/11:12”
Hammer	limestone	F/8:12”
Hammer	quartz	O/11:18”
Hammer	limestone	E/8:12”
Hammer	quartzite	O/9:24”
Hammer	sandstone	A/8:12”
Hammer (fragment)	shale	L/8:12”
Hammer (fragment)	limestone	C/10:6”
Hammer (fragment)	limestone	L/8:6”
Hammer/pounder	quartzite	O/11:12”
Hammer/pounder	shale	H/8:18”
Hammer (?)	limestone	G/8:12”
Knife (fragment, post hoc)	shale	N/8:6”
Notch	quartz	H/8:18”
Quadrangular adze	shale	N/8:3”
Rubber	shale	O/13:9”
Rubber	shale	A/8:12”
Rubber (fragment)	shale	A/8:36”
Rubber/pestle	shale	E/10:12”
Rubber (?)	shale	A/8:18”
Rubber (?)	limestone	A/10:18”
Rubber (?)	shale	A/8:18”
Rubber (?)	shale	N/10:18”
Rubber (?)	limestone	N/8:9”
Scraper	quartz	M/8:18”
Scraper	quartz	O/13:18”
Sumatralith	shale	O/9:12”
Tool fragment	shale	O/13:4”
Utilised flake fragment	shale	O/13:3”
Utilised flake fragment	limestone	Mouth/Surface

Whetstone	limestone	N/12:12”
Whetstone (fragment)	shale	F/10:18”
Whetstone/hammer	limestone	N/12:12”
Whetstone (?)	shale	E/11:12”

Technology.

Cores: There were 19 cores, all from the 1959 excavations. Five came from square H/8 with three at 24” depth and two at 18” depth. All cores were quartz and for making flakes, the single exception being a limestone flake core found on the surface. All the quartz cores were single platform and direction with a single exception of an opposed (bipolar) core. Most cores were made on small river pebbles. There were two cores from I/8 at 30” and two from N/10 at 12” and 24”. The frequency and distribution of cores does not suggest any kind of reduction intensity or clearly organised knapping areas. The maximum number of removals was 5 (in seven cases) and the minimum was one. This again suggests little intensity in reduction although care should be exercised as a later large removal could remove evidence of earlier flakes, especially on small cores.

The non-core artefactual collection can be broken down as follows:

Table 2. Blank types.

Blank type	number	limestone	quartz	shale	other
Flake	205	18	103	83	1
Flake fragment	59	3	23	33	0
Lump	16	1	11	2	1
Blade	2	0	2	0	0
Blade fragment	1	0	1	0	0
Pebble	43	20	11	10	2
Pebble fragment	29	6	4	19	0
Shatter	119	4	75	40	0
Pebble ¼	3	1	0	1	1
Cobble	3	2	0	0	1
Fragment	11	6	1	4	0
Pebble ½	2	1	0	1	0
Flake/blade	5	1	2	2	0
Cobble ¼	1	1	0	0	0
Cobble ½	2	1	0	0	1
Plaquette	1	1	0	0	0

It may be seen from Table 2 that there is some selection of preferred raw material but a substantial part of what is represented is material found around the site area naturally. The apparent over-representation of quartz reflects its small size producing lots of small flakes and chips. The use of anvil technique is also liable to produce more than single flakes at a time. The quartz is also more consistent in quality than the shale or limestone and so was probably preferred for that reason. There were other stones, calcite/gypsum crystals, small rounded water-worn pebbles formed by swirling water in hollows in the limestone and other fragments that were not considered artefactual and have not been included in the final summary. The numbers of these are recorded in the original notes. It should be said that some of the ‘fragments’, ‘shatter’ and pebbles may be natural pieces too. A plaquette is a tabular limestone fragment eroded from the roof of the cave (roof spalls) and sometimes these have been used later by humans (as has been documented at Niah West Mouth and Lobang Angus (Reynolds forthcoming).

Examination of the platforms of the flaked element revealed the following:

Table 3. Platform types.

Quartz (n=106)					
Cortical	11	Crushed	25	Plain	70
Shale (n=101)					
Cortical	12	Crushed	27	Plain	62
Limestone (n=9)					
Cortical	5	Crushed	1	Plain	3

No other platform types were recorded. The sample size for limestone is too small to make generalisations but the pattern for quartz and shale is similar. Once again, no special treatment or core preparation is visible. The pattern of flaking is based upon direct hard hammer percussion, probably using relatively large pebbles as hammers. Although the use of bipolar technique, and the presence of flakes from it suggest quartz is treated differently at times due to its less tractable nature.

There were sixteen burnt pieces which is quite low for an assemblage of this size given the ashy nature of the deposits and the suspected presence of hearths. Lithic material was often knapped around hearths and stones used to line hearths but neither could be suggested from this data.

Examination of the blank forms (Table 4) shows a predominance of tertiary flakes.

Table 4. Blank forms.

Flakes					
Tertiary	135	Secondary	46	Primary	23
Flake Fragments					
Tertiary	45	Secondary	11	Primary	3
Flake/blades					
Tertiary	3	Secondary	2	Primary	0
Blades					
Tertiary	1	Secondary	1	Primary	0
Blade fragments					
Tertiary	1	Secondary	0	Primary	0

This is curious as reliance on small pebbles would create a relatively greater chance of removing cortex during knapping. This might suggest an intensive reduction of the cores (although there is little evidence for this) or working of the cores to avoid cortical areas. This is not visible from the sample of cores recovered from the site. In may be, therefore, that a significant number of blanks are being manufactured elsewhere, either elsewhere on the site or from outside it.

The small number of blades and flake/blades and a lack of bladelets would argue that there is no deliberate reduction aimed at producing these blank types, a fact confirmed by the lack of cores for blades and bladelets.

There were a total of 16 siret flakes recorded. These flakes are usually produced through the use of large, heavy hammers splitting the intended flake by accident along the flaking axis. Seven of the siret flakes were in quartz and nine were shale. This data confirms the pattern suggested above of direct hard hammer percussion for flaking. There are a small number of plunged (a single quartz piece) and hinged flakes which is within the expected range for an assemblage of this size and form of technology.

Distribution of materials.

The notes archived at the National Museum in Kuching state that there were a number of post holes, a few burials and a significant amount of bioturbation (mostly by porcupines). Given this fact, the use of depth data based upon spits holds limited value. It may be seen that lithic material occurs across the site at a variety of depths from the surface to 90”. The bulk of material came from spits ending at 12” (113 cases), 18” (95 cases) 6” (56 cases) 24” (50 cases) and 30” (29”). The distribution pattern of tools and cores reflects this. Spatially, the flaked material came mainly from squares G/8 (30), H/8 (31) C/10 (26) and K/8 (21). There was also a significant amount of material from the back wall of the cave where square O/11 yielded 41 pieces and O/13 28. The presence of material at the rear of the cave in this frequency may suggest discard of sharp stones away from the occupation and activity areas. It should be noted, however, that these figures for individual squares are actually very low – Palaeolithic sites in Europe can produce 1,000s of pieces in similar areas.

The pattern of tool distribution partly reflects the overall distribution of material but with a greater concentration of tools in the rear of the cave, squares N/8 (5 pieces) and O/14 (7 pieces) are the richest with the exception of A/8 which is right at the front of the excavated area which also has 7 pieces. Otherwise there is a small number of squares with one or two pieces each. The pattern for tool distribution could again suggest tool discard around the edge of the occupation/activity area but sample sizes are too small to make anything other than suggestions.

The greatest number of cores is found in square H/8 (5 pieces) with no other square yielding more than two examples but again of the four squares with two cores one is in the main area (I/8) and all the others are towards the rear of the cave (N/10, O/12, O/14). Allowing for some separation in depth and sample sizes there is little more that can be said with any confidence about the distribution of materials at the site.

Discussion

The site has provided a small and limited sample of lithic material for interpretation of activity and behaviour. There is a clear pattern of direct hard hammer percussion with the occasional use of bipolar technique for particularly intractable quartz pebbles. The flakes are used, where this can be determined, for a small number of tasks probably involving the manufacture or processing of bone and wood. The use of lithic material is consistent but low-intensity and locally available materials are used. There is no evidence of pressure on lithic resources. Many of the identified tools are expedient and made on a suitably shaped natural pebble rather than worked into form and the whole pattern of lithic exploitation appears to be *ad hoc*. The presence of a sumatralith requires comment; it is as likely that it is a core for flakes as a tool in its own right and no necessary link to the Hoabinhian techno-complex is claimed arising from the presence of a single such piece at Gua Sireh. This said, the distribution of the Hoabinhian includes Sumatra and so a possible presence on Borneo should not be ruled out.

The assemblage would fit within the pattern observed for Sarawak of a small assemblage size, limited formal tool range and an opportunistic use of materials. The range of activities witnessed is small and appears to centre mostly upon the working of other materials, probably to make tools.

Conclusions

The material from Gua Sireh may be compared with that of Niah Cave Holocene levels and would match its characteristics in terms of approach to tool production and use (Reynolds in Barker et al. 2000, 2001, 2002a and b, 2003 and forthcoming). The lithic assemblages from both sites derive from an informal hard hammer, direct percussion system with flaking from one end of the core only predominating. The more specific use of anvil technique for quartz river pebbles is also found at Niah. There is no evidence for intensive reduction or preferential selection of blank forms at either site although it would appear that at Niah material was being introduced to site in the form of already manufactured flakes. The larger tool element is often mad eon suitably shaped pebbles and cobbles with little pre-use shaping taking place. Local raw materials dominate at both sites and are used in the same ways (with the exception of quartz pebbles). This pattern of lithic resource exploitation appears to derive from Pleistocene inhabitants at Niah and there does not seem to be any increase in the manufacture or use of formally flaked tools over time. There is a slight increase in a few specialised types such as ground or polished axes but these are always rare and probably imported to both sites. The lithics from Gua Sireh confirm a pattern of unspecialised industry that is also found at Niah and can also be found at numerous other Southeast Asian sites. Presently, lithic data from Southeast Asia cannot be used for the effective characterisation of culture history.

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Figure Captions.

Figure 1. Map of Sarawak showing the locations of Gua Sireh and Niah Caves.

Figure 2. Plan of Gua Sireh showing the different excavation trenches (After Datan 1993).

Key to Figure 2:

H/S - Harrison Solheim trenches 1959
EK – Edmund Kurui 1980
ZM – Zuraina Majid 1977
G8.F8/E8 – Ipoi Datan 1989

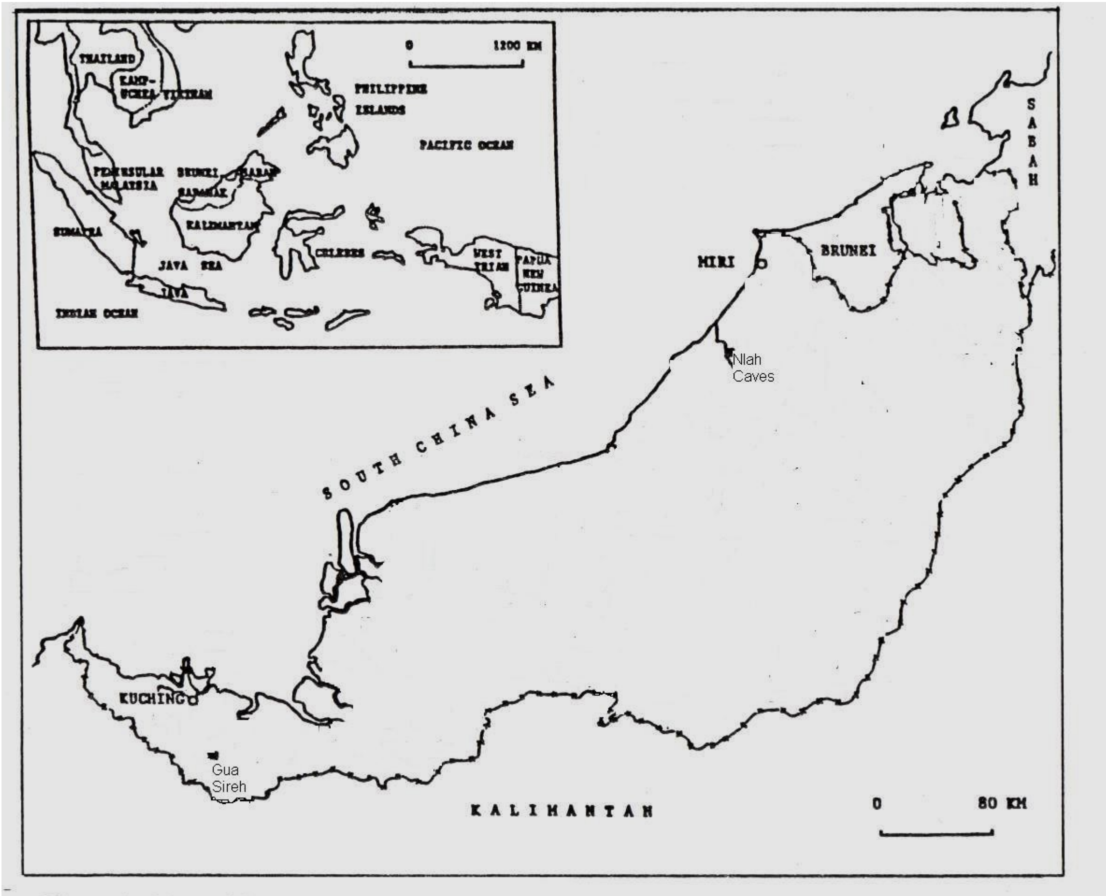
0
1200 KM
THAILAND
PHILIPPINE
ISLANDS
PACIFIC OCEAN
JAVA SEA
JAVA
INDIAN OCEAN
CELEBES
SABAH
BRUNEI
MIRI
Niah
Caves
SOUTH CHINA SEA
KUCHING
Gua
Sireh
KALIMANTAN
0
80 KM

Figure 1

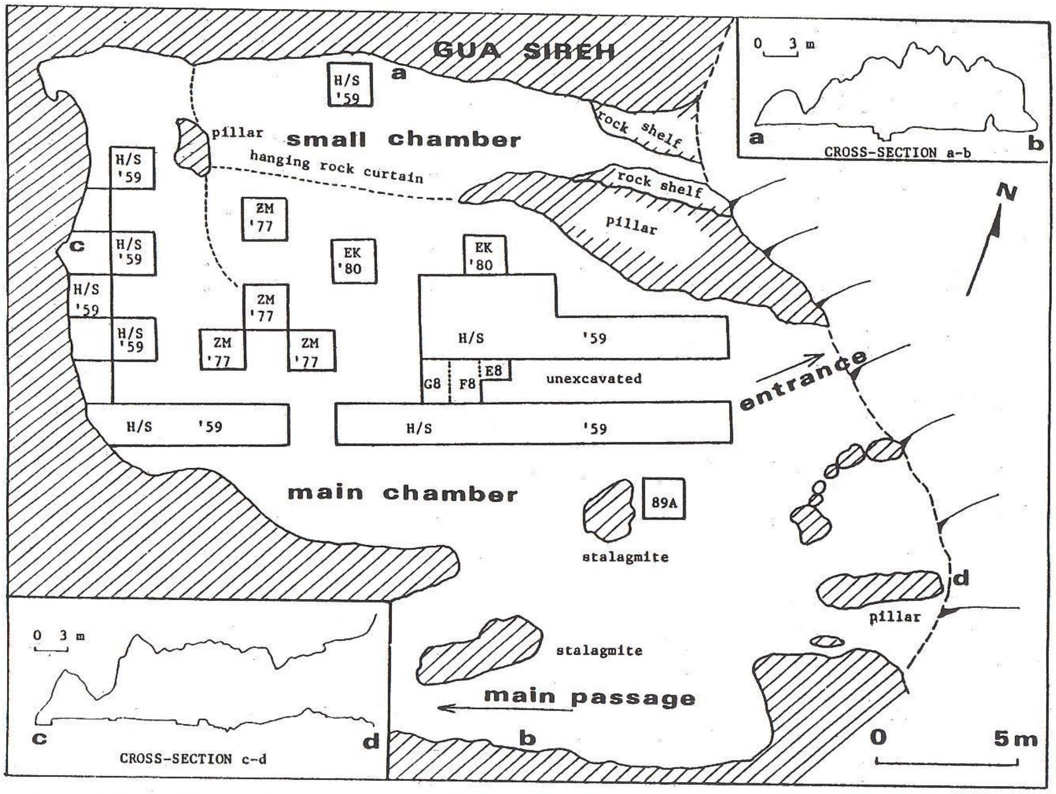
GUA SIREH
a
H/S '59
pillar
small chamber
hanging rock curtain
rock shelf
rock shelf
pillar
N
0 3 m
a
CROSS-SECTION a-b
b
c
H/S '59
ZM '77
EK '80
EK '80
H/S '59
unexcavated
G8
F8
E8
entrance
main chamber
89A
stalagmite
d
pillar
stalagmite
main passage
b
0
5m
0 3 m
c
CROSS-SECTION c-d
d

Figure 2