Cave and Karst Prospecting within Seram Island (Maluku province) Indonesia

An expedition by

Guido Baroncini Turricchia and Andrea Benassi.

Submitted to the Manusela National Park

23 May-22 June 2012

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FRONT PAGE
The Front Page shows The Sapalewa River entering in a 100 meters portal, Taniwel, Seram.
2° 55′ 25″ S
128° 28′ 17″ E
13-June-2012
Photo by Guido Baroncini Turricchia
Panorama of 5 shots, Canon 5d Mark II + EF 16-35mm f/2.8 L II USM + Tripod Gitzo GT0541

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Acknowledgments

Although the idea and the main goal of this expedition was conceived and investigated in Italy, the success of this expedition is due to the collaboration with Indonesian people.

First of all we would like to thank the Director of Manusela National Park, Zulkifli Ibnu; he showed great interest towards our research activity and offered men and facilities which contributed to the success of our expedition. The collaboration of the Park also facilitated the communication with local stakeholders.

We would like to thank Ahmad Noi Sholek for his full collaboration and friendship; he was our main communication bridge with local people. His adventurous spirit, kindness and diplomacy facilitated a lot our mission. As much as Ahmad, the park guard La Ato Nuru assisted us for the entire trip, opening up our way with the machete and putting us in contact with the local people in the area of the Park. Special thanks are also due to the porters and guides Im, Buan, Oni, Imp, Emi and Sonny for their help. Thanks to the Kings of Kasieh and Taniwel for having welcomed us in their community and thanks also to the families that hosted us during our stay in Huaulu, Saleman, Kasieh and Taniwel.

A Special thanks to Roberto Ammendola who lent us his professional photographic gear and to our partners Marina and Roberta.

Introduction

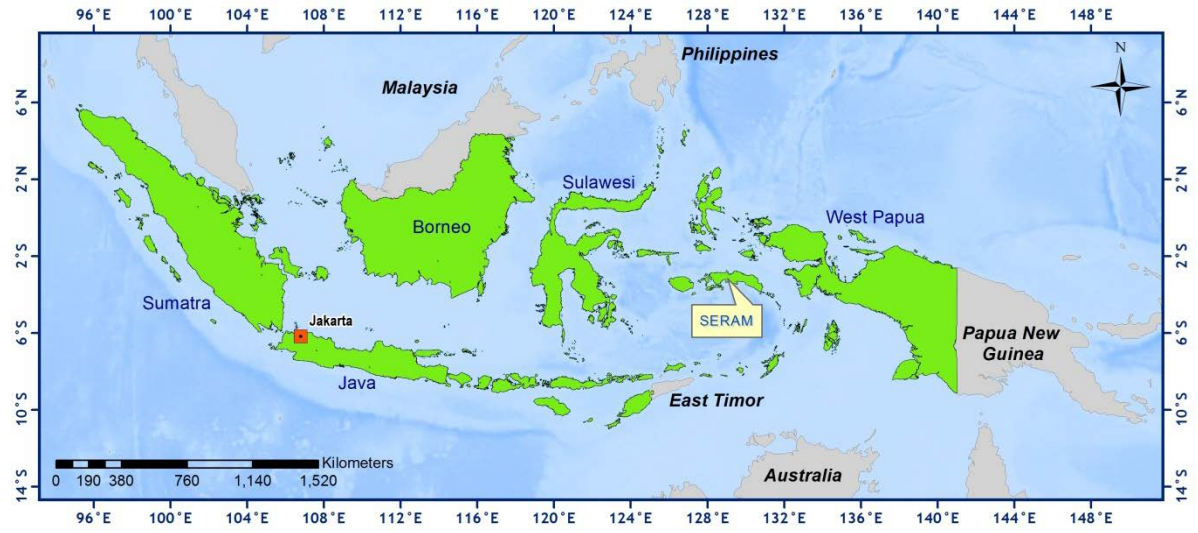


Figure 1: The Indonesian Archipelago

Indonesia with its 18000 islands and 240 million people is one of the most extended and populated countries in the world. However the Maluku province is one of the less populated and Seram Island with its 33 people/km^2 doesn't make exception. This Island, so famous in the past for its spices products imported in Europe with long journey across the oceans, in the last decades didn't attract the international attention with the exception of some local separatist actions and a bloody religious struggle mainly in Ambon that unfortunately led to the death of thousands of locals: news that pushed away any interest of international travelers. But in the last years the political situation is back to normality and Seram Island is again easily accessible.

Past studies and expeditions

Despite the number of publications related to Seram and Buru geology (134 at April 2011 according to (Van Gorsel 2011), and the vast extension of Limestone formations described since the early '900 on the Islands, only 2 documented cave expeditions were organized in this interesting and promising area of Maluku province. The first in 1996 (Jackson 1997) was organized by the Sydney University Speleological Society (SUSS) and the Wessex Caving Club (WCC): 10 cavers were active for one month in the area of Sawai/Saleman, in the central north coast of Seram identifying and partially surveying 33 caves. Goa Hatu Saka, the most important explorative result of the expedition is still nowadays the deepest cave in Indonesia with a depth of 388 meters. In summer 2011 another group of cavers, this time

from Java, came to Seram Island and continued to investigate the karst massif between Saleman and Sawai Village. The Acintyacunyata Speleological Club of Yogyakarta located 45 entrances and made the survey of 12, some of them showing prospects and potential of further exploration. Other caves where partially documented by Archeologists in the Southwest sector of Seram and in the Island of Ambon and Saparua (Spriggs 1990d; Kyle Latinis 2005).

Maps, satellites images and aerial photos

Figure 2: Old Map by Le Rouge 1756

Since the Portuguese started their trade activities in Maluku region in the early '500 followed by the Dutch in the '600, the needs of maps especially for navigation were strongly felt. Because of the difficulties to penetrate the internal part of the mountain range due to hostile tribes and environment, to get the first good proper map of Seram we had to wait the 3 years Dutch survey expedition of 1917-1919 described in three thesis (Valk 1945; Germeraad 1946; Van der sluis 1950). A strong effort was done to realize a 1:100.000 scale map, where not only the topography is quite accurate but also the toponymy reaches a high quality mostly not improved in the following series. Thanks to Google Earth we identified from satellite images where Sapalewa River disappear. We analyzed the DEM[1] and determined the catchment area of Sapalewa before the cave: it cover a surface of 250km^2; considering an average rainfall of 2800 $^{mm}/_{year}$ and bearing in mind that $^2/_3$ goes in ET[2], the average discharge should be around 8m^3/s. Local measurement done during the prospection showed a discharge around 50m^3/s indicating clearly a flood event.

[1] Digital Elevation Model
[2] Evapotranspiration

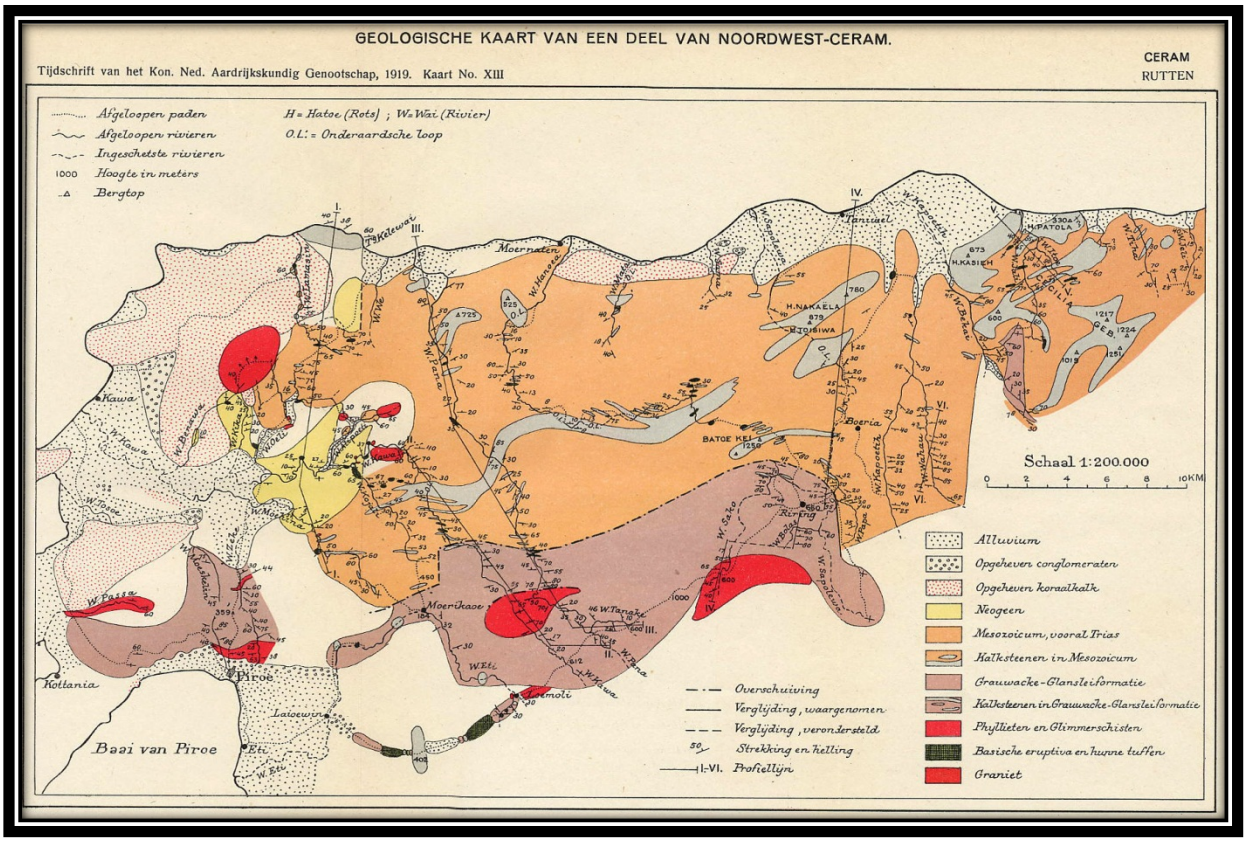


Figure 3: Northwest Seram Geological map by Rutten 1919

Figure 4: Aerial Photo of Sapalewa River

Logistics

Logistics is an important factor to reach the goals decided at the opening of each expedition. Time, food and weight constraints play a key role in the preparation of the voyage.

Time

The simple Indonesian tourist Visa of one month, coupled with 6 days of displacement, reduced our effective time on the Island to 24 days. We tried to take maximum advantage of the fact that we started our journey with only two participants: the goal was to cover as best as possible unexplored[3] karst area to document presence of caves and other karst features, to better understand this region and plan further investigations. Because of time constraints we decided to focus our attention only on two areas: spend more than half of the time to reach the top of Binaiya and prospecting the surrounding area; use the rest of the time in the Northwest sector of Seram to survey the Sapalewa Underground River observed by satellite and aerial photo and evaluate this karst sector.

Food

The choice of food was oriented at maximum efficiency: high Kcal/weight ratio, low encumbrance, low waste, low needs of heat energy. Even if for trekking/high activity level a daily consumption of around 3000Kcal/person/day is advised, the need to bring with us the minimum possible weight led us to calculate the food on the basis of 1800kcal/person/day. Here what we bought for the trekking on Binaiya.

Food	Kg	Kcal/100gr	Kcal tot
Dry fruit	1	472	4720
Rise	6	362	21720
Noodles	2.8	450	12600
Jam	1.6	252	4032
Meat	3.4	303	10302
Biscuits	2.5	450	11250
Bread	2.5	244	6100
Coffee	0.5	0	0
Sugar	2	400	8000
Salt	1	0	0
Chocobars	1.4	481	6734
Oil	0.75	900	6750
The	0.2	0	0
Total	**25.6kg**		**92208**

[3] Unexplored from a speleological point of view

Gear

We spent many hours in Italy discussing animatedly for the lighter and most functional gear, avoiding duplication and with the awareness that every extra kilogram would have reduced the prospected surface. At the end we decided to allocate around 5kg to personal clothes, 6.5kg to the photographic gear, 6.5kg to progression gear and ropes, 12 kg to the camping gear and accessories, and the rest for food.

Personal Clothes (x2)	Units	Weight per unit	Total weight
Hat	2	0.09	0.18
Mosquitonet	1	0.045	0.045
Anorak	1	0.4	0.4
T-shirts	2	0.2	0.2
Pants	2	0.3	0.6
Light gloves	1	0.04	0.04
Underwear	4	0.07	0.28
Sandals	1	0.23	0.23
Boots	1	1.8	1.8
Towel	1	0.18	0.18
Socks	4	0.09	0.36
Pile	1	0.4	0.4
TOTAL			**4.7kg**

Photo's	Units	Weight per unit	Total weight
Canon 5d Mark II	1	0.9	0.9
16-35mm F2.8 L II	1	0.65	0.65
70-200mm F2.8 L IS II	1	1.5	1.5
Tripod Gitzo GT0531	1	1.05	1.05
Holster 30	1	0.6	0.6
Accessories	1	0.4	0.4
Go pro Hero	1	0.15	0.15
Nikon Coolpix AW100	1	0.18	0.18
Battery	3	0.08	0.24
LED	2	0.4	0.8
TOTAL			**6.5kg**

Camping, Gear & Accessories	Units	Weight per unit	Total weight
Tent	1	2.5	2.5
Provisions	1	0.45	0.45
Radio	2	0.15	0.3

Disto	1	0.14	0.14
GPS	1	0.21	0.21
Survey Book	1	0.09	0.09
Compass/clino	1	0.21	0.21
Maps	1	0.2	0.2
Survey bag	1	0.28	0.28
Battery AA	12	0.03	0.36
Battery AAA	12	0.01	0.144
Termic blanket	1	0.06	0.06
Lighter	2	0.02	0.04
Knife	1	0.05	0.05
Sleeping Bag	2	0.75	1.5
Isomat	2	0.15	0.3
Backpack 90	1	2.3	2.3
Backpack	1	1.6	1.6
Dry bag	2	0.38	0.76
Ropes	60	0.075	4.5
Progression gear	1	2	2
TOTAL			**18.3kg**

	Units	**Weight per unit**	**Total weight**
Personal Clothes	2	4.7	**9.4**
Photo's	1	6.5	**6.5**
Camping Gear & accessories	1	18.4	**18.3**
SuperTotal			**34.2kg**

Health & Medicines

Because of the remoteness of many localities to be explored, we brought with us all the remedies that a couple of kilograms allowed to carry: the impossibility to benefit for many days of local health facilities forced us to consider many possible risk situations. We left Italy with the following vaccines:

- Anti-poliomyelitis
- Anti-Choleric
- Anti-encephalitis
- Anti-hepatitis A+B
- Anti-typhus
- Anti-meningitis
- Anti-rabbis
- Anti-tetanic

None of this is compulsory to travel in Indonesia but for our kind of activities (rural area, forest and caves) it is advisable to take in consideration this expense. Malaria is endemic in Maluku province, so we decided to start prophylaxis against malaria[4]. Mosquito were present all along the trip with exception of the top of Binaiya. We used Autan Plus[5] where necessary, but sometimes mosquitos didn't care. In Kanikeh Village locals asked our help for treatment of a 1 year old boy with malaria symptoms. In the past year in the same village 9 people were affected. Here the list of medicine we brought with us, their quantity and use.

Medicine	Bring	Used
Antibiotic (Amoxicillina)	24	0
Stomach antibiotic (Bimixin)	30	12
Anti-Diarrhea (Imodium)	10	0
Lactic (Enterogermina)	8	8
Antispasmodic (Plasil)	6	2
Sore throat (Neoborocillina)	12	4
Sore throat (Froben spray)	1	1
Malaria (Lariam)	10	10
Salt	8	8
(Novalgina)	1	1
Pain killer (Orudis)	8	2
Painkiller (Buprofen)	12	4
Skin protection (Zink Oxide)	1	1
Mosquito Killer (Autan)	1	1
Gauzes and Bandages	6	2

Visa and Permits

Even if the aim of our visit to Seram was mainly scientific and speleo/explorative, since we were just 2 persons and without too much time, we decided to proceed as tourists to avoid bureaucracy and waste of time in preparation, deferring a more official path to next expedition in case this preliminary activity was encouraging, as it was. We got the tourist Visa directly at the arrival in Jakarta[6], and once in Ambon we showed up at the airport police station to declare our presence and intention to visit the Island. We did the same in Masohi getting a local touristic permit. Since most of our activity was inside the Manusela National Park we also presented ourselves to the director of the Park who granted the permits and kindly offered his logistic help. The fifth day in West Seram, in Taniwel Village, at the police station we realized that our permit wasn't valid in that part of the island; they recently had changed the border and this misunderstanding caused the premature end of

[4] We decided to get Lariam, free of charge in Italy, must be taken once a week since the week before departure and up to 4 weeks after the possible period of exposition. Side effect in psychopathic subject.
[5] 30% DEET
[6] One month Visa, to stay more you need a special one for working or research purpose

our journey[7]: we were invited to immediately refer to Piru headquarter and from there kindly invited to go back in the part of the island where our permit was valid.

[7] Fortunately a shortening of only 3 days that we wisely spent snorkeling in the coral reef of Saparua

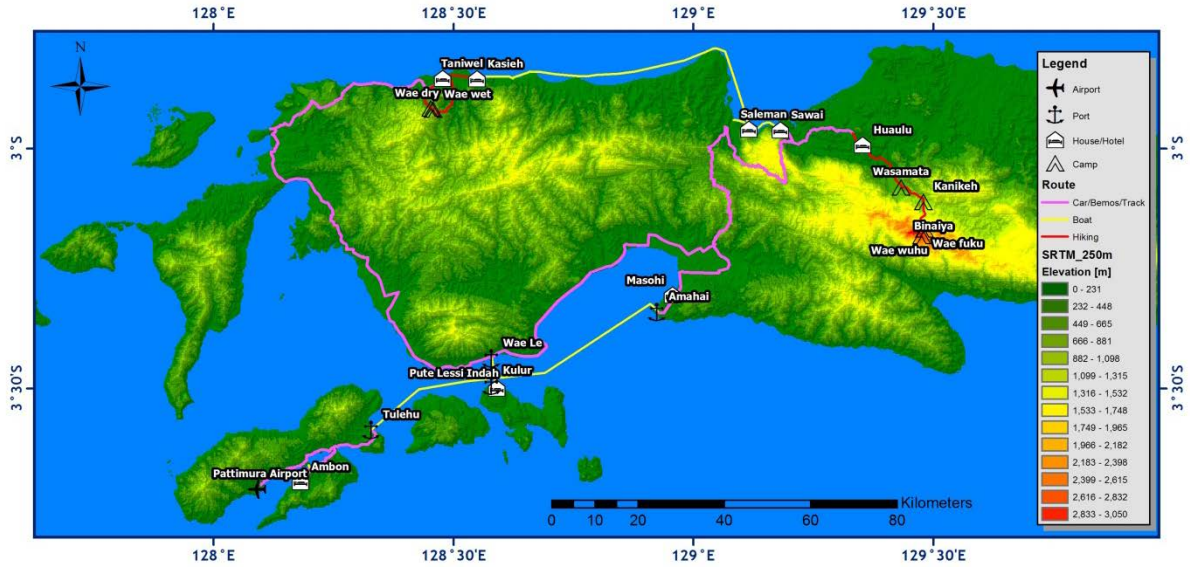


Figure 5: The Expedition trip

Across the World [Rome/Ambon, 23-25 May 2012]

We left Fiumicino airport (Rome) with Fly Emirates at 22.40 of May 23rd. On the 24th we arrived with half an hour delay in Dubai, waited 5 hours for the following flight. We left with 15 minutes delay and arrived in Djakarta at night with 35 minutes delay. No turbulence neither luggage problems, only an alarm for a passenger smoking in the bathroom. The yellow bus free of charge took us from the international terminal to the national one. We tried to sleep some hours on the floor outside of the airport. We took the Batavia Flight at 6 in the morning, and at 12, after more than 12000km of flights, we landed in Pattimura Airport. At the Airport's police station we reported our presence and intention to travel across Seram, they took note of our plan and left us continue. We reached Ambon with a couple of motorbikes crossing the Ambon bay with a ferryboat. Weather was good. We left our belongings in the Beta hotel and started to look around asking for information in the port and visiting the center. Local people looked surprised to see foreign people here. Everybody was busy cleaning and refurbishing for the incoming big June political gathering. Food was cheap, spicy and good, but we were incredibly tired after the 3 days journey and went to bed early.

"*Hello Mister!*" [Ambon/Masohi, 26-27 May 2012]

We left Ambon before sunrise with a minibus and rapidly arrived at Tulehu port on the east coast of the island. The internal sea was quite calm and the speedy ferryboat rode past the waves and in 1h35 arrived at Amahai port in the south cost of Seram.

Figure 6: Crossing Banda Sea with the ferry

Fifteen minutes later we are in the center of Masohi the central Seram district capital. Here, more than in Ambon, people were incredibly surprised for our presence and continuously said "*Hello Mister!*", with big smiles and surprise in the face of everybody- It looked like the main island were even less visited than Ambon. We went to the Manusela National Park Headquarter to explain our prospecting intention and to collect information about the areas we planned to visit. The welcome was warm and after this first contact we agreed to make an official presentation to the employees on the next Monday, before leaving the city together with a park guard and a local caver and translator kindly organized by the director. We passed the rest of the day to take contact with locals and the city. A strong rain in the afternoon tried without success to bring a bit of fresh air. In the evening we discussed about the food and material we needed to buy. Sunday morning we bought at the supermarket all the needs for the first 10 days of trekking, again in the afternoon the rain arrived strong.

To the heart of Seram's tradition [Masohi/Huaulu village, 28-May-12]

In the morning we described to the director and his employees the main places and the targets we wanted to reach. The audience looked interested and participated with questions to the talk. We could count on the car of the Park and Gnoman the driver to travel across the island up to the northern part inside the Manusela National Park. When the Park's pickup couldn't go any further due to a fallen bridge, we carried on our shoulders all the material and continued along the path for a couple of km until we arrived at the Huaulu Village, just in time to avoid the afternoon storm. Huaulu is a well-known place for us: In the seventies and in the eighties Valerio Valeri, an Italian anthropologist spent with the locals more than 40 months trying to understand local behavior and traditions, as is described in his posthumous book *The Forest of Taboos(Valeri 2000)*.

Figure 7: Huaulu Village

Based on his book we had imagined for many months this place and his people and with insatiable curiosity we tried to match our fancy with reality. Initially our hosts were somewhat detached but when we showed them the book they immediately changed their attitude and showed to be glad and surprised about our deep interest for their community. We passed a nice evening sharing stories, smiles and experiences.

Leaches and floods [Huaulu village/Kanikeh village, 28-29 May 2012]

In the morning, in the south direction, it appeared clear to us the Hatu Kouala Its limestone cliffs were visible and attracted our attention. The locals informed us that is was possible to get there in 1-2 days, and we decided that it could be a possible target for a future expedition especially because from DEM information a big close valley is hidden behind that range. Thanks to Ato we made a deal with 2 local porters, Buan and Im; they would have helped us to transport food and materials up to the Binaiya. The path started quite steep and Guido soon realized that his training in Italy was not sufficient due to the different moisture and temperature conditions. In this first day we experienced the body loss of many liters of water. Once in the river the situation got better and we could proceed more easily thanks to the water that cooled us down a bit. We passed through Roho Village without any stop and from there for many kilometers we didn't see

Figure 8: Bamboos Bridge near Kanikeh

rivers anymore. Guido had to stop every 2-300 meters due to the incredible humidity, whereas the locals are completely at ease. As a holy liberation the rain arrived. We had never before experienced such a strong flow of water. We were amazed that even by screaming aloud we could not communicate with each other, we asked if this intensity was normal and they answered that is an average rain. Even if completely wet the rain regenerated our spirit and we started to walk faster. After less than one hour we reached the Wasamata River. The view was astonishing: the brown water flowed furiously, the water level increased 2 meters above normal conditions and we could not cross it. Buan upon discovering a leech in the Guido's eye snatched it away. After this first shocking contact with the hungry little beast we started to check each other anxiously to be sure we were "clean". Since the camp area was completely muddy Im and Buan started to cut bamboos and in less than one hour the dry floor of our camp was ready their ability with bamboos is incredible: they can do everything with them. The morning after the water level had sufficiently lowered and we could cross the river. After some hour we finally met a first evidence of karst: a little outcrop area populated by limestone blades was located on the right of the path. Just before arriving to the Kanikeh village we stopped near a nice clean river. Here we could again appreciate the incredible engineering capability of the locals who had built with only bamboos a long and resistant bridge that allowed us to cross safely the river even in case of flood. Kanikeh village is very nice and well maintained, nice soft grass and flowers are present in the garden of all the houses and in the main road. Nowadays it has become Christian but we had the chance to notice that their old traditions and beliefs are still very much present.

Figure 9: Talking about Binaiya with locals

As we already knew from our internet investigations before going up to the Binaiya we were “invited” to participate to the Betel’s protection ritual and the signing of the guest book, 2 practices in between the real beliefs and the tourist trap. We took advantage of this meeting to get some information about names of local places and mountains. We slept in our tents under a concrete open structure.

The steep climb [Kanikeh village/Wai Fuku, 30-31 May 2012]

Early in the morning we woke up with the intention to climb up as much as possible. At around 1500 m elevation we started again to see limestone outcrops and much time didn’t pass before we met the first pit: it was 15m deep and could possibly continue but without air flow. Before the end of the day we collected the points of other 6 entrances, entered into a couple of them, noticing some little concretion and some presence of fauna not particularly specialized. All the caves were of small dimensions and without any explorative interest but important to determine a limestone layer between 1500 and 2000 meter with an impermeable layer interval. We comfortably slept in Wai Huhu camp. The day after with a hike through a fast vegetation change we arrived to Way Fuku. Here we arranged the camp near a small pond. The temperature of around 14 degrees was perfect to us, whereas the locals, not accustomed to it were visibly affected.

The high Binaiya range [1 Jun 2012]

We left one porter at the camp and in 5 we moved in the west direction along the crest out of the touristic path and in an area unknown both to the park guard and to the local porters. The karst structure changed along the path, passing from a more fractured rock to a more compact limestone rich in siliceous inclusion.

Figure 10: Crystallized inclusion in Triassic limestone

Often the closed valleys that we crossed and where we hoped to find entrances of caves were hosting small ponds, where deer grazed.

Figure 11: Epikarst features at 3000 meters.

Only in one case at an elevation of 2750 meter we found one entrance but as the previous one without any explorative continuation. We finally reached the true Binaiya peak, 30 meters higher than the most known one but half hike day far. Here the epikarst features are dominant and big dark karst blades are everywhere but no evidence of underground access. This limestone is commonly interpreted as Jurassic but paleontological evidence appears to suggest a late Triassic age (Martini, Zaninetti et al. 2004). We left happy to have reached this incredible place but a bit disappointed for the absence of big caves. At Wai Fuku we found that a group of Javanese hikers were also camping.

The fast drop [Wai Fuku/Sawai Village, 2-5 Jun 2012]

Our way back was quite fast. We started to run out of food and the idea of a nice bath in the coral reef of Sawai was leading our thoughts. The first day down to Kanikeh, with the exception of Ato who involuntarily kicked down a stone almost hitting Iyek, passed quite smoothly. Unfortunately the day after, due to the long numbers of hours of walk in the rivers, with suspended sandy solids inside the boots, the feet skin affected Iyek and Andrea, who despite the zinc-oxide protection couldn't advance easily. We arrived in Sawai Village late in the afternoon just in time for a tasty snack and an incredible swim.

Cliffs, shells and corals [Sawai/Saleman, 6-8 Jun 2012]

Figure 12: Sawai's Cliffs

The north coast between Sawai and Saleman, with its high limestone cliffs that enter directly in the sea, was object of attention by the 1996 international expedition and the 2011 Indonesian expedition (ASC 2011). So we limited ourselves to verify the description of some features made by the past cavers sailing with a little local canoe along the coast and enjoying the incredible and colorful undersea with his enormous corals and the astonishing beach full of big shells. An appointment that was repeating every evening was the exit of a long column of bats out of the Luisiala cave just above Saleman Village; they leave their home to go hunting along the coast and coming back before the sun rises. This corner of the Manusela National

Park is one of the most beautiful, but despite its nice and various attractions only a few hundred tourists visit this place every year.

Figure 13: Sawai bay

The only remarkable negative point, that as far as we could see is common to all the villages along the Seram coast, is that the local people throw directly into the sea all their garbage, then the sea currents spread this waste all along the coast impoverishing the value of the natural landscape. Only some ten years ago this waste disposal behavior wasn't harming the environment because all the product were natural (biodegradable) whereas now many things are made on plastic that can stay thousands of years before degradation.

Motorized tree trunk [Saleman/Kasieh, 9 Jun 2012]

Bridges in the north coast way were possibly down due to strong flood events. We decided to reach the Taniwel area by the sea and arranged with a Saleman fisherman to rent a boat for the crossing. But after seeing the boat we were not sure anymore that we had done the right choice. The voyage was almost 90 km long and we were a bit scared and doubtful that this little boat obtained from a tree trunk could transport 6 people and 100kg of material without problems. We left the village at 4h30 in the morning. It was still dark but at least the sea was completely flat. The boat captain mounted 2 little motors (very similar to the grass cutter motors) on the tree trunk: they had to ensure a speed of 13 km/h and give also the direction to the trunk that was not fitted with a tiller. The crossing was 7 hours long. We passed near a big *spectral ferryboat* stranded in the coral reef. Some km north a storm menaced our way. To understand if we were in trouble we used to give a look at the captain

face: if he was relaxed we were relaxed. Iyek was occupied all the time in emptying the boat from the in leaking water, some dolphins jumped far from us and the coast showed some white cliff. Binaiya skyline moved away and Cecilia's range was approaching and we are impatient to reach our destination. Suddenly the face of the captain was not relaxed anymore: a strong sea current mixed with unexpected wind forces forced us to retreat quickly to the coast. We waited the passage of this little maelstrom and continued, but one motor was damaged and we could rely only on the one left. Fortunately we arrived safe at Kasieh village where we were guests of captain's relatives.

Figure 14: Hatu Patola karst cone from Kasieh Beach

32 little cavers [Kasieh/Goa Tana, 9 Jun 2012]

In Kasieh, after a nice lunch welcome, Guido and Iyek went to talk with the King of the village to tell our intentions. Meanwhile a large group of kids gathered around offering to take us to some really nice caves nearby. The group increased along the way and we arrived at the entrance of the first cave, Goa Toke (Gecko's Cave), with 32 kids. It was really nice to see the enthusiasm of these children who fought with each other to show us their place. We entered in Goa Tana (Soil's Cave), at the beginning a bit selective due to some narrow passages and a little jump of a couple of meter and only in 16 continued with us. We had just 3 led light with us and we started to be a bit scared fearing that the situation could become dangerous, but the kids pushed us to continue and we entered 2/300 meters inside the mountain along nice and long galleries up to a big room with the high roof completely full of bats. Life was everywhere, swallows, amblypygi, uropygi, orthoptera, coleoptera and we noticed a couple of possible explorative continuation that required gear. We left the cave with the little friends singing happily all around us.

The Great Sapalewa [Kasieh/Taniwel/Sapalewa, 10-12 Jun 2012]

In the northern part of the island the fuel is 2 times more expensive than in the Masohi area. Considering our limited budget and no access to cash machine we decided to continue by foot. In 1h30 we were in Taniwel and we went to the local King to explain our prospecting plans. He put us in contact with a local guide, Sonny, who offered to lead us along the Sapalewa River up to the two main cave entrances. We organized the food and

left the same morning Taniwel Village. The path was long and full of annoying insect and spiders. In some part was it also dangerous due to steepness of the terrain and thorny plants but the magnificence of the high trees with enormous roots and the inviting noise of the River forced us to continue. It was already dark when we planted our tents on the surface full of roots. That night, due to the fatigue caused by the steepness of the mountain, we were running out of drinking water, despite the fact that we were just at 400 meters from the river cave. The day after we continued our hike in the forest, Sonny left us "just for a moment to find the better path" and disappeared for almost 3 hours. After the first hour we were already quite worried. He knew the way, he had the food, but he had disappeared. Andrea and Ato decided to go to look for him in case he was in trouble while Guido and Iyek waited in the last place we had sawn him. We were already organizing our way back to look for help in the search for the missing man when he reappeared. Finally, after a long round walk, we arrived in the proximity of the River in the point where it comes out of the mountain. The discharge flow rate was impressive. Despite the fact that we were in dry season the brown color of the water suggested that the Sapalewa was in spate. We estimated of a flow rate 50m^3/s.

Figure 15: The low entrance of the Sapalewa cave

We were all astonished and excited about the finding and started to explore the cave from the top. We advanced 4-500 meters also along a huge lateral fossil gallery that brought to another entrance. The discharge prevented us from continuing along the main way so we decided to document the place with pictures and went back to the camp, as usual under a heavy afternoon rain. The day after we crossed the mountain and along the walk we explored Goa Patune, a cave of medium size that once was probably connected with the

underground system but not anymore. Limestone features started to be evident along the path and we saw a couple of little rivers disappear. When we arrived at less than 400 meters from the Sapalewa River sinkhole, we encountered an incredibly well maintained old Dutch road, 250 meters long 1.5 meter wide and with a variable height between one and five meters. Evidently the colonists, in order to maintain the contact between Piru and Taniwel avoiding the long circumnavigation of Hoamoal peninsula, had decided to build this road in the only place where the Sapalewa doesn't need to be forded. Nearby was the nice Goa Batu Sori (Stone's afternoon cave) with its little clean lakes, nice formations and old graffiti, a cave already mentioned in the 1918 Dutch expedition.

Just before reaching the great sinkhole we also explored another couple of caves of 70/80 meters, the second one showing evidence of airflow and nice exploration perspectives. Finally we arrived where the Sapalewa River enters into the mountain. The view was incredible, the portal high between 80 to 100 meters and the River entering violently into the dark. Swallows fly in and out and big tree trunks are embedded up to 30 meter above the present river level. We documented with photos and movies the place but we could not continue with the limited gear we brought with us, so we decided to go back the same day to Taniwel. 2 km far away, on the Buria/Taniwel road, a big panel informs about the imminent start of work to modify the flow and realize a 10MW hydro plant. We were really disappointed: the most incredible wonder of Seram, one of the biggest underground rivers in the whole world, still unexplored, will be probably soon be ruined to produce just a little amount of energy. A deep sense of sorrow and bitterness overtook us in our way back.

Forced vacation [Taniwel/Piru/Masohi/Saparua, 13-18 Jun 2012]

We had just woken up when "*our presence was requested at the local police station*". Once there Andrea was questioned. For more than one hour and It turned out that our Visa was valid only in the central part of Seram (Masohi Province) but not in Piru Province where we then were. They explained to us that we had to report to the police headquarter in Piru. In Piru they told us we had to leave the province and if we wanted to come back we had to ask the visa in Ambon. At that point, since only a few days of stay remained, we decided to dedicate the last days to relax. We went back to Masohi where we organized a short presentation about our explorations. The day after we moved to Saparua Island, in a nice bay near Kulor where we spent the last 3 days in complete relax: exploring and surveying some aquatic caves and enjoying the coral reef and the incredible sea food.

Figure 16: Seven princes cave

Big Building and little bookshops [Jakarta/Rome, 19-22 Jun 2012]

We left Ambon with a little delay. After a stop in Surabaya airport where they checked again our hand luggage we finally arrived in Jakarta. A fast bus left the airport and in one hour we were in the center of the capital. Jakarta is a young city and is growing fast, high skyscrapers near modern mosques mixed with a mess of poor neighborhoods. We spent quite some time trying to find a bookshop, but without any sucess. We decided to concentrate our efforts in tasting all the marvelous food varieties that were available almost everywhere along the streets. After a hot walk around the national monument we went directly to the airport. An unpleasant tentative of extortion by a public officer at the passport control point left us with a bitter taste. We arrived in Dubai with one hour delay; after ten hours we got the airplane to Rome where we arrived in perfect time happy to find our baggage.

Cave List

Here we present the list and position of the caves found during our prospection in Seram Island. The coordinates are expressed in UTM 52M; the precision of the cave entrance depends on GPS signal at the moment of acquisition[8] ; the GPS allowed us to reach a precision in between 5 to 50 meters depending on land cover. Were also realized two maps representing Karst feature and distribution in Seram Island: A general overview, adaptation of different geological papers and another map zoomed in the North West sector, where 12 underground rivers were localized based on Dutch geological maps and satellite information. Only Sapalewa River was reached during this prospection. Based on North-West Seram geological map by Rutten we calculate the area covered by Triassic (670km^2), by the interbedded karst (66km^2) and by the Koral karst (148km^2).

Cave Name	Location	Lat	Long	Elev	Prec	Lenght	Depth
Gua Satu baik	Waensela	9652004	552699	1567	15	15	-15
Gua Dua	Waensela	9651860	552860	1550	15	5	
Gua Tiga	Waensela	9651773	553003	1599	15	5	
Gua Empat	Waensela	9651544	553132	1697	15	5	
Gua Lima	wai huhu	9650469	553603	1969	15	5	
Gua Labah-labah	wai huhu	9650409	553584	1989	15	21	-8
Gua top	Binaiya	9649090	551555	2796	30	12	
Gua Hatu Patola	Hatu Patola	9684232	453009	248	50	5	
Gua Toke	Hatu Kasieh	9683982	449306	90	30	80	-30
Gua Puhon	Hatu Kasieh	9684038	449143	62	30	10	
Gua Tana	Hatu Kasieh	9684045	449100	63	30	250	-10
Gua Sapalewa (spring)	Hatu Toisiwa	9677900	440066	220	50	500	+80
Gua Sapalewa (sink)	Hatu Toisiwa	9676886	441299	344	50	100	+30/-70
Gua Patune	Hatu Toisiwa	9677227	439775	430	15	88	-35
Gua Batu Sori	Hatu Toisiwa	9676736	440692	422	30	200	+15/-10
Gua cepat cepat	Hatu Toisiwa	9676975	440743	414	30	70	-8
Gua Kelelawar Hijau	Hatu Toisiwa	9676958	440989	413	30	60	-30

[8] We used a GPS Garmin Map 60 CSx

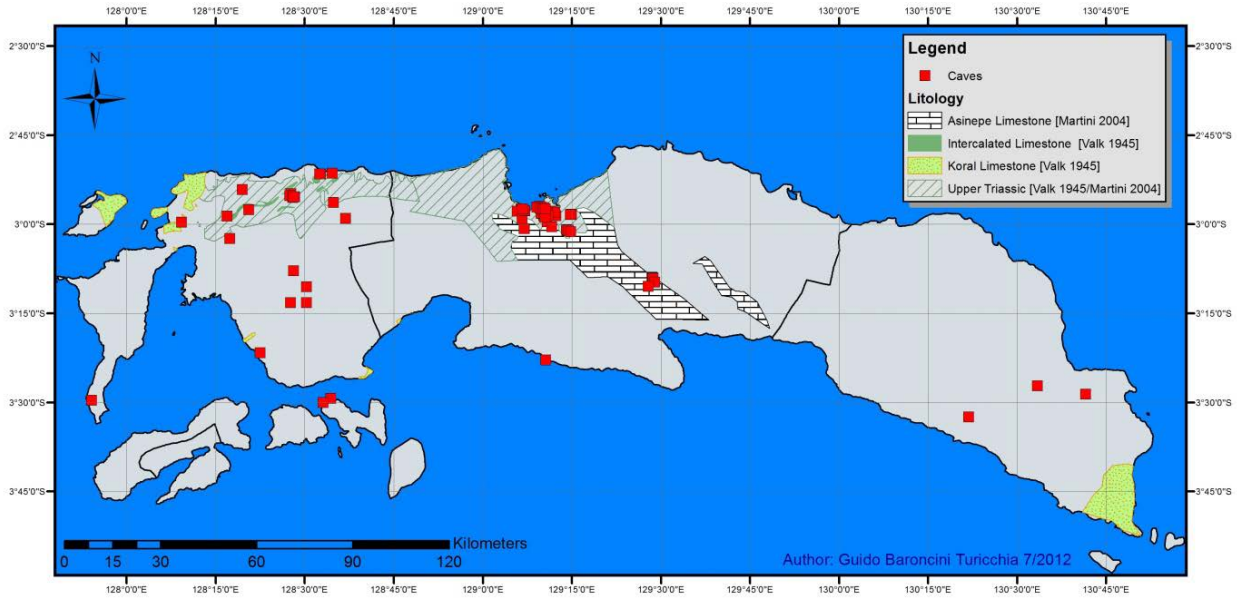
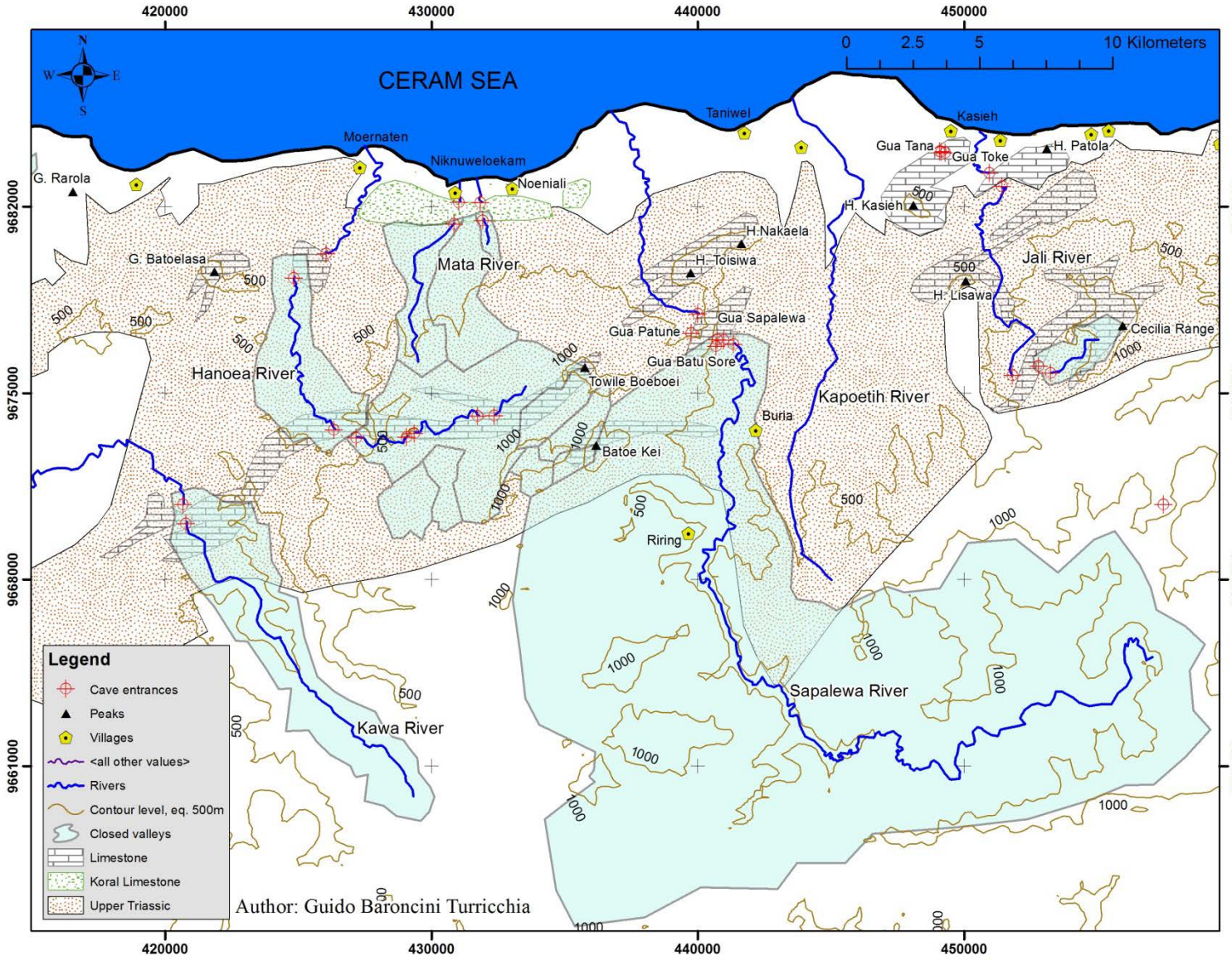


Figure 17: Caves and Karst Distribution in Seram Island, adaptation of difference sources



Expedition Budget

	Unit cost €	Units	Total Cost €
Flights Rome/Dubay/Jakarta and Back	570	2	1140
Flights Jakarta/Ambon and Back	153	2	306
Porters and Guides	14	15	266
Fuel	0.4	55	22
Speedboat	8	2	16
Regular boat	1	2	2
Motor	5	2	10
Trunk boat	53+12+12	3	77
Truck	40	1	40
Bemos/car		4	35
Bus	2	2	4
Visa, permits and taxes	20+5+2+3	2	60
Food and accommodation	215	2	430
Caving Material	155	1	155
Maps, Remote Sensing and GIS data	103+105+230	3	438
Vaccination, medicine and cure	350+150	1	500
Total Cost			**3501 €**

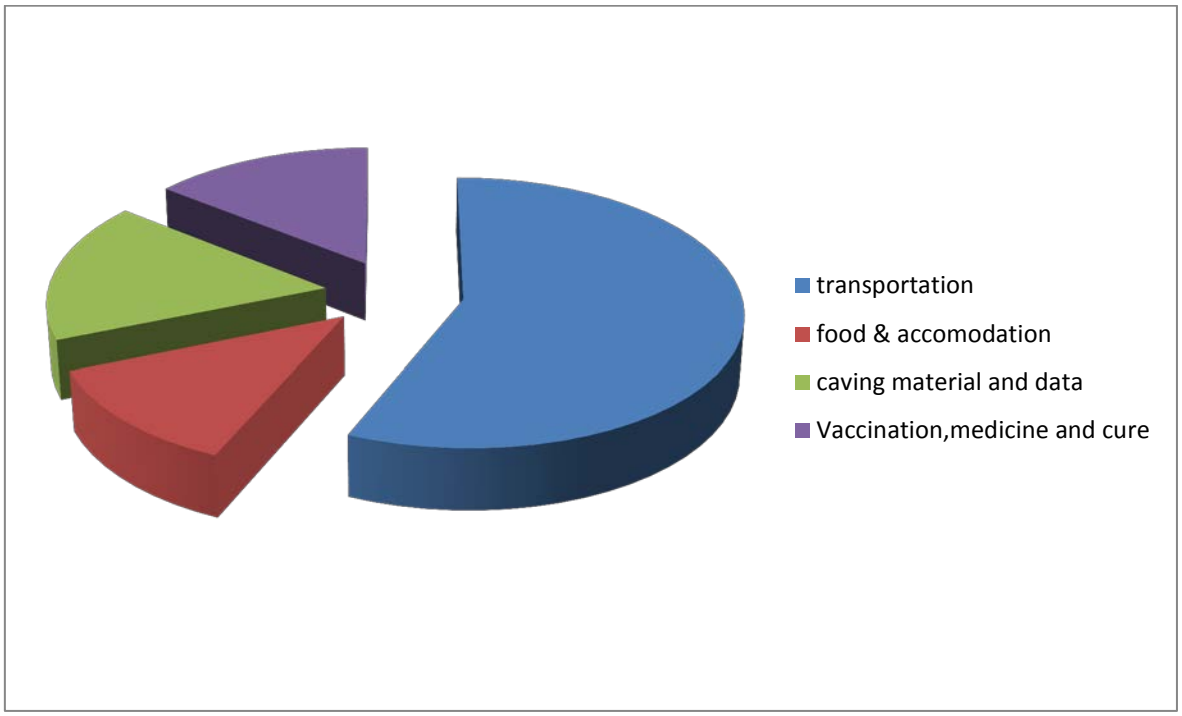
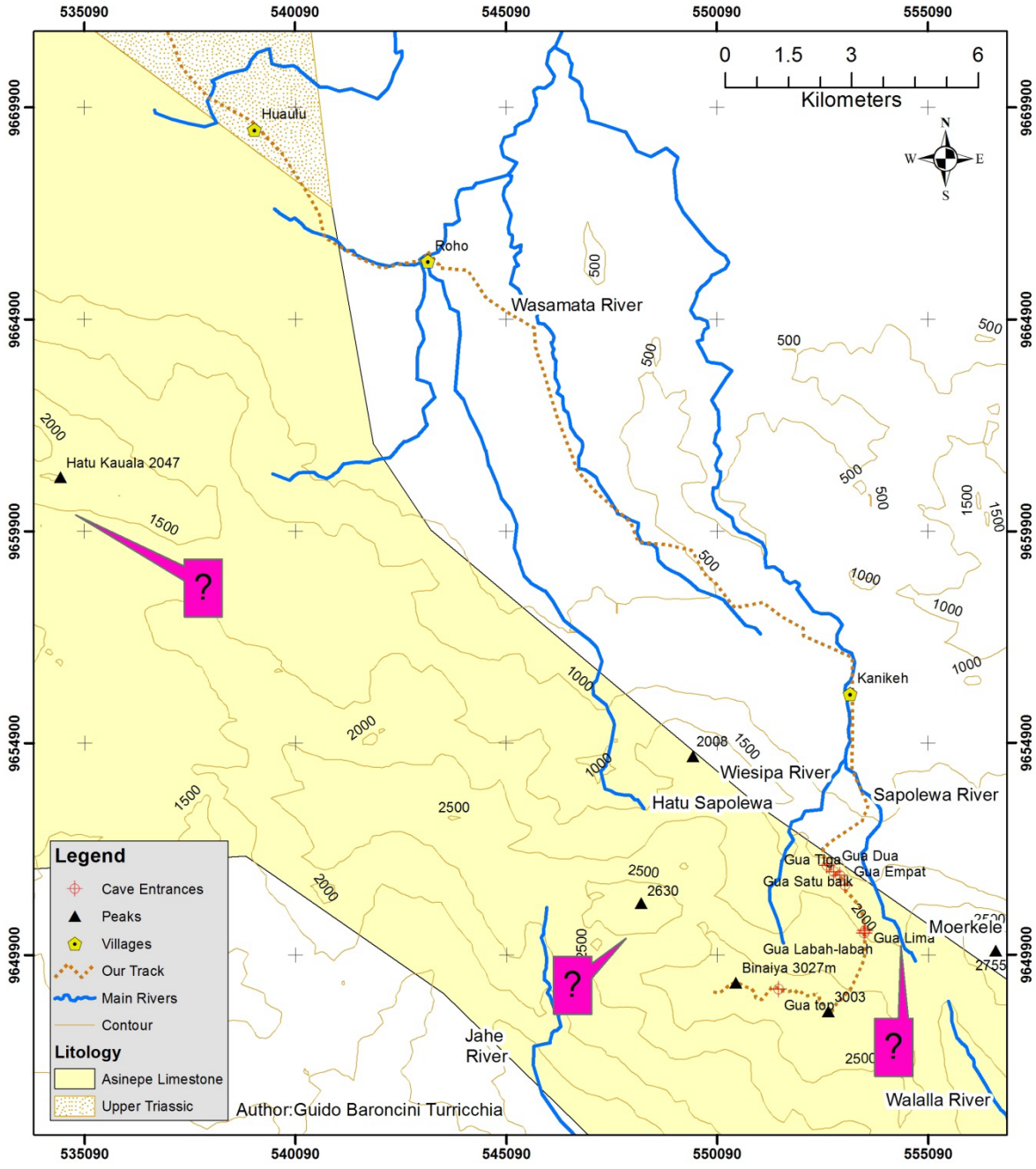


Figure 18: Partition of expedition expenses

Recommendations and future activities

After this first speleological overview of the Island, it is clear to us that Seram karst can offer to cavers, scientists and locals many opportunities. Four are the possible areas of interest for future expeditions.



Top of Binaiya

We just had the time to scratch the surface in this sector; we confirm the presence of karst features only from the height of 1500m to the top of the range. Facing north "only" a possible vertical potential of 1000-1200 meters is possible; we can say nothing about the south side. Kanikeh people said that the spring of Sapolewa[9] River is a waterfall with behind a big cave; we couldn't confirm that information due to lack of time. And the valleys and plateau west of Binaiya peak look promising.

Figure 19:Mount Binaiya and the west unexplored area

Hatu Kauala

To our knowledge this is a really interesting place. Hatu Kauala is around 2047 meters high. The international cave expedition of 1996 reached a huge karst spring (30m^3/s) in the north side at 150 meters elevation; moreover a large closed valley is hidden behind the peaks.

Hatu Saka

Even if Hatu Saka is internationally known as the deepest cave in Indonesia, It was reached by cavers only two times and, due to a flood event, exploration couldn't be continued. But the cave continues and the springs are almost 1000 meters lower than the sinkhole.

Figure 20: Amblypygi in Batu Sori Cave

Taniwel Area

The up to know unvisited northwest karst sector, with his more than 210km^2 of limestone surface and peaks up to 1450 meters, demonstrates a strong explorative potential, with 11 underground rivers already identified but not reached. The Sapalewa River,

[9] Similar name but different from Sapalewa River

with its estimated 50m^3/s flow [10] and a portal 100 meters high, enters in the top five biggest underground rivers in the whole world. Further explorations, with survey and biological and geological sampling will be proposed to LIPI[11] , Indonesian cavers as international experts for a joined expedition in the next dry season. The specific position of Seram Island near the Wallace's line, between the South East Asia and Oceania ecozones will offer to cave biologist an incredibly valid opportunity to study the sharp biological change that characterizes the region and that in the cave fauna can be studied. The increased knowledge of local beauty, the publication of the exploration results, the organization of photo-graphic exhibits and presentations will benefit not only the scientific and caving community but also the locals that could possibly see an increase of the tourism linked with these incredibly beautiful landscapes. To the Manusela National Park we would like to highlight four main points:

- In top of Binaiya, Wai Fuku camp area is in proximity of a small pond used by deer and other animals that cannot sustain the anthropic pressure (washing dishes, waste disposal etc.) of uneducated tourists. An alternative should be the use of Wai Huhu as last camping site. This camp allows reaching Binaiya peak in 3-4 hours without too much damage for the delicate ecosystem of the high ponds. A periodic monitoring of water sample from pond should be taken and analyzed to maintain under control the pollution levels already reached.
- The porters that bring tourists from Kanikeh Village, while quite expert in low forest environment, should be helped in gaining a better knowledge of high mountain risk situation, and a better understanding of gear needs. They should also be the first to educate the tourists on to how deal with waste disposal (i.e. Bring back exhausted batteries and other not biodegradable products)
- In the villages along the coast the discharge into the sea of plastic and other garbage, should be avoided. If more modern system of waste disposal are still not available the park should open the way to this direction and collaborate with local authorities to obtain it. Tourists don't go where sea looks dirty.
- Even if the Sapalewa Underground River is not inside Manusela National Park, since MNP is the main local protection authority in the island, and considering the importance of its cave system, we suggest to study in collaboration with LIPI the possibility to include this area in some protection scheme, to try to preserve from modification this indescribable Indonesian wonder of Nature.

[10] Measurement done the 12-6-2012
[11] Indonesian Institute of Science

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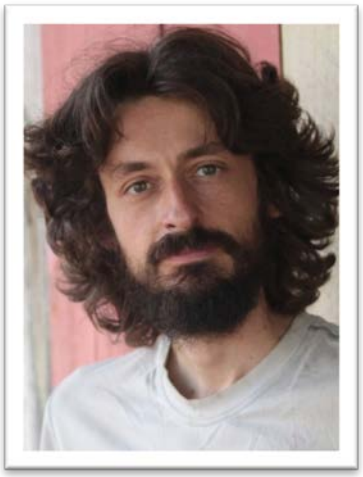

Iyek (ASC)

Ato(Manusela NP)

Buan (Huaulu)

Im (Huaulu)

Imp (Kanikeh)

Oni (Kanikeh)

Sonny (Taniwel)