

Geotourism of Batu Dinding Kilo Tiga, Amurang District, South Minahasa Regency, North Sulawesi - Indonesia

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Abstract. Start your abstract Batu Dinding Kilo Tiga or famously called Batu Dinding is one of tourist destinations in Kilo Tiga village, Amurang district, South Minahasa regency, North Sulawesi. In terms of Geology, Batu Dinding is a rock cliff with columnar structure and constituted in the form of andesitic thraakit rocks which is one of intermediate igneous rocks of volcanic aged Late Tertiary until Early Quarter, precisely during the Pleistocene. The structure and appearance of Batu Dinding was like a ladder, make Batu Dinding in demand as a destination for wall climbing or cliff hanger. The area around the Batu Dinding, there are Pamurapa River that at a time when it was high tide, can be used for rafting. Unfortunately, the accommodation and accessibility of the Amurang Batu Dinding are poor, causing Batu Dinding rarely to visit. The aim of the paper is to introduce as well as media publications of Batu Dinding tourism in order to increase local income and in addition it can be as a geological site for learning purposes.

1. Introduction

According to Farsani et al (2013), geotourism is nature tourism with unique geological and geomorphological landscape. The geotourism as country tourism asset could be a solution in order to support local businesses and products. North Sulawesi has many potential tourism sites that not well explored yet even it has high attractiveness. One of the tourism resources that has not been explored is geotourism features (Mangindaan et al, 2014). Geotourism defined as tourism which focuses on a landscape (or others geological features) as the basis for providing visitor engagement, learning, and enjoyment. It has links with adventure, cultural, and ecological tourism that focus on creating geotourism product that protect geoheritage and build communities (Robinson, 2015).

Geographically, North Sulawesi located between 00°15'51" N – 05°34'06" N and 120°07'00" E - 127°10'30" E. based on territory administration, North Sulawesi province has 11 districts and four cities, namely; Bolaang Mongondow, Minahasa, Sangihe archipelago, Talaud archipelago, South Minahasa, North Minahasa, North Bolaang Mongondow, Sitaro archipelago, Southeast Minahasa, South Bolaang Mongondow, East Bolaang Mongondow, Manado, Bitung, Tomohan, and Mobagu.

Batu Dinding as Geotourism site is located in Kilo Tiga village, Amurang district, South Minahasa regency, North Sulawesi province (**Error! Reference source not found.**), precisely 5 km northwest of Amurang, and about 60 km southwest of Manado. According to Sompotan (2012), Sulawesi has complex geological conditions and complex tectonic. This complexity is due to the convergence of three tectonic plates, the Indo-Australian plate, Pacific plate, and Eurasian plate.

Batu Dinding as a natural rock cliff with columnar structure that has high up to 90 meters, composed of andesitic thraakit (**Error! Reference source not found.**). Batu Dinding used as cliff hanger and wall climbing arena. As tourist destination, Batu Dinding has poor supporting infrastructure. The nearest lodgment and restaurant are located in Amurang, about 5 km from Kilo Tiga village.



Beside to wall climbing, the beauty of Kilo Tiga village also interesting to visit. In fact, in this village there is Pamurapa River that usually used for rafting. Little publication and poor supporting tourist infrastructure make Batu Dinding and Kilo Tiga village rarely visited. The aims of this paper are to publicize the tourist attractions in Kilo Tiga village, especially Batu Dinding and enhances the usability of Batu Dinding as a tourist destination or as a field study.

2. Methodology

Mouriki and Charalampos (2009) explained that certain methodology required to assess the geotopes (geological site). The methodology using model to evaluate the touristic value and conservation status of landform and geomorphosite. In this research, after conducting field observations and interviews directly with Komunitas Pecinta Alam (KPA) Sulawesi Utara and Kilo Tiga villagers, the authors evaluated two Geotourism site in Kilo Tiga village, Batu Dinding and Pamurapa River. Scoring method used to evaluate both Geotourism sites. The scoring method based upon paper “Geoheritage and Geotourism Potential of the Strzelin Hills (Sudetic Foreland, SW Poland)”, written by Solarska Anna and Jarry Zdislaw (2010). The scoring method used four aspects as a reference assessments, consists of accessibility, state of preservation, scientific worth, and education significance (**Error! Reference source not found.**).

Table 1. Criteria of assessment for Kilo Tiga’s geosite evaluation (according to Anna and Zdislaw, 2010)

Criterion	Traits	Points
Accessibility	Site clearly visible, located directly on the touristic trail or nature’s path	5
	Site clearly visible, located on the road or path	4
	Site barely visible, located more than 250 m away from the path or road	3
	Site difficult to access for tourist (ex. significantly overgrown or difficult to access)	2
	Site unavailable for tourists	1
State of preservation	Well preserved site with no visible signs of degradation	5
	Site in slight violation of its structure	4
	Partially destroyed	3
	Site heavily modified by human	2
	Site destroyed - loss character of geosites	1
Scientific worth	Very high: one site in the region, unique in a wider scale	10
	High: very important for regional studies	8
	Average: significant for regional research	6
	Low: Common site with average values	4
	Very low: no partikular distinctive features	2
Education significance	Very high: number of represented issues: 5 and more	10
	High: number of represented issues: 4	8
	Average: number of represented issues: 3	6
	Low: number of represented issues: 2	4
	Very low: number of represented issues: 1	2

3. Geology of Study Area

The research area located in Kilo Tiga village, Amurang district, South Minahasa regency, North Sulawesi. This paper also discussed the geological conditions and litotectonic system of Sulawesi Island, particularly in the northern arm of Sulawesi Island.

3.1. Regional Geology of Sulawesi

Geologically, Sulawesi and the surrounding area is a complex area. Complexity is due to the convergence of three lithospheric plates, the Indo-Australian plates (northward), Pacific plate (westward), and Eurasian plate (south-southeast) (**Error! Reference source not found.**). In the northern part of Sulawesi, there is North Sulawesi Trench which is a subduction zone of Sulawesi Sea (Celebes Sea) and northern arm of Sulawesi (Darman, 2011).

Based on lithologic and tectonic conditions, Sulawesi and the surrounding area is divided into five tectonic provinces (**Error! Reference source not found.**), the North Sulawesi Magmatic Arc, West Sulawesi Plutono-Volcanic Arc, Central Sulawesi Metamorphic Belt as part of Australian block, East Sulawesi Ophiolite which is a segment of Trias – Miocene oceanic crust, and Banggai-Sula Microcontinental fragments (Sompotan, 2012).

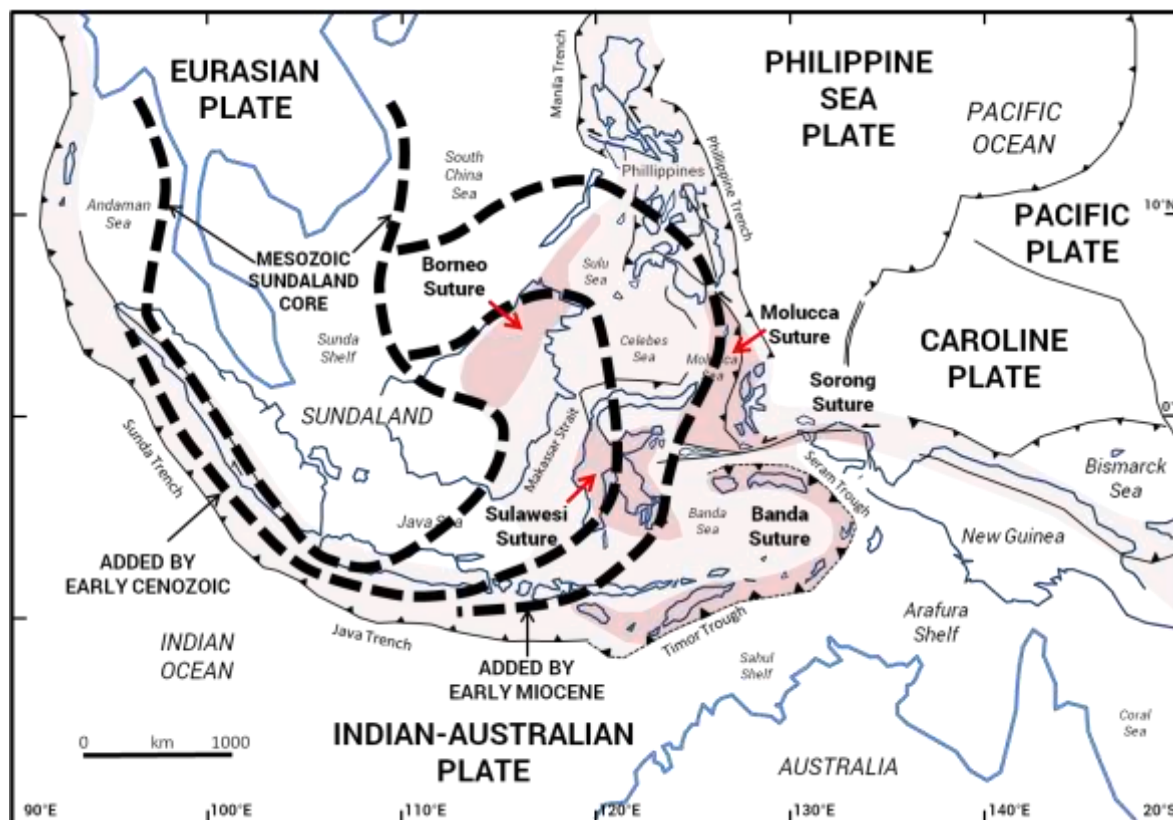


Figure 1. Tectonic boundary of Indonesia (Modified from Sompotan, 2012 after Hall and Smyth, 2008)

3.2 North Sulawesi Magmatic Arc

The North Sulawesi Magmatic Arc (**Error! Reference source not found.**) extending from Buol to Manado, covering North Sulawesi Province and Gorontalo. North Sulawesi Arc extends about 500 km from 121° E to 125°20' E with relatively constant width of 50 – 70 km. This area reaches altitude 2065 m and 3255 m in western Gorontalo (area around neck of Sulawesi) (Darman, 2000).

Evolution of North Sulawesi Arc could be divided into two main stages (Sompotan, 2012):

1. West-trending subduction during Early Miocene (22 – 16 Ma)
2. Post-collision rifting and the appointment of arc, with the onset of subduction along North Sulawesi Trench during Late Miocene to Quaternary (9 Ma).

North Sulawesi region dominated by limestone as a constituent lithology of Ratatotok sedimentary basin. The others lithologies that compile the basin are (Sompotan, 2012):

1. Breccia-sandstone group which consists of breccia to coarse conglomerate, fine and coarse sandstone cross bedding, siltstone, claystone (found in Ratatotok – Basaan), and pyroxene-andesite breccia.
2. Tondano Tuff group (Pliocene) which consists of coarse volcanic rock fragments containing fragments of andesite, pumice, tuff, ignimbrite breccia, and andesitic thakit rock.
3. Quaternary rocks group that composed of andesite-basalt lava, bombs, and ash.
4. The youngest group consist of coral reef limestone, lake sediment, stream sediment, and alluvium.

Pliocene and Quaternary volcanicity belonging to the Sangihe Arc (**Error! Reference source not found.**) conceals much of the Early Miocene geology near Manado (**Error! Reference source not found.**). Small exposures of andesite and diorite below Quaternary volcanic cover on the Sangihe island (north of Manado), suggest that older arc volcanics form the basement of the present-day Sangihe Arc (Darman, 2000).

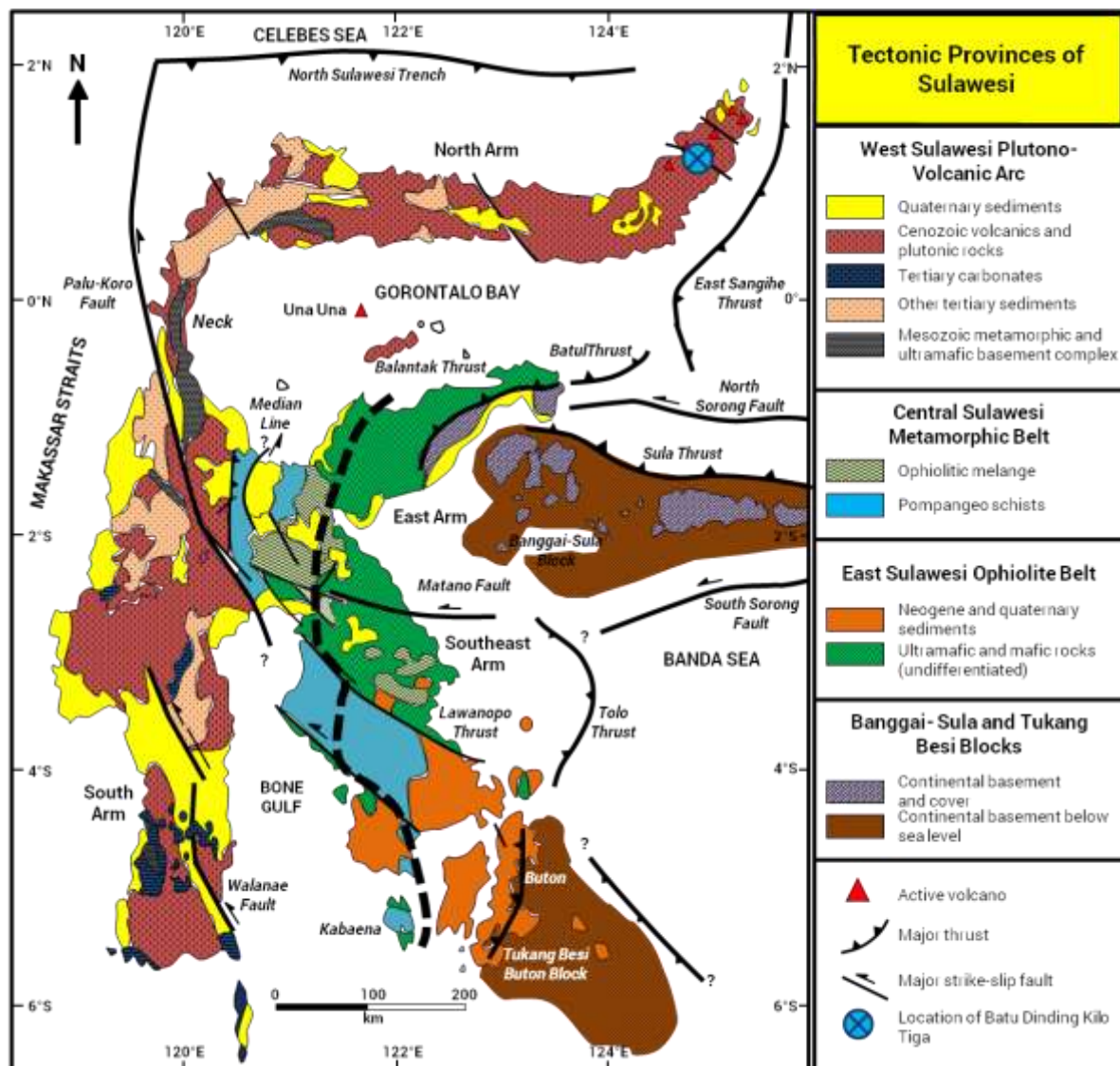


Figure 2. Tectonic provinces of Sulawesi (Modified from Sompotan, 2012 after Hall and Wilson, 2000). Location of Batu Dinding Kilo Tiga located in northern arm of Sulawesi.

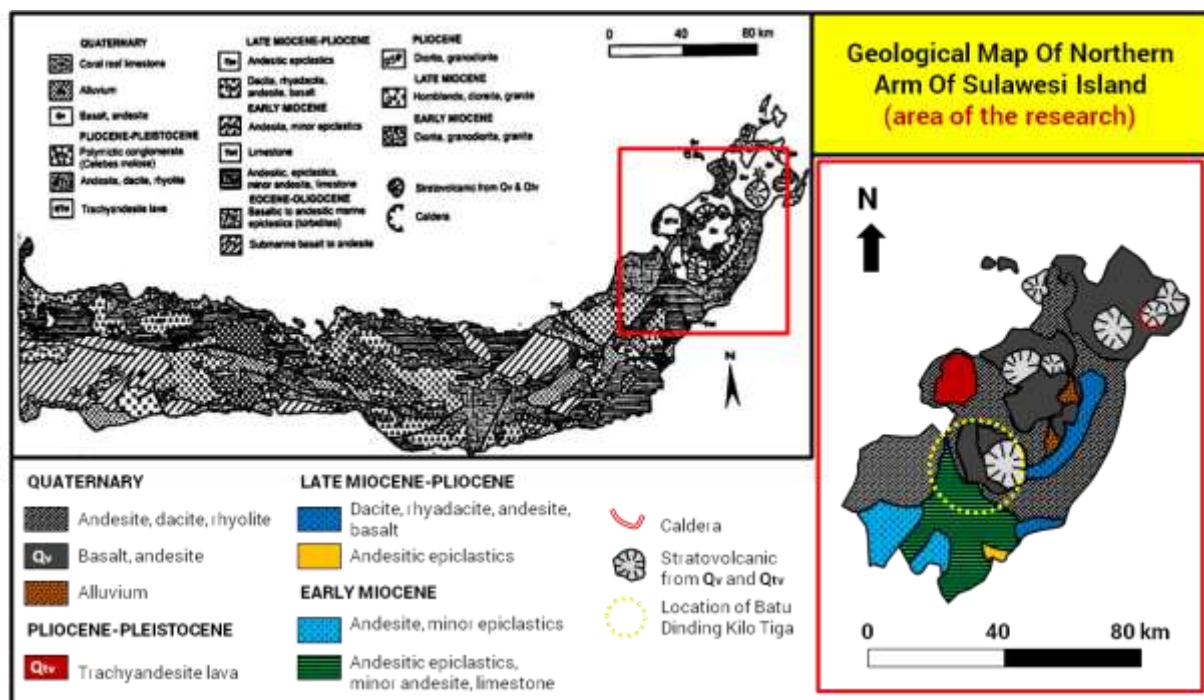


Figure 3. Simplified geological map of northern arm of Sulawesi Island (Modified from Darman, 2000 after Kavalieris et al, 1992).

4. Batu Dinding As Geotourism Site

Batu Dinding is located in Kilo Tiga village, Amurang district, South Minahasa regency, North Sulawesi. The village itself is housed in the route between Amurang and Tombatu. Batu Dinding can be reached from Amurang or Manado by private vehicles or public transportations. However, Batu Dinding can't be achieved with one trip, visitors have to use taxibike from public transportation drop-off point to Kilo Tiga village, and then walk to Batu Dinding.

Batu Dinding is a natural rock cliff that has 90 meters high. This cliff consists of andesitic thrahit with columnar structure. The unique shape with difficult level for climbing, make Batu Dinding used for cliff hanger and wall climbing (**Error! Reference source not found.**).

The configuration of columnar rocks were reversed, make the climbing became difficult and challenging. There are several climbing routes that have been installed by Kelompok Pecinta Alam (KPA) Sulawesi Utara. The climbing routes are:

1. Ofu route (bee in English), the route where the climbing path through some beehives which are some of them inhabited.
2. Spider route, the route where climbing path disjoint, so to finish this route, climbers have to jump from one path to another.
3. Hang Dog route, the route where to pass this route, climbers have to hang for several times.
4. Climb or Swim (COS) route, the route where the path crosses and passing water flow that flows in one side of the cliff.
5. Tragedy route, the route to commemorate the team members who were killed because of swept by Ranoyapo River when the flooding occurs.
6. Malaria route, the second hardest climbing route after Ratapan route.
7. Ratapan route (lament in English), the hardest climbing route in Batu Dinding. Stamina, mind, and strength of climbers will be drained during climbing, make the climbers complain or lamenting.

Until now, only a few people who are able to finish Malaria and Ratapan route. Because it is still in the stage of the development plan, Batu Dinding is free from charge, but it is recommended for visitors to leave a voluntary donation for maintenance and cleanliness management that conducted independently by villagers. For visitors who want to climb, it is recommended to bring their own climbing equipment and contact KPA Sulawesi Utara first.

Near to Batu Dinding, there is Pamurapa River that usually used for Rafting (**Error! Reference source not found.**). Pamurapa River is a short river that carries volcanic and fluvial sediment from volcanoes around Amurang. The river also used as traditional sand quarry and suitable as a sedimentology and hydrology learning site. Score for both Batu Dinding and Pamurapa River are shown in **Error! Reference source not found.**.



Figure 4. Batu Dinding in Kilo Tiga village with its unique structure used for wall climbing or as a place to take pictures.



Table 2. Score (evaluation result) for Kilo Tiga's geosite

Geosite	Criterion				Total
	Accessibility	State of preservation	Scientific worth	Education significance	
Batu Dinding	3	5	8	10	26
Pamurapa River	3	5	6	5	19

5. Conclusions

Batu Dinding is a site which consist of vertical colmnar joint stands about 90 meters from the ground. The Batu Dinding columnar joint classified as andecite-basaltic rocks which undergone cooling period. During the period of cooling, lava started to crack and the crack grows perpendicular to the surface. Because of the uniqueness and the history of forming, Batu Dinding is suitable as Geotourism destination and structural geology educational place.

Pamurapa river is also suitable as geotourism destination. The river flows in the north of Batu Dinding site. During the rain season, the river will cover the flood plain peripheral. After this season, the materials that brought by the flood will cover the flood plain and its suitable as educational place for sedimentology.

Accessibility to Batu Dinding and Pamurapa River fairly easy, less than 250 meters from main road and only be reached by walk. Both sites are well preserved and still rarely visited. Management and maintenance of Batu Dinding and Pamurapa River conducted independently by the local community. In terms of the usefulness of field studies, Batu Dinding and Pamurapa River are very important for geological study of Sulawesi, especially North Sulawesi.

Lodgment and restaurant only exist in the nearby town of Kilo Tiga village, Amurang and Manado. For the convenience of visitors, it should be established tourist supporting infrastructure such as rental climbing equipment, restaurant, and lodgment in the area of Kilo Tiga village.

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