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Hydrogeology of Limestone Formation of Sepingtiang, Lahat-Indonesia

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KARST HYDROGEOLOGY INVESTIGATION AS TOOL FOR LANDUSE PLANNING

Backgrounds

- Indonesian regulations on spatial planning stipulates that the limestone area must be classified into two categories, i.e a protected area and cultivated area
- Limestone outcrops with well developed karst morphology or distinctive karstic hydrogeology must be designated as protected area
- Limestone quarry and other utilization must be placed outside the protected area

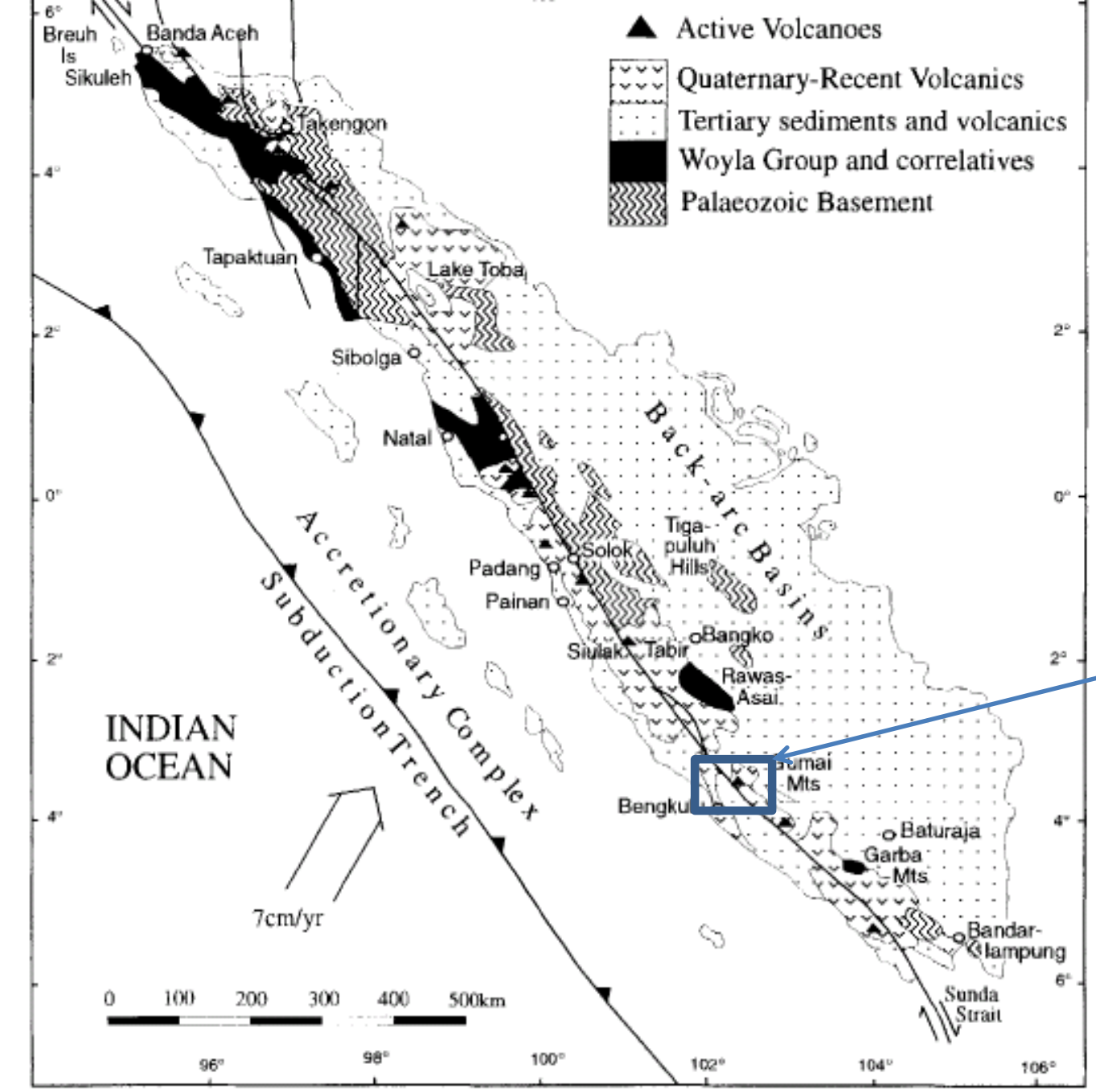
- The research presented here is a report of karst hydrogeology study in Sepingtiang Formation in bid of finding an area for limestone quarry
- The research mostly conducted through field survey. It includes karstic hydrogeological features (epikarst characteristics, sinkhole, sinking stream, resurgence identification, as well as in site hydrochemistry measurement

Study Area


SUMATRA
Write a description for your map.
Legend
Sumatra
Google earth
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat
500 mi
N

Geological Setting

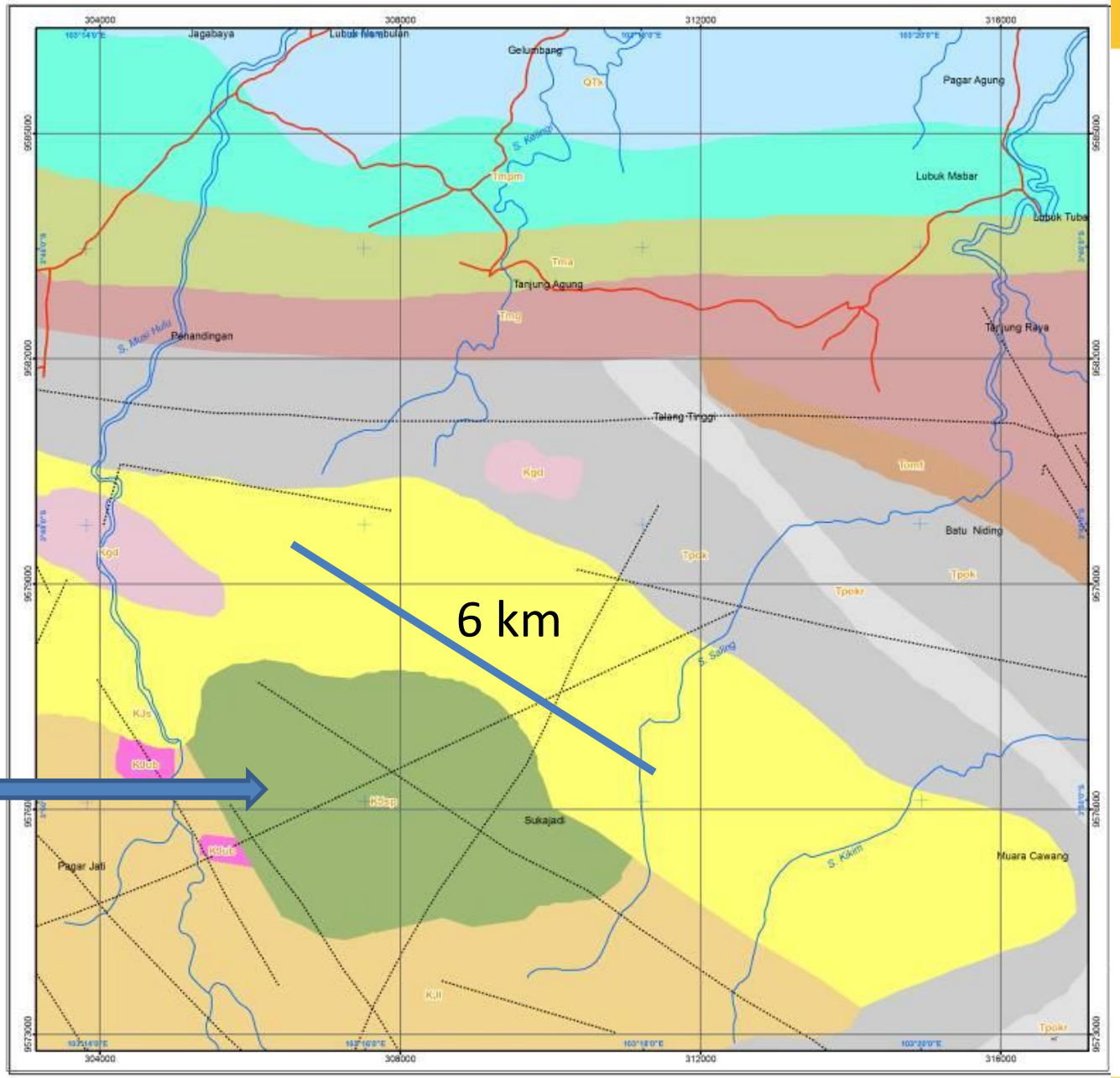
Sepingtiang Formation is one of the oldest limestone formation in Indonesia. The formation is characterized by very hard crystalline limestone of Late Jurassic-Cretaceous. The limestone belongs to Woyla Group that is considered to be the basement of Sumatra Island.



Study Area

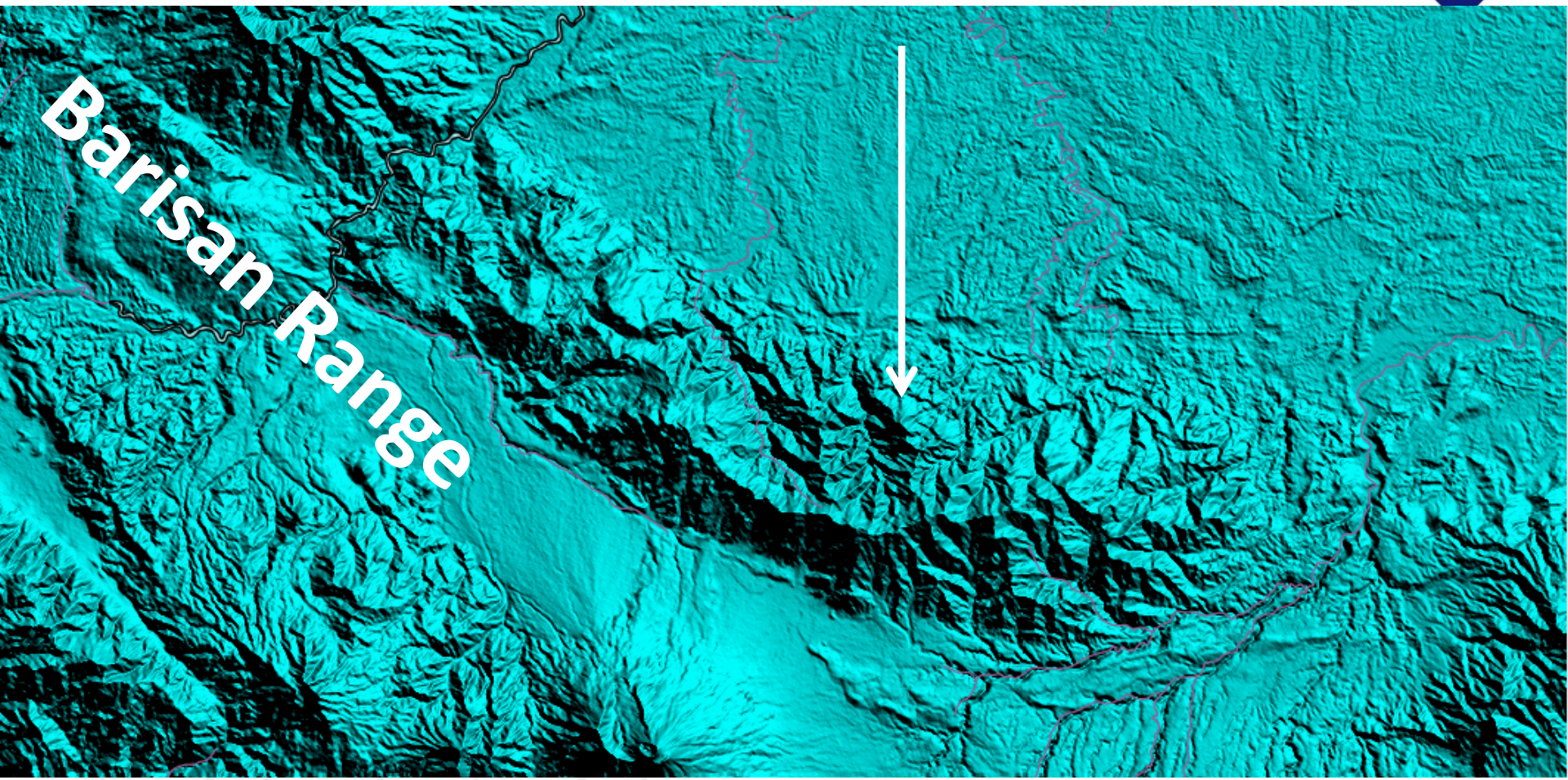
Simplified Geological Map of Sumatra (Barber et.al, 2005)

Sepingtiang Formation is an inlier limestone formation within younger sedimentary rocks in the slope of block faulted Barisan Range of Sumatra

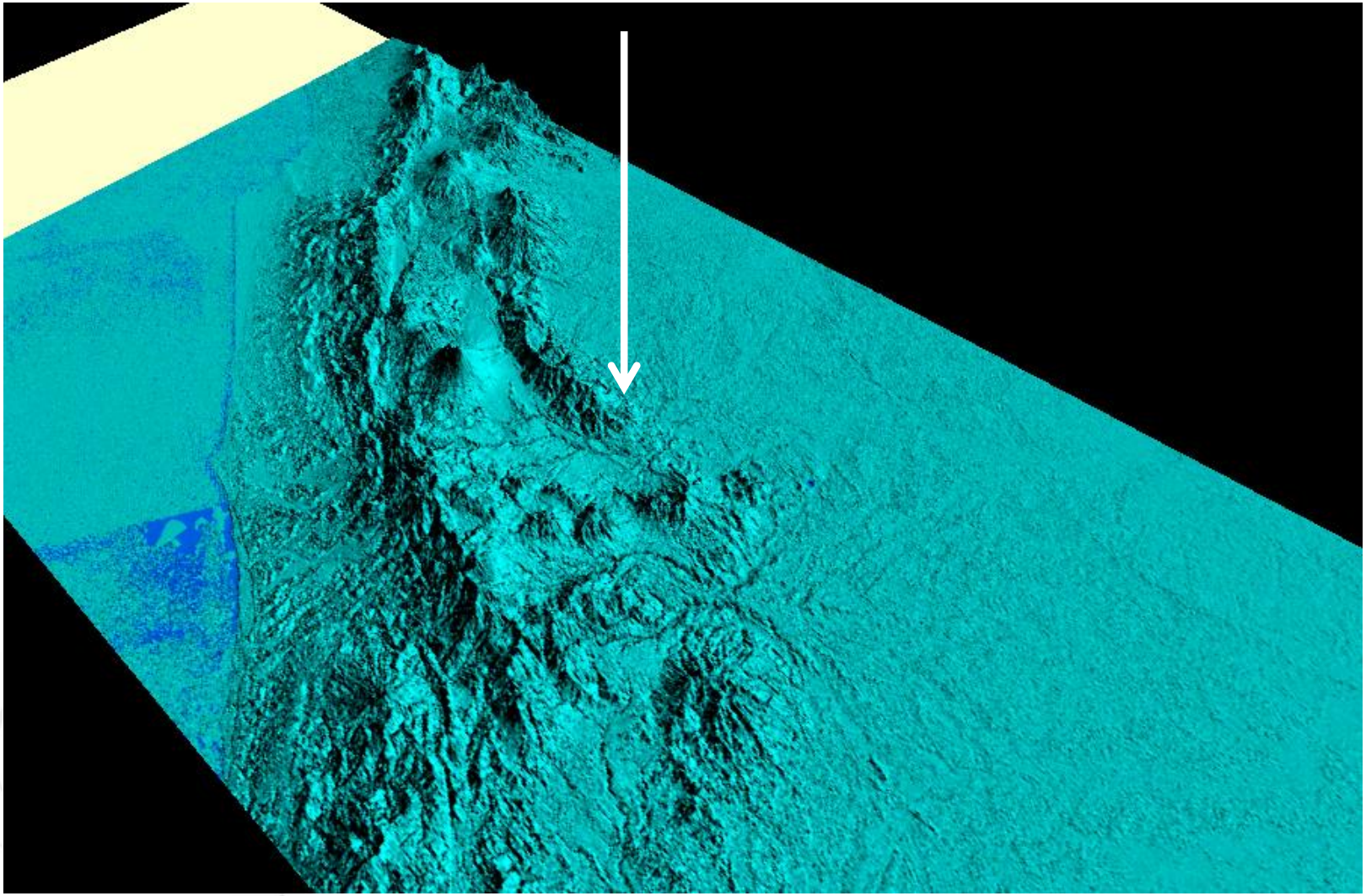


Geomorphological Setting

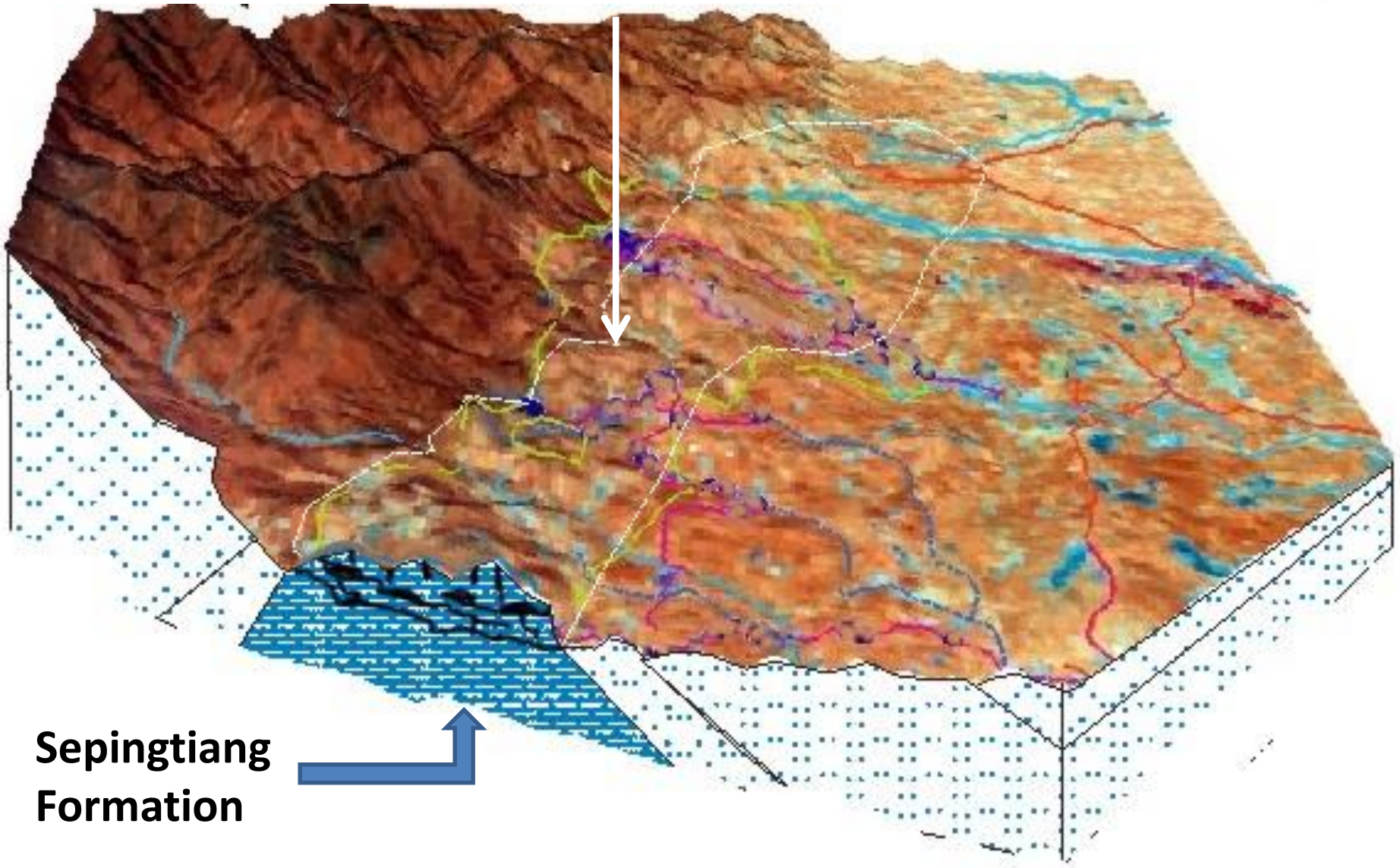
Sepingtiang Hills



Sepingtiang Ridge



Sepingtiang Ridge
6 km long, 3 km wide



Morphology of Sepingtian is characterized by a ridge elevated upto 200 m from the surrounding area. Conical karst hill which is usually typical of indonesian karst is not found in the area

Karstic hydrogelogical features

Epikarst Characteristics

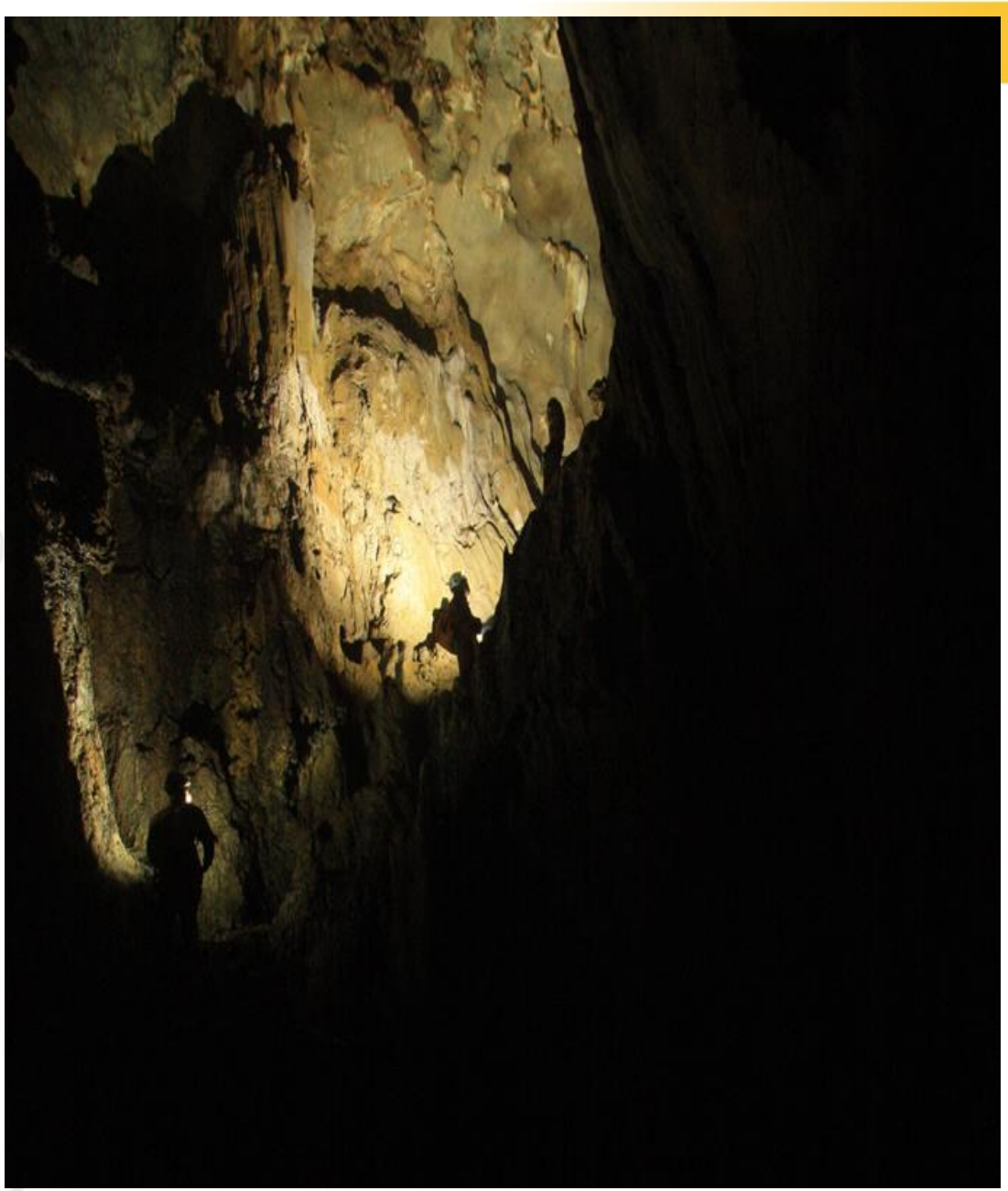
- Cutaneous zone : Soil is relatively thick 1,0 up to 1.5 meter → being the major flow component of karst spring in the upper slope
- Subcutaneous zone : Not developed well, protocave and other micro solution cavities is not abundance

Underground river and conduit component

Sinkholes

Surface river in the area functioning as allogenic recharge of the underground river

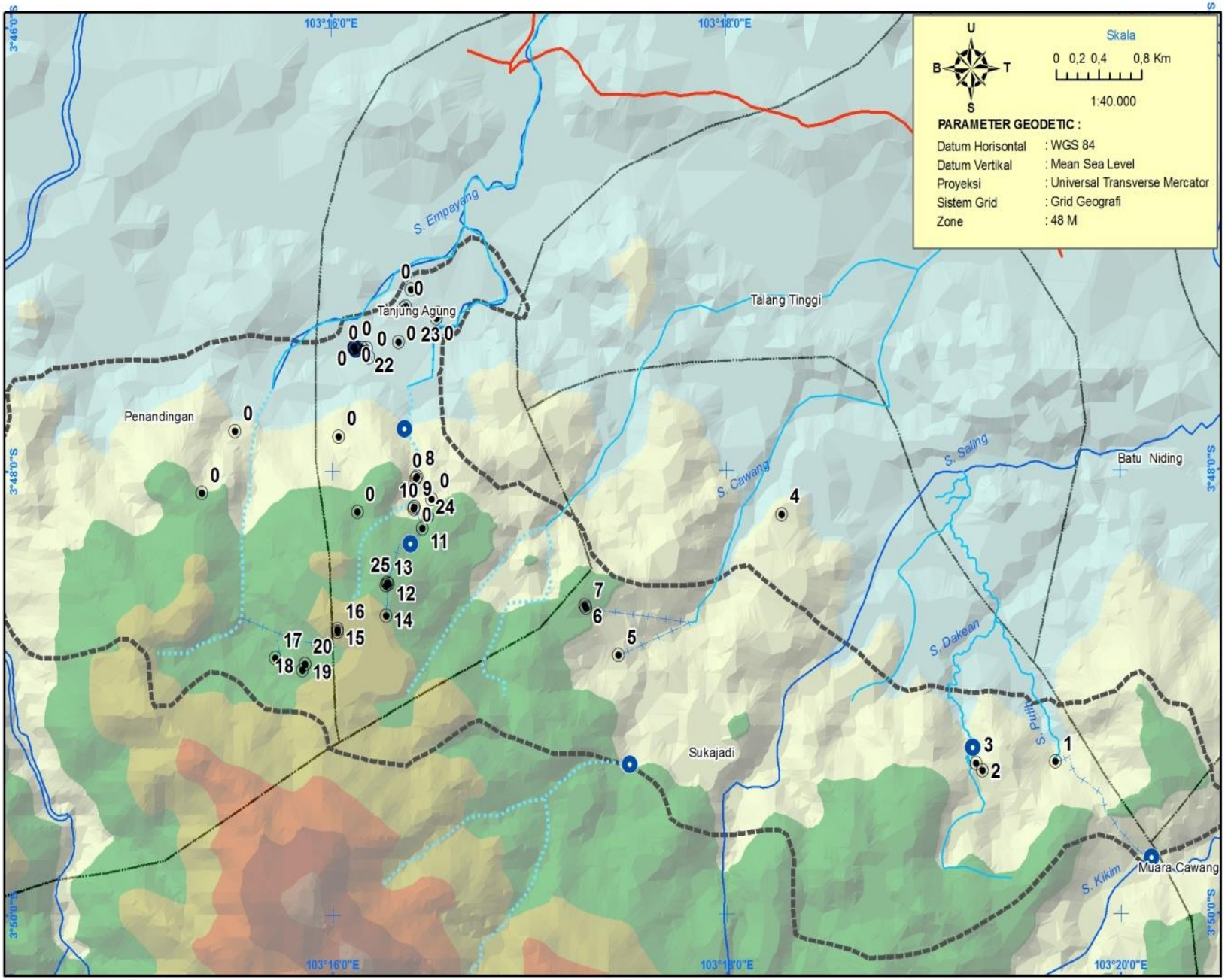
Sinking point of surface river, leaving a dry valley to the lower river course

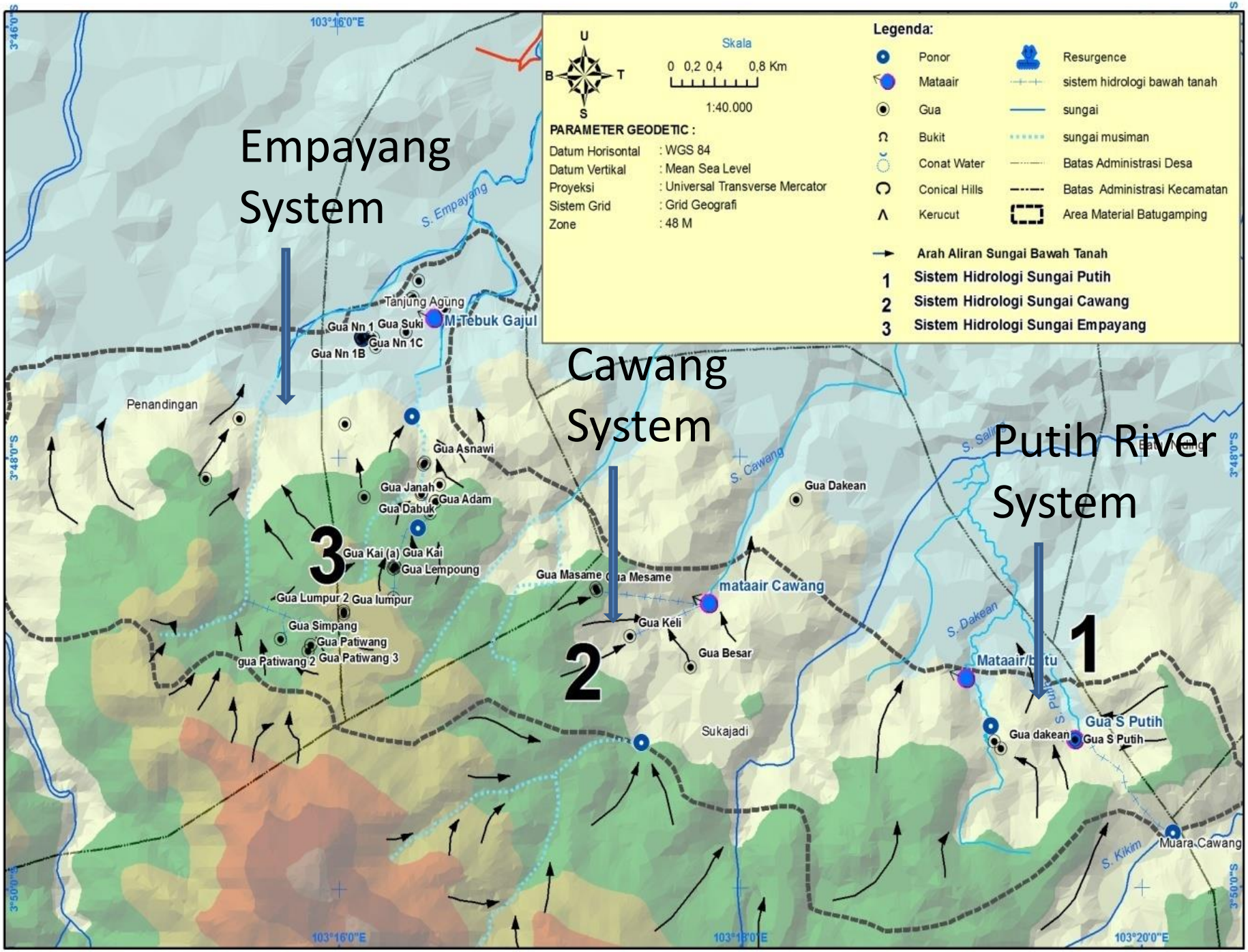


Besar Cave
This cave is situated in the bottom of dried valley

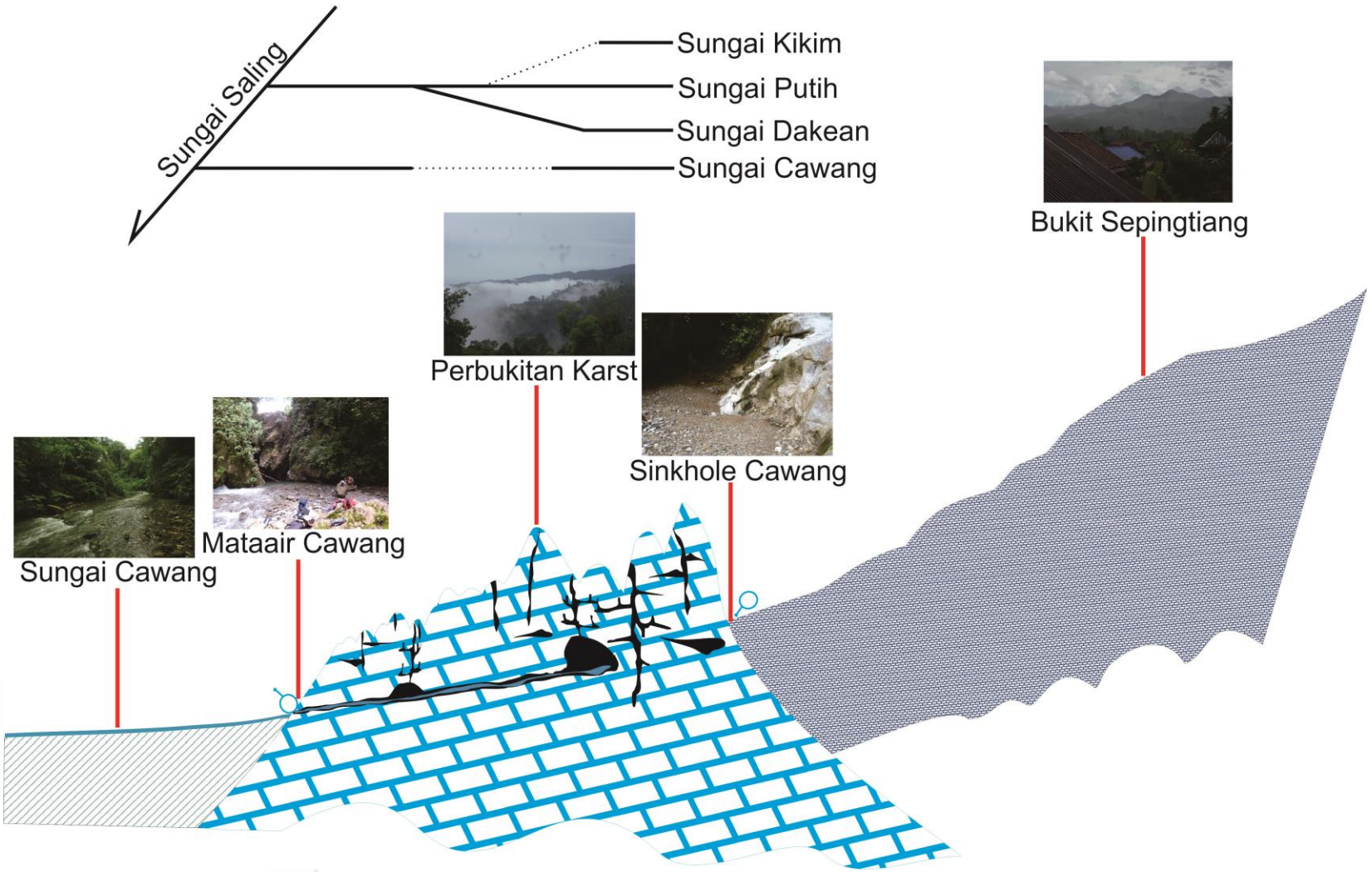
Sumterne an river recharged by allogenic river

No	Nama	X	Y	Elevasi (m)	Jenis Goa	Keterdapatan air	Lebar Mulut (m)	Arah mulut	Arah lorong
1	Goa Adam	308371	9579305	488	vertikal	kering	1		
2	Goa Asnawi	308320	9579738	392	multi pitch	terdapat air	1,8	N 210 E	
3	Goa Dabuk	308294	9579484	430	multi pitch	terdapat air	1,5	N 260 E	
4	Goa Aris	308291	9579468	435	multi pitch	kering	1		
5	Goa Gentenglagan	308028	9578580	630	multi pitch	terdapat air	1		N 160 E
6	Goa Janah	308422	9579408	481	multi pitch	terdapat air	15		N 80 E
7	Goa Kai	308038	9578852	630	vertikal	terdapat air	2	N 210 E	N 300 E
8	Goa Keli	310214	9578253	392	multi pitch	terdapat air	2	N 80 E	
9	Goa Kepayang	308513	9581098	212	horisontal	terdapat air	4,5	utara - selatan	selatan
10	Goa Lempoung	308028	9578831	623	multi pitch	terdapat air	3,5		N 240 E
11	Goa Lumpur	307576	9578449	659	vertikal	terdapat kolam	0,5	N 20 E	N 200 E
12	Goa Mesame	309911	9578643	478	multi pitch	terdapat air	2		N 340 E
13	Goa Sungai Candui	307743	9580782	223	horisontal	terdapat air	2,5	N 10 E	N 278 E
14	Goa Patiwang	307244	9578127	638	multi pitch	terdapat air	4		N 200 E
15	Goa Patiwang 2	307267	9578176	657	vertikal	kering	1,5		
16	Goa Simpang	306988	9578229	560	vertikal	terdapat air	1,2	barat - timur	
17	Goa Suki	307809	9580803	245	horisontal	terdapat air	4	N290 E	
18	Goa Besar	310773	957799	498	horisontal	terdapat air	6		


U
B
T
S
Skala
0 0,2 0,4 0,8 Km
1:40.000
PARAMETER GEODETIC :
Datum Horisontal : WGS 84
Datum Vertikal : Mean Sea Level
Proyeksi : Universal Transverse Mercator
Sistem Grid : Grid Geografi
Zone : 48 M
103°16'0"E
103°18'0"E
103°20'0"E
3°46'0"S
3°48'0"S
3°50'0"S
S. Empayang
Tanjung Agung
Talang Tinggi
Penandingan
S. Cawang
S. Saling
Batu Niding
S. Dakean
S. Putih
Sukajadi
Muara Cawang
S. Kikim


Empayang System
Cawang System
Putih River System
U
B
T
S
Skala
0 0,2 0,4 0,8 Km
1:40.000
PARAMETER GEODETIC :
Datum Horisontal : WGS 84
Datum Vertikal : Mean Sea Level
Proyeksi : Universal Transverse Mercator
Sistem Grid : Grid Geografi
Zone : 48 M
Legenda:
Ponor
Resurgence
Mataair
sistem hidrologi bawah tanah
Gua
sungai
Bukit
sungai musiman
Conat Water
Batas Administrasi Desa
Conical Hills
Batas Administrasi Kecamatan
Kerucut
Area Material Batugamping
Arah Aliran Sungai Bawah Tanah
1 Sistem Hidrologi Sungai Putih
2 Sistem Hidrologi Sungai Cawang
3 Sistem Hidrologi Sungai Empayang
S. Empayang
Tanjung Agung
M.Tebuk Gajul
Gua Nn 1
Gua Suki
Gua Nn 1C
Gua Nn 1B
Penandingan
Gua Asnawi
Gua Janah
Gua Adam
Gua Dabuk
Gua Kai (a)
Gua Kai
Gua Lempoung
Gua Lumpur 2
Gua lumpur
Gua Simpang
Gua Patiwang
gua Patiwang 2
Gua Patiwang 3
S. Cawang
Gua Dakean
Gua Masame
Gua Mesame
mataair Cawang
Gua Keli
Gua Besar
Sukajadi
S. Dakean
Mataair/batu
Gua S Putih
Gua dakean
Gua S Putih
S. Kikim
Muara Cawang
103°16'0"E
103°18'0"E
103°20'0"E
3°46'0"S
3°48'0"S
3°50'0"S

Profil Melintang Sistem Hidrologi Sungai Cawang



Underground River

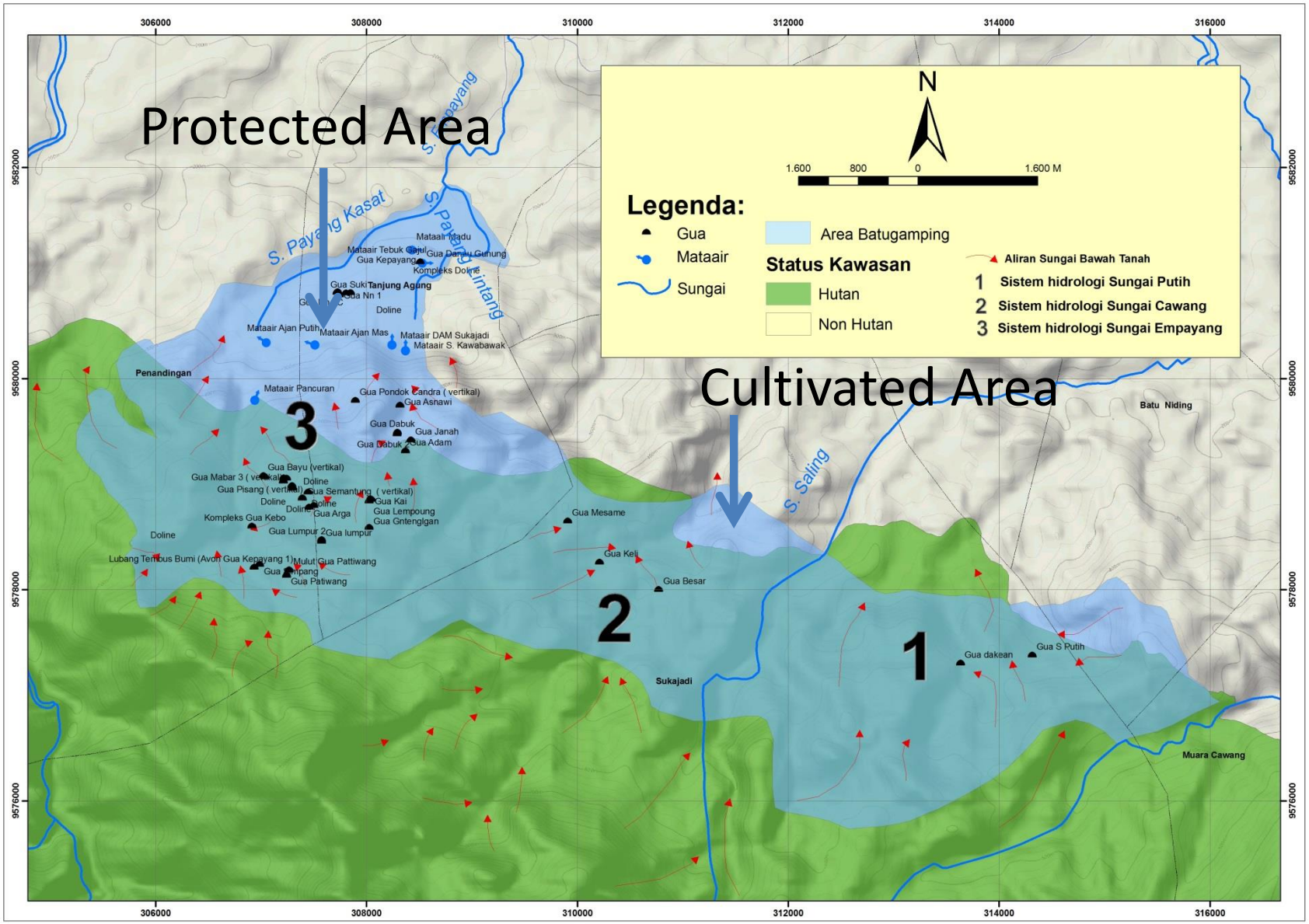
No.	Spring	Elevasi (mdpal)	Ca (mg/l)	HCO3 (mmol/l)
1	Putih Spring		76	3,5
2	NN		70	3,3
3	Cawang A Spring	297	76	3,5
4	Cawang B Spring	297	74	4,2
5	Cawang C Spring	297	80	5,2
6	Tebuk Gajul Spring	229	78	5,1

Epikarst Spring

Criteria for Karst Protected Area

Ministerial Decree No 17 2012 on designation karst area as protedted area

a) Having outstanding scientific value
b) The karst is functioning as recharge area of nearby karst spring and underground river
c) As a groundwater permanent and productive aquifer
d) Having perennial spring and perenial underground river


Protected Area
Cultivated Area
N
1.600 800 0 1.600 M
Legenda:
Gua
Mataair
Sungai
Area Batugamping
Status Kawasan
Hutan
Non Hutan
Aliran Sungai Bawah Tanah
1 Sistem hidrologi Sungai Putih
2 Sistem hidrologi Sungai Cawang
3 Sistem hidrologi Sungai Empayang
S. Payang Kasat
S. Payang Lintang
S. Saling
Tanjung Agung
Penandingan
Batu Niding
Sukajadi
Muara Cawang
Mataair Ajan Putih
Mataair Ajan Mas
Mataair DAM Sukajadi
Mataair S. Kawabawak
Mataair Pancuran
Gua Bayu (vertikal)
Gua Mesame
Gua Keli
Gua Besar
Gua dakean
Gua S Putih
Kompleks Gua Kebo
Gua Lumpur 2
Gua lumpur
Lubang Tembus Bumi (Avon Gua Kepayang 1)
Gua Pattiwang
306000
308000
310000
312000
314000
316000
9582000
9580000
9578000
9576000

Conclusion

- Criteria (a), (b), (c) are not very important in the Sepingtiang Formation
- The most important criteria for protected area designation is criteria d) stipulates that karst with perennial underground river and spring must be designated as protected area
- It is recommended that Sepetiang Formation must not assigned as limestone quarry

THANK YOU