LATE PLEISTOCENE TO MID-HOLOCENE COASTAL AND INLAND INTERACTION IN THE GUNUNG SEWU KARST, YOGYAKARTA

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ABSTRACT

The Gunung Sewu karst in the Southern Mountains of Java Island has specific characteristics from a geoarchaeological viewpoint. Cross disciplinary approaches utilising Geographic Information Systems (GIS), and geographical and geological information, are very useful for examining correlations between site distributions and geophysical processes. The geographical and geological aspects of the region contribute information for understanding prehistoric interactions between coastal and inland communities. GIS technology was applied in an examination of terrain, the karst landscape, and the distributions of cave sites.

INTRODUCTION

Gunung Sewu is a karst region which covers three kabupaten in three provinces; Kabupaten Gunungkidul (Yogyakarta), Kabupaten Wonogiri (Central Java) and Kabupaten Pacitan (East Java). It runs for 80 km along the southern coast of Java from Parangtritis in the west to Pacitan Bay in the east. The karst extends inland for about 30 km to the north between two depressions, the Wonosari Basin in the west and the Baturetno Basin in the east (Pannekoek 1949; van Bemmelen 1970; Yuwono 2006) (Fig. 1).

The southern edge of the karst region is dominated by coastal cliffs and bays. Inland, the karst is characterised by conical hills with polygonal dolines and a labyrinthine network of dry valleys. Some depressions are wet all year, but others contain wet season lakes only. Otherwise, most of the water flow in the region is sub-surface, and apart from the dolines the karst is rather barren and without surface water.

On the other hand, the Miocene limestones of the Wonosari Formation (Mark 1961; Bemmelen 1970) contain large numbers of phreatic caves and rock shelters suitable for prehistoric occupation. More than 100 cave sites have been recorded, but few have been excavated (Simanjuntak 2002; Yuwono 2002). Tanudirjo et al. (2003) located more than 40 caves during a survey of Kecamatan Tanjungsari, 22 recognised as archaeological sites.

However, interaction patterns among the cave communities during the prehistoric period have not as yet been studied. Therefore, this research aims to:

1. expand the survey into the western part of Gunung Sewu (Kabupaten Gunungkidul);
2. study the distribution patterns of caves in the context of the Gunung Sewu landscape;
3. recover archaeological data through excavation for investigating prehistoric interaction between coastal and inland region.

RESEARCH STRATEGY

The research comprised interpretation of maps and Landsat imagery, surface survey, and excavation. The research area consists of the western part of Gunung Sewu, especially Tanjungsari and the adjacent area of Kabupaten Gunungkidul, Yogyakarta Province (Fig. 2).

The surface survey was based on a 1:25.000 Rupa Bumi Indonesia (RBI) digital map, Shuttle Radar Topographic Mission (SRTM) imagery made in 2005, and on data from Landsat ETM band 457 (30 m resolution (Yuwono 2004). The occupational suitability of a cave was determined by factors such as the size and capacity of the chamber (Yuwono 2006).

The survey produced 22 caves with archaeological potential, 20 without. Most of the caves at Tanjungsari were located in 2003, while those at Semanu and in the eastern part of Tanjungsari were surveyed in this research (Table 1, at end of paper). Excavations were carried out in Song Jrebeng in the coastal area and at Song Tritis further inland (Fig. 2). Song Jrebeng had the richest surface finds amongst the coastal cave sites, while Song Tritis was chosen based on its morphology. Excavations at Song Jrebeng and Song Tritis were undertaken in July and August 2006. Two test pits were excavated in each cave (TP 1 and TP 2). The excavation at Song Jrebeng was about 60 cm deep, at Song Tritis about 1 m.

RESULTS OF THE RESEARCH

Song Jrebeng (Fig. 3)

Song Jrebeng is a rockshelter 85 m above sea level near Pantai Kukup, Kabupaten Gunungkidul. It is about 23 m wide and 5 m high, and faces south to Pantai Kukup,

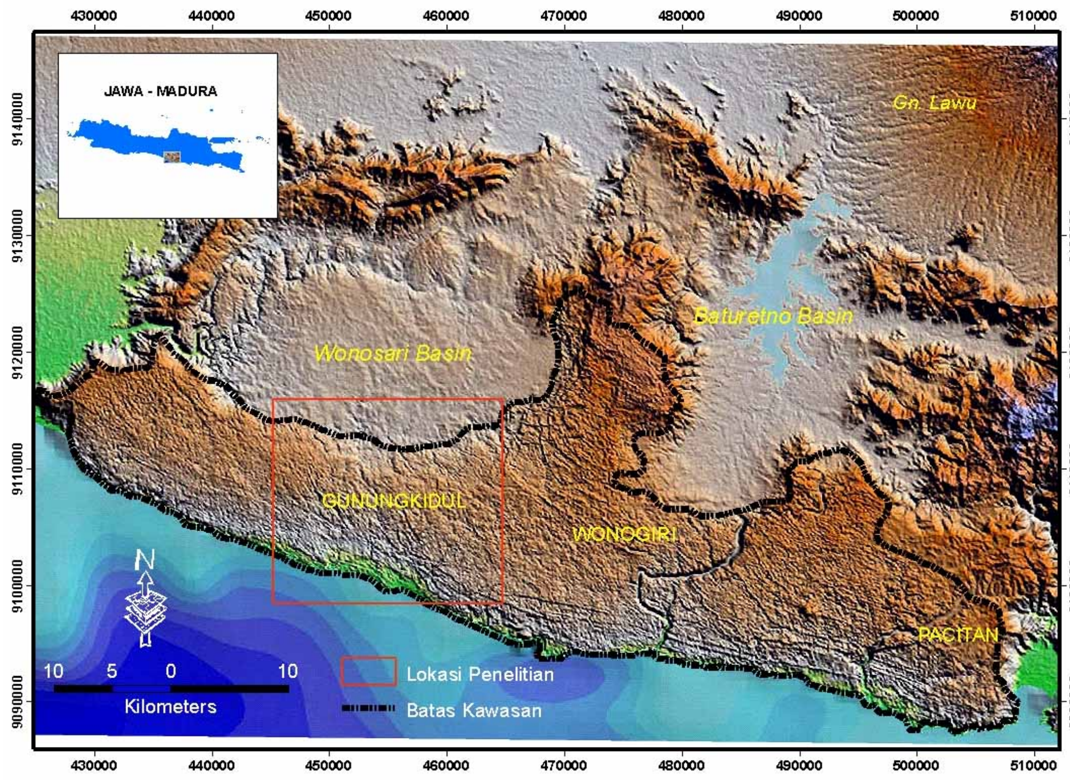

Figure 1. The Gunung Sewu region based on an SRTM image, 2005 (Source: Samodra 2006).

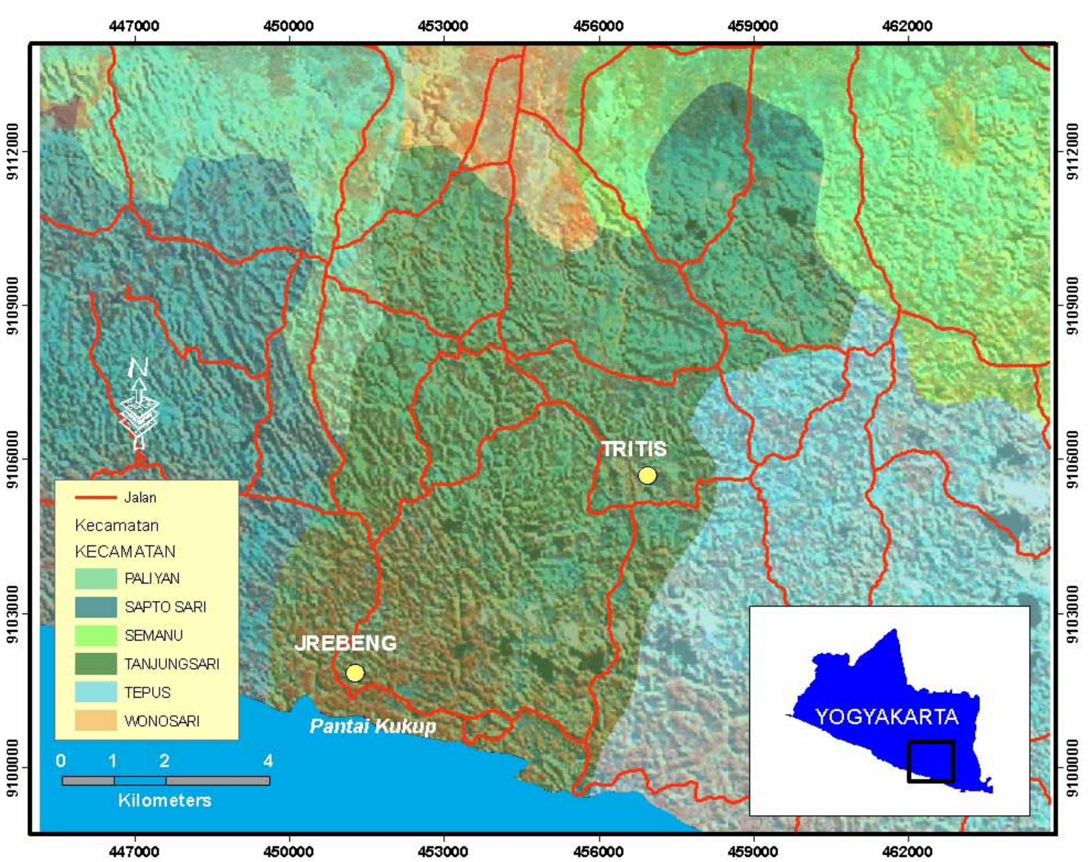

Figure 2. Research area: Tanjungsari and surrounding regions (Source: RBI map and Landsat imagery ETM band 457).

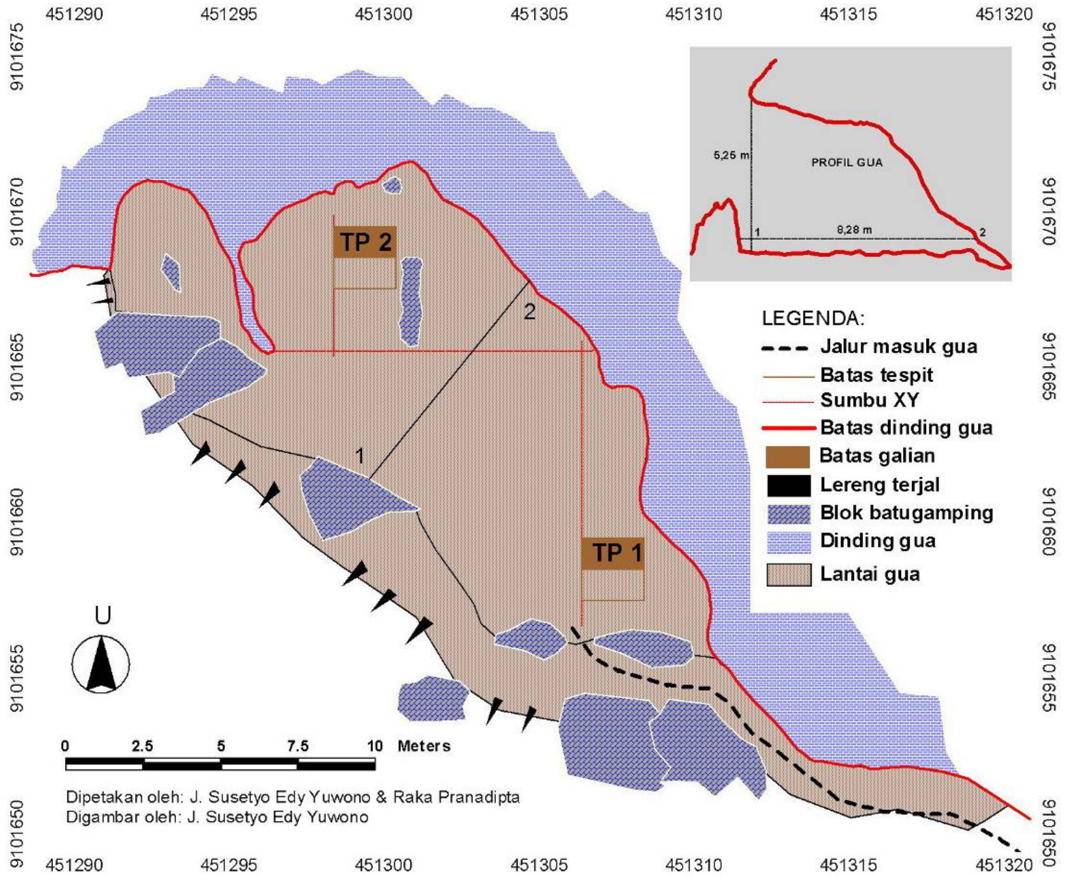

Figure 3. Plan of Song Jrebeng and locations of testpits.

Figure 4a. Kukup coastal landscape from Song Jrebeng.

Figure 4b. Kukup coastal landscape from Song Jrebeng.

which lies about 700 m away (Fig. 4). The chamber is about 8 m deep. The cave is situated in a steep hill side (550) about 50 m above the valley floor, and is quite difficult to reach (Fig. 5). However, compared to the other caves in the region, its archaeological potential was considered to be the highest. The cave floor is dry and loose sediment, with occasional disturbances (Fig 6a, b).

Song Tritis

Song Tritis is situated at Desa Ngestirejo, Tanjungsari, 7 km northeast of Song Jrebeng (Fig. 2), at about 247 m above sea level. This large rockshelter faces southeast. Its mouth is 80 m wide, 5 m high, and the inner space is about 20 m deep.

Song Tritis is in one of several hills which encircle a polygonal depression with a permanent lake called Telaga Tritis (Figs 7a, 7b, 8). Compared to Song Jrebeng, this cave is very easy to reach from an access road to the lake. The existence of this access has disturbed the surface finds.

Figure 5. The position of Song Jrebeng on a hill slope.

Figure 6a. TP1 at Jrebeng (Photo: Taufiqurrahman S.)

Figure 6b. TP2 at Jrebeng (Photo: Taufiqurrahman S.

Figure 7a. The location of Song Tritis.

Figure 7b. The lake near Song Tritis.

Figure 8. TP1 at Tritis (Photo: Suhartono).

Most of the interior of Song Tritis is covered by limestone boulders. Nevertheless, there was space for excavation at the back (Fig. 9). The surface here is lower than the cave mouth, so that rain water can enter the cave along the dripline. The surface soil in the excavated area

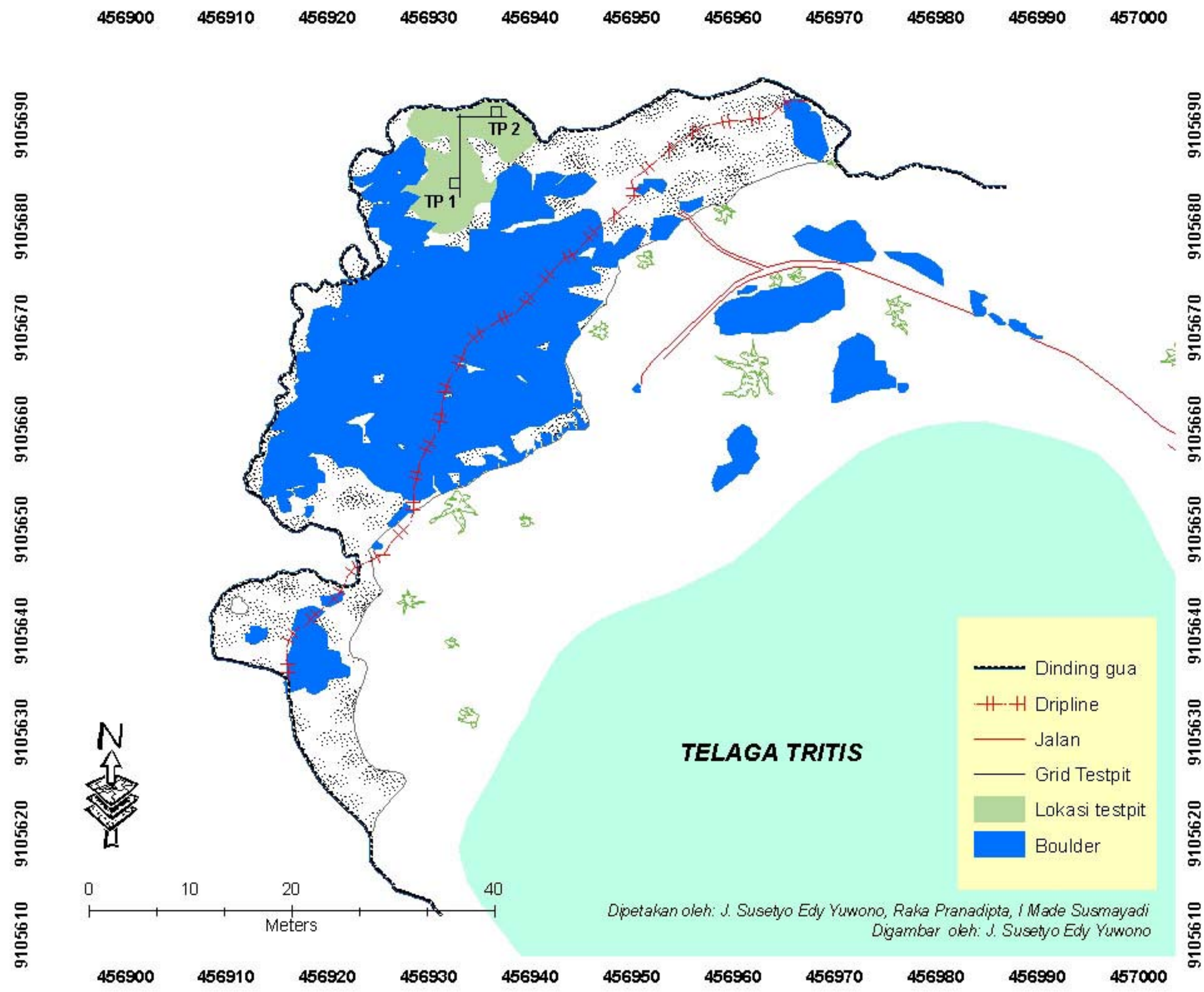

Figure 9. Plan of Song Tritis and locations of testpits.

Figure 10. Well preserved animal bones from Tritis (Photo: Suhartono).

Figure 11. The bone cluster in Fig. 10, in situ *in TP1 at Tritis (Photo: Suhartono).*

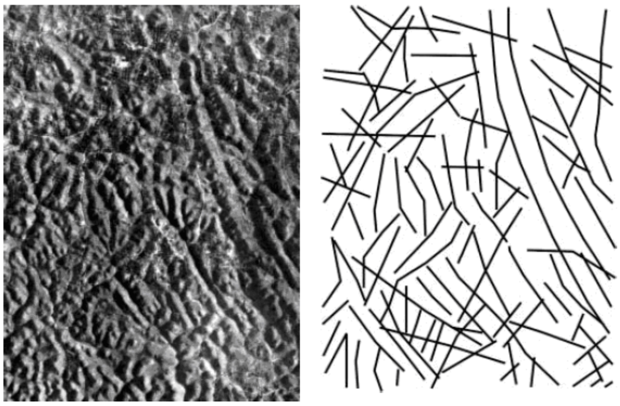

Figure 12. Samples of labyrinth-conekarst in Gunung Sewu (after Haryono & Day 2004)

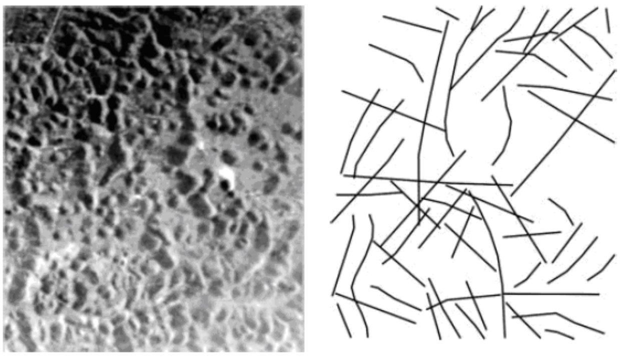

Figure 13. Samples of residual conekarst in Gunung Sewu (after Haryono & Day 2004)

of coarse sand, damp and dark brown in color. However, the results of stratigraphic analysis and granulometry, conducted by Eko Haryono in Laboratium Geografi Tanah at Gadjah Mada University, suggest that the caves would have been dry enough to support human occupation in the past.

The materials uncovered in the excavations were classified into organic (shell and non-shell) and non organic materials (Table 2, at end of paper).

Taxonomic analysis undertaken in the Faculty of Biology at Gadjah Mada University showed similarities in the species of animals exploited for consumption in the two caves, but with significant differences in percentages. The animal remains consist of species of *Bos, Cervus, Sus, Gallus, Macaca, Hystrix, Tragulus, Rattus, Capra, Rhinoceros, Trionyx, Varanus* and *Geochelone,* and indeterminate specimens of Bovidae, Leporidae, Pongidae, Vivveridae, Muridae, Rodentia, Testudinata and Pisces. Bones dominated over shells in the inland cave of Song Tritis (bout 84.45%) and the fragments were larger than those from Song Jrebeng (Figs 10, 11). It seems that these animals were butchered in or surrounding the cave.

On the other hand, shells were dominant in Song Jrebeng (76.51% of organic materials). They can be divided into four classes: Bivalvia (5 families), Echinoidea (1 family), Gastropoda (17 families) and Polyplacopora (1 family). Not all families found in the coastal site occurred in the inland site (Table 3). The number of opercula found at Song Jrebeng approached 3000, compared to only 4 from Song Tritis. Such differences are very significant.

Non-organic materials found in the two caves also showed differences (Table 2). It is quite possible that stone artefacts were not so important in the coastal site of Song Jrebeng, where the most common artefacts were bone awls and spatulae (56 specimens) and shell scrapers (7 specimens).

INTERPRETATIONS FROM IMAGE AND SURFACE SURVEYS

Song Jrebeng and Song Tritis represent coastal and inland caves respectively. These two caves, about 7 km apart, had similar finds but with differences in percentages. Some other caves within the surveyed area also displayed high archaeological potential (Table 1, at end of paper).

By overlaying a map of cave distribution and the results of three-dimensional analysis using data a Triangulated Irregular Network (TIN), it can be seen that the archaeological caves tend to form a linear pattern. The dominant factor which influenced this was the dry valley network, a most important component of a karst landscape. This pattern also channelled interaction between coastal and inland communities.

The Gunung Sewu karts consists of two main forms; a labyrinthine cone-karst with a dense rectilinear valley pattern shown in Fig. 12, and a residual version of the same shown in Fig. 13. The residual cone-karst is characterised by isolated hills separated by plains (Haryono and Day 2004). The valleys allowed movement between coastal and inland areas, to as far inland as the Wonosari Basin to the north of Gunung Sewu. This basin contained a swamp during the Late Pleistocene into the Middle Holocene (Raharjo 2002). Four major corridors which connected coastal areas and the Wonosari have been located, based on the interpretation of Landsat imagery and the TIN map.

1. The Sepanjang Corridor

This corridor runs from Sepanjang beach to the north, connecting groups of coastal caves (Jrebeng, Porangan, Watusigar, Gupak Warak, Ngleses, Ngringin, Watulawang and Bajak) with the inland caves (Gua Sumur, Gunung Kubon and Biru) (Fig. 14).

2. The Bruno Corridor

This corridor runs from Krakal beach to the north, almost parallel to the Sepanjang corridor. Many cave sites were found along it, from Gua Bruno in the south through Bledhek, Telaga Ciut, Nglibeng, Tritis, Ngorodowo, Jurug, Kombo and Pacul Gowang in the north (Fig. 15).

3. The Sundak Corridor

This corridor links Gua Bruno and Gua Bawahan I (Fig. 16) and provided alternative access to the eastern caves in the Semanu region. Other caves may be found along this corridor, especially in the Tepus region.

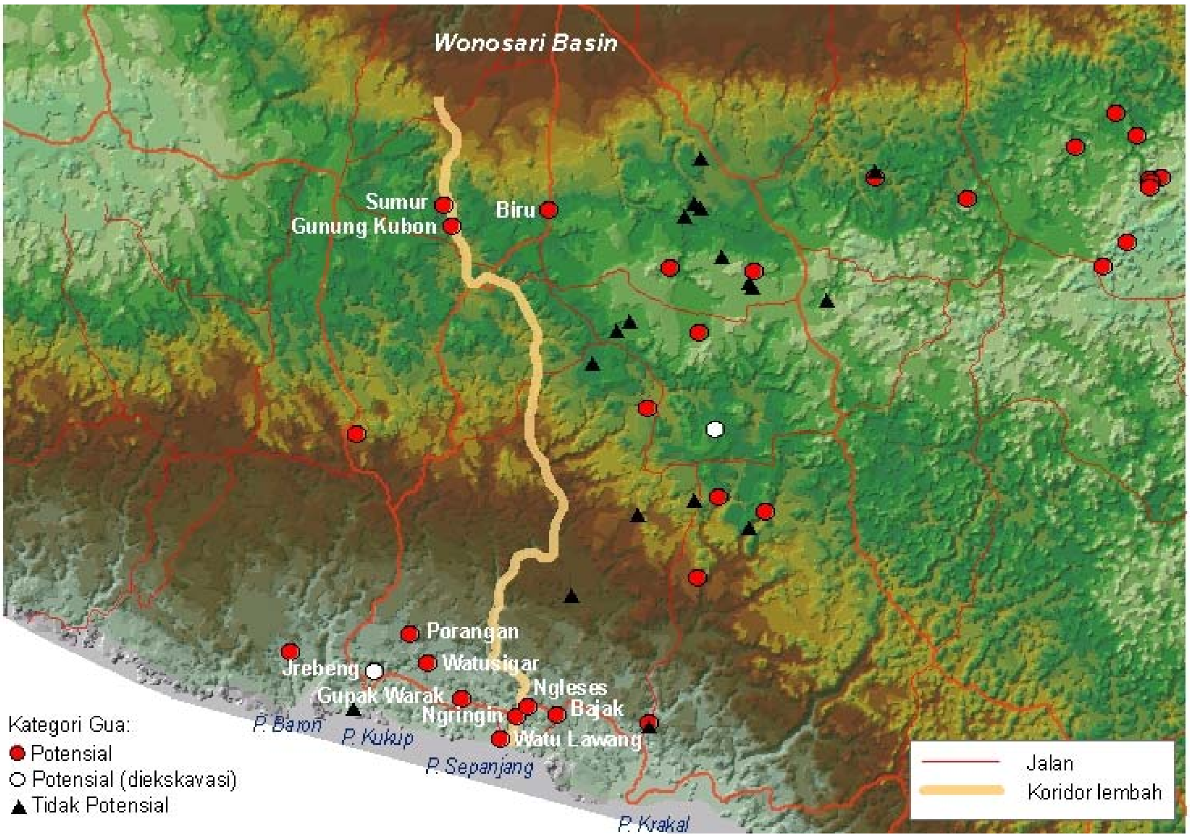

Figure 14. The Sepanjang Corridor.

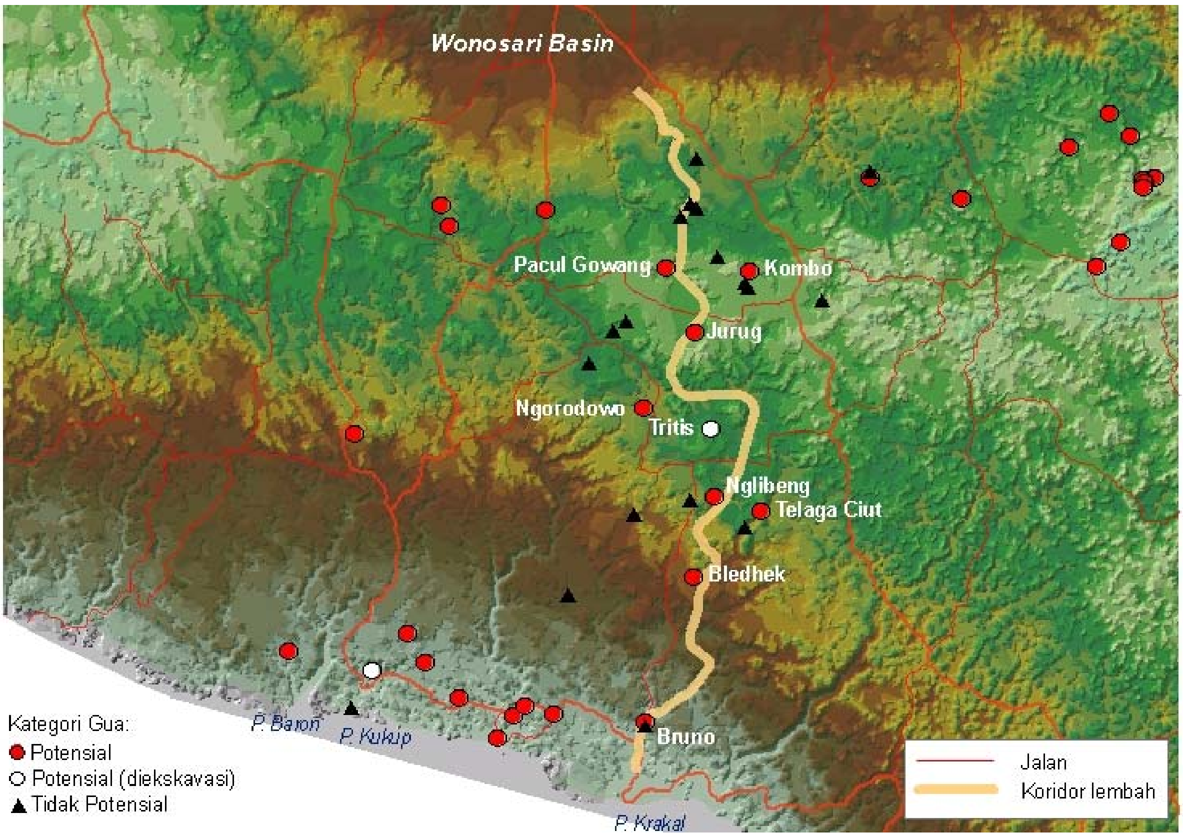

Figure 15. The Bruno Corridor.

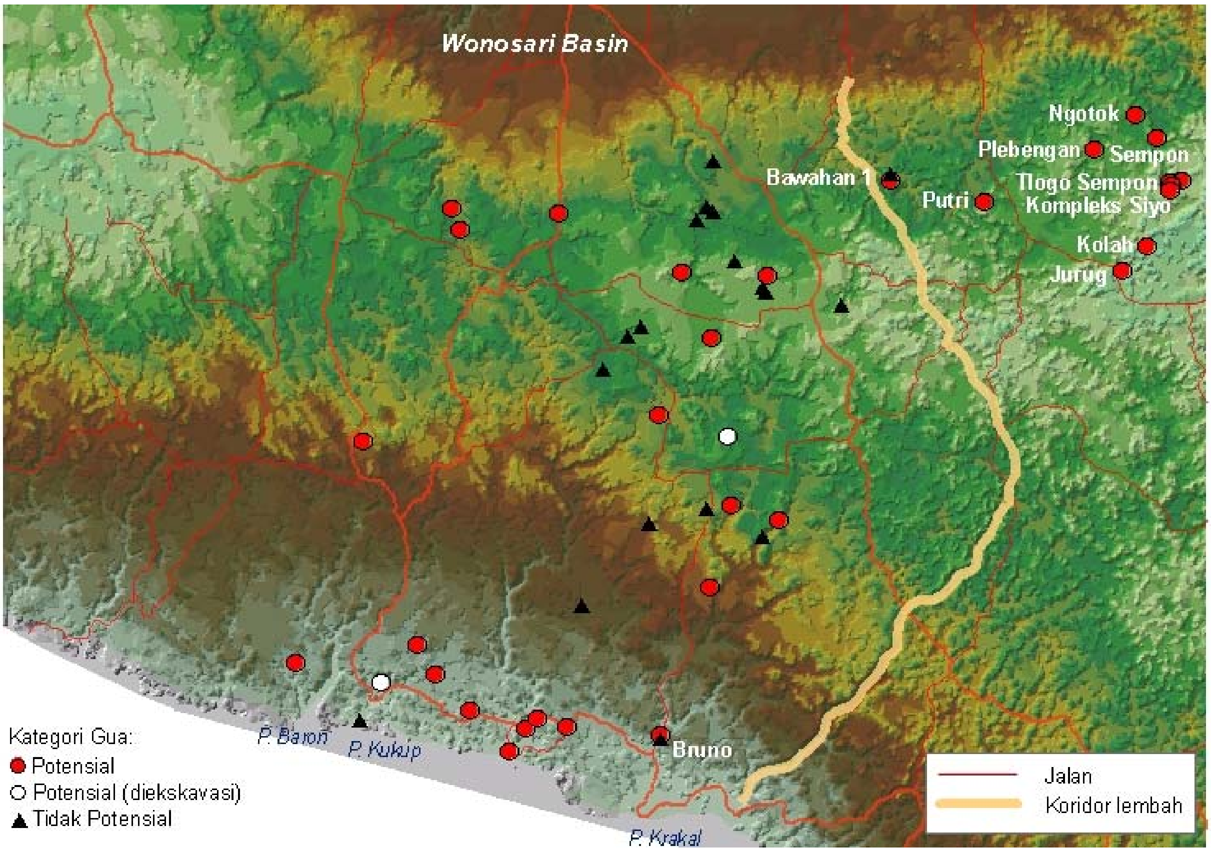

Figure 16. The Sundak Corridor.

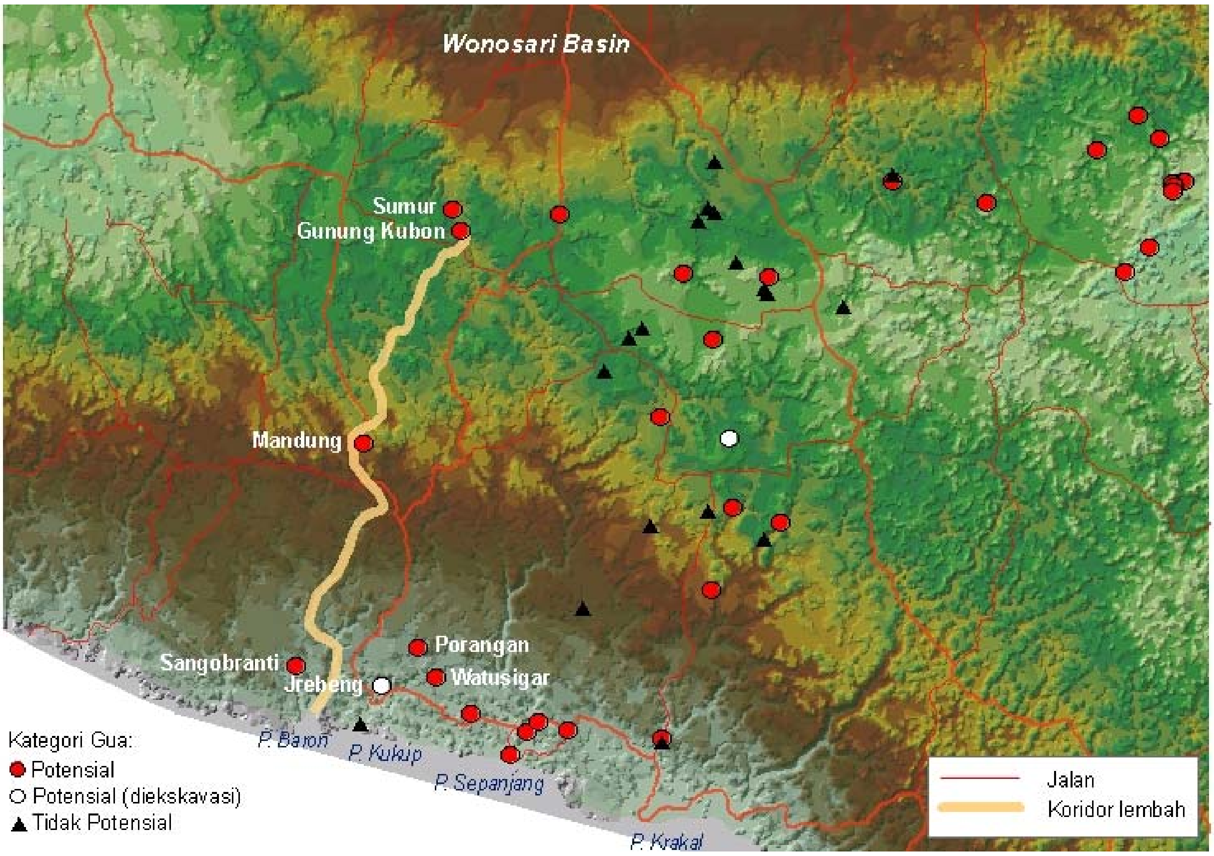

Figure 17. The Baron Corridor.

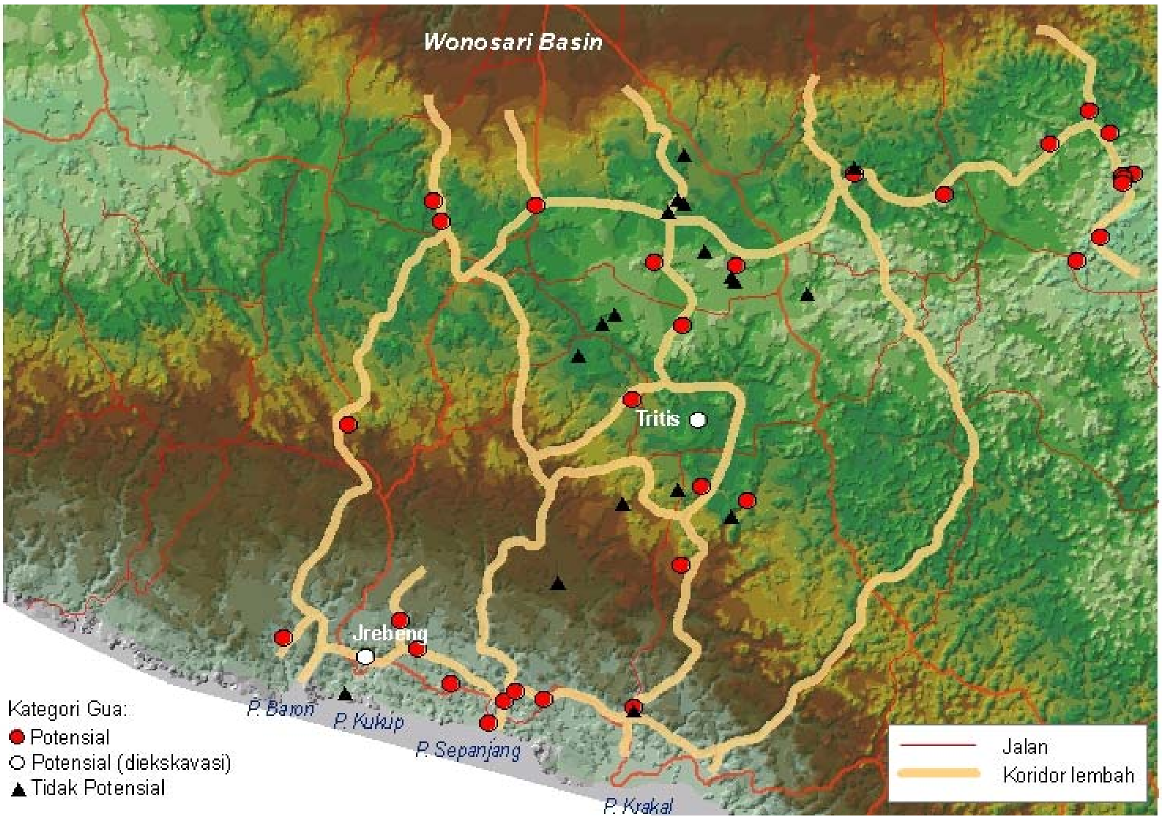

Figure 18. The overall network of karst valleys and caves.

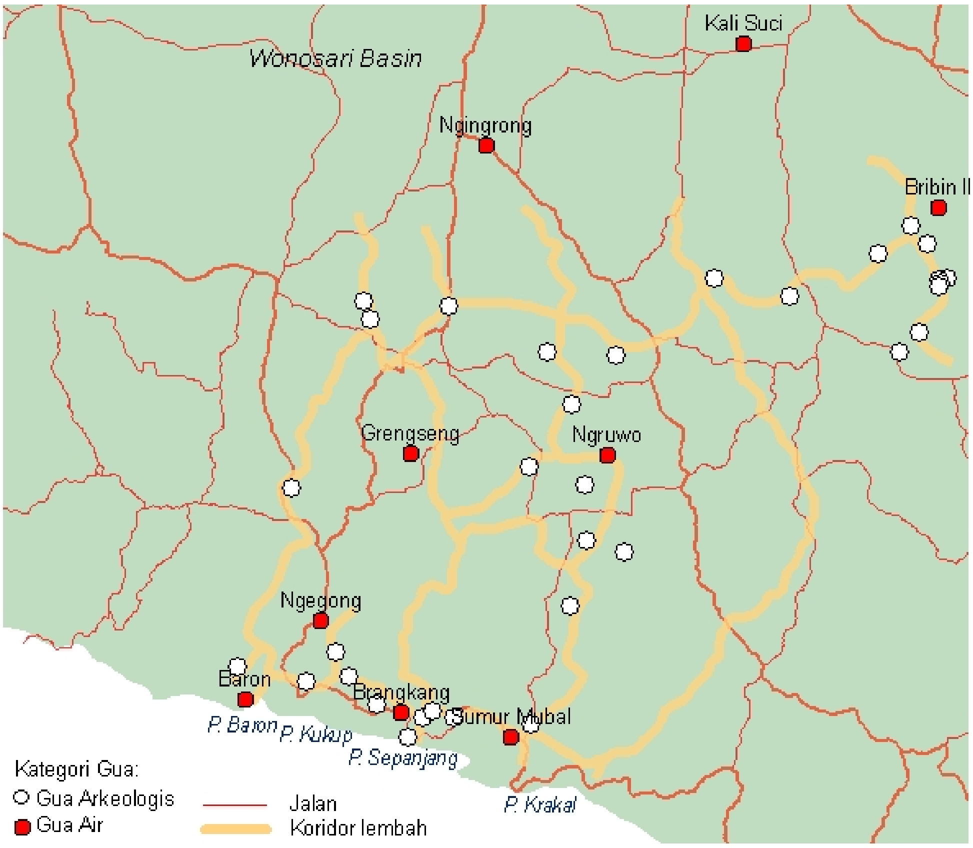

Figure 19. The distributions of archaeological and water-filled caves in the study area.

4. The Baron Corridor

This most westerly corridor starts from Baron beach and joins the Sepanjang corridor at Gunung Kubon. This corridor might have been used by the inhabitants of Sangobranti, Jrebeng, Porangan and Watusigar caves in the coastal area, and Mandung, Gunung Kubon and Sumur caves in the inland region (Fig. 17).

Figure 18 shows all the valley corridors in the research area. This figure also indicates cross-links between the Song Jrebeng and Tritis communities. The corridors which may have been used were coastal-coastal, coastal-inland, or on some occasions inland-inland.

The distribution of the Tanjungsari cave sites correlates with other components of the Gunung Sewu karst, in particular the large Bribin-Baron underground river system. Many uninhabitable caves (*gua air*) such as sinkholes and collapsed dolines, together with blind valleys, also follow this underground system (Fig. 19). Hydrological examination of the Bribin–Baron underground river system undertaken by Soenarto (2004) justifies these correlations between archaeological phenomena and endokarstic structures (Yuwono 2006).

CONCLUSIONS

The linear distribution patterns of cave sites in the research area suggest that prehistoric settlement in Gunung Sewu was much influenced by terrain and other elements of palaeo-landscape. Karstic valley corridors determined the nature of interaction between communities within different geographical regions. The excavations at Song Jrebeng and Song Tritis showed that both sites shared coastal and inland resources, but in different proportions.

Tanjungsari and adjacent areas form only a small region of the whole Gunung Sewu complex, and reveal interesting geoarchaeological phenomena. Broader research is still needed, and the location chosen for future research is the Sundak Corridor, close to the former valley of the Solo River.

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Table 1. The full list of Tanjungsari and Semanu cave sites.

NO	CAVES	KECAMATAN	KABUPATEN	ABSCISSA	ORDINATE	CATEGORY
1	Biru	Tanjungsari	Gunungkidul	454214	9109302	Potential
2	Sumur	Tanjungsari	Gunungkidul	452472	9109376	Potential
3	Gunung Kubon	Tanjungsari	Gunungkidul	452610	9109034	Potential
4	Mandung	Tanjungsari	Gunungkidul	451018	9105594	Potential
5	Sangobranti	Tanjungsari	Gunungkidul	449938	9101984	Potential
6	Kukup	Tanjungsari	Gunungkidul	450968	9101046	No Potential
7	Jrebeng	Tanjungsari	Gunungkidul	451313	9101652	Potential (excavated)
8	Porangan	Tanjungsari	Gunungkidul	451905	9102264	Potential
9	Watusigar	Tanjungsari	Gunungkidul	452200	9101782	Potential
10	Gupak Warak	Tanjungsari	Gunungkidul	452755	9101212	Potential
11	Watulawang	Tanjungsari	Gunungkidul	453398	9100526	Potential
12	Ngringin	Tanjungsari	Gunungkidul	453673	9100920	Potential
13	Ngleses	Tanjungsari	Gunungkidul	453874	9101070	Potential
14	Bajak'	Tanjungsari	Gunungkidul	454331	9100940	Potential
15	Gobyak	Tanjungsari	Gunungkidul	454592	9102904	No Potential
16	Bersole	Tanjungsari	Gunungkidul	455680	9104254	No Potential
17	Ngorodowo	Tanjungsari	Gunungkidul	455844	9106014	Potential
18	Sempu	Tanjungsari	Gunungkidul	454918	9106768	No Potential
19	Bowong	Tanjungsari	Gunungkidul	455344	9107306	No Potential
20	Bowong II	Tanjungsari	Gunungkidul	455533	9107454	No Potential
21	Pacul Gowang	Tanjungsari	Gunungkidul	456215	9108344	Potential
22	Ngawat I	Tanjungsari	Gunungkidul	456457	9109208	No Potential
23	Ngawat II	Tanjungsari	Gunungkidul	456609	9109420	No Potential
24	Ngawat III	Tanjungsari	Gunungkidul	456716	9109338	No Potential
25	Bodeh I	Tanjungsari	Gunungkidul	456723	9110170	No Potential
26	Bodeh II	Tanjungsari	Gunungkidul	456717	9110170	No Potential
27	Bawahan I	Tanjungsari	Gunungkidul	459612	9109846	Potential
28	Bawahan II	Tanjungsari	Gunungkidul	459608	9109944	No Potential
29	Cabe	Tanjungsari	Gunungkidul	457077	9108532	No Potential
30	Kombo	Tanjungsari	Gunungkidul	457597	9108290	Potential
31	Tabuhan	Tanjungsari	Gunungkidul	457534	9108092	No Potential
32	Mblubuk	Tanjungsari	Gunungkidul	457569	9108014	No Potential
33	Ngropah	Tanjungsari	Gunungkidul	458798	9107816	No Potential
34	Jurug	Tanjungsari	Gunungkidul	456701	9107286	Potential
35	Tritis	Tanjungsari	Gunungkidul	456961	9105674	Potential (excavated)
36	Tangkil	Tanjungsari	Gunungkidul	456626	9104504	No Potential
37	Nglibeng	Tanjungsari	Gunungkidul	457010	9104532	Potential
38	Telaga Ciut	Tanjungsari	Gunungkidul	457786	9104292	Potential
39	Jurug Tileng	Tanjungsari	Gunungkidul	457529	9104038	No Potential
40	Bledhek	Tanjungsari	Gunungkidul	456680	9103198	Potential
41	Bruno	Tanjungsari	Gunungkidul	455868	9100812	Potential
42	Kirik	Tanjungsari	Gunungkidul	455863	9100752	No Potential
43	Jurug	Semanu	Gunungkidul	463371	9108366	Potential
44	Kolah	Semanu	Gunungkidul	463778	9108758	Potential
45	Ngotok	Semanu	Gunungkidul	463587	9110918	Potential
46	Plebengan	Semanu	Gunungkidul	462936	9110344	Potential
47	Sempon	Semanu	Gunungkidul	463948	9110544	Potential
48	Tlogo Sempon	Semanu	Gunungkidul	464339	9109844	Potential
49	Siyo1	Semanu	Gunungkidul	464163	9109818	Potential
50	Siyo 2	Semanu	Gunungkidul	464191	9109770	Potential
51	Siyo 2	Semanu	Gunungkidul	464165	9109684	Potential
52	Putri	Semanu	Gunungkidul	461140	9109490	Potential

Table 2. Find distributions at Song Jrebeng and Song Tritis.

CATEGORY OF FINDS	SONG JREBENG		SONG TRITIS	
	Number of specimens	%	Number of specimens	%
Organic materials (non shell)	3,408	23.32	9,305	84.45
Organic materials (shell)	11,180	76.51	1,539	13.97
Non organic materials	22	0.15	175	1.59
Unidentified	3	0.02	0	0
Total	14,613	100.00	11,019	100.00

Table 3. Molluscan families recovered from Song Jrebeng and Song Tritis (analysed by Rury Eprilurahman, Faculty of Biology, Gadjah Mada University).

	CLASS	FAMILY	SONG JREBENG	SONG TRITIS
1	Bivalvia	Arcidae	*	
		Mytillidae	*	*
		Spondylidae	*	
		Tridacnidae	*	
		Veneridae	*	*
2	Echinoidea	Echinidae	*	
3	Gastropoda	Acmeidae	*	*
		Buccinidae	*	
		Cerithiidae	*	*
		Clausiliidae	*	*
		Cypraeidae	*	*
		Fasciolariidae	*	
		Fissurellidae	*	
		Haliotidae	*	
		Hiponicidae	*	
		Muricidae	*	*
		Neritidae	*	*
		Patellidae	*	
		Pleuroceridae	*	*
		Tonnidae	*	
		Trochidae	*	
		Turbinidae	*	*
		Viviparidae	*	
4	Polyplacopora	Chitonidae	*	*