JURNAL
GEOSAINS DAN TEKNOLOGI
Volume 6 Nomer 2, Juli 2023

SOUTHERN TASIKMALAYA ANCIENT SUBMARINE VOLCANO: EVIDENCE OF ERUPTIONS AND THEIR DIVERSITY AS GEOLOGICAL HERITAGE

Agustina Djafar[1*], Ifan Yoga Pratama Suharyogi[1], Rahajeng Ayu Permana Sari[1], Anita Galih Ringga Jayanti[1,2], Andhy Darmeidi Sipayung[1], and Indyo Pratomo[1]

[1]Geological Museum, Geological Agency, Ministry of Energy and Mineral Resources
[2]Geological Engineering Department, Faculty of Engineering, Universitas Diponegoro

Abstract

In the southern Tasikmalaya area West Java Province, Indonesia, there are Tertiary volcanic rocks, with an east-west trending distribution pattern. Physiographically, this area is included in the southern mountain zone of West Java and is generally composed of tuff and polymic breccias with intercalated of lava and limestone which are grouped into the Jampang Formation and Genteng Members Jampang Formation. The existence of these volcanic and sedimentary rocks of Oligocene – Middle Miocene in the area is an indication of submarine volcano. The purpose of this paper is to identify evidence of eruptions and submarine volcano products found in the southern Tasikmalaya area, for further assessment of the geological diversity potential as a geological heritage. The method used are field data collection and quantitative data analysis, namely identification of geological heritage based on "Technical Guidelines for the Assessment of Geological Heritage Resources". The submarine volcano products which found in this area are peperite, and basaltic andesite lava at Karang Tawulan Beach, traces of alteration, and hydrothermal mineralization like Panca Tengah jasper, and Cipatujah volcanogenic massive sulphide. These evidences show that volcanic activities in the southern Tasikmalaya took place continuously from Oligocene to Middle Miocene. From the results of the assessment, the geological diversity in this area has a scientific value of "medium-high".
Keywords: basaltic andesite lava; geological heritage; jasper; peperite; southern Tasikmalaya; submarine volcano.

Abstrak

Di daerah Tasikmalaya Selatan dijumpai batuan gunungapi berumur Tersier, dengan pola sebaran berarah timur-barat. Secara fisiografi, daerah tersebut termasuk ke dalam zona Pegunungan Selatan Jawa Barat dan umumnya tersusun oleh tuf dan breksi polimik dengan sisipan lava dan batugamping yang dikelompokkan ke dalam Formasi Jampang dan Anggota Genteng Formasi Jampang. Keterdapatan batuan gunungapi dan batuan sedimen berumur Oligosen – Miosen Tengah di daerah tersebut merupakan indikasi adanya aktivitas gunungapi bawah laut. Tujuan dari makalah ini adalah untuk mengidentifikasi jejak erupsi dan produk gunungapi bawah laut yang dijumpai di daerah Tasikmalaya Selatan, untuk dilakukan penilaian potensi keragaman geologi sebagai warisan geologi. Metode yang digunakan adalah pengumpulan data lapangan dan analisis data secara kuantitatif, yaitu identifikasi warisan geologi berdasarkan "Petunjuk Teknis Asesmen Sumberdaya Warisan Geologi". Produk gunungapi bawah laut yang dijumpai berupa peperit dan lava andesit basaltik Pantai Karang Tawulan, serta jejak-jejak ubahan dan mineralisasi hidrotermal berupa jasper Panca Tengah dan endapan bijih sulfida masif Cipatujah. Hal tersebut menunjukkan bahwa kegiatan volkanik di daerah Tasikmalaya Selatan berlangsung secara berkesinambungan sejak Oligosen hingga Miosen Tengah. Dari hasil pembobotan nilai warisan geologi, maka keragaman geologi gunungapi api bawah laut Tasikmalaya Selatan memiliki penilaian scientific "sedang – tinggi".
Kata Kunci: *lava andesit basaltic; warisan geologi; jasper; peperite; Tasikmalaya Selatan; gunungapi bawah laut.*

---

*) Korespondensi: agustinadjafar@gmail.com
Diajukan : 3 Maret 2023
Diterima : 5 September 2023
Diterbitkan : 18 Desember 2023

INTRODUCTION

Tectonic and magmatism activities in Java Island have begun since the Late Cretaceous, caused by the existence of a subduction zone located to the south, in the form of the subduction of the Indo-Australian plate under the Eurasian Plate. The movement resulted in *superimposed volcanism* over time, and this activity continues to this day. This can be seen from the distribution of volcanic rocks on the Java Island, as in Fig. 1, which was proposed by Soeria-Atmadja *et al.* (1994). The subduction between Sumatera, Java and Borneo had stopped at 90 million years ago and began to be active again around Sundaland 45 million years ago. Antarctica and Australia separated, and Australia began to move northwards (Hall, 2013). Hall (2009) reconstructed the paleogeographic changes of Southeast Asia, and the results showed that tectonic activity that occurred during the Late Eocene – Miocene triggered submarine *volcano* activities in the southern part of Java Island. The volcanism activity began about 40 million years ago (Late Eocene), and produced Tertiary-aged volcanic rocks in the south of Java Island, known as the Old Andesite Formation (van Bemmellen, 1949) or the Lower Eocene – Early Miocene aged arc volcanic and magmatic rock groups (Soeria-Atmadja *et al.*, 1994). The existence of these rocks is one of the types of evidence that the southern part of Java Island was once part of the volcanic arc.

The existence of ancient volcanoes in the south of Java Island is not easy to observe on the surface because the shape of the landscape has mostly been lost due to weathering and erosion, as well as disturbances in geological structures. However, the product of volcanism activity, in the form of lava-water-sedimentary interactions such as peperites, hyaloclastite, and pillow lava can be used as a reference for proving that the area was once part of a submarine volcano.

Submarine volcanoes (volcanic seamounts) are the most common forms in the deep oceans, generally associated with major fissures or weak zones in the plates, and have a truncated conical shape due to collaps with varying crater and caldera profiles. Small volcanoes generally have circular to elliptical craters, while those measuring 2 – 4 km or more have a complex and irregular shape with several volcanic centers, and ridges radiate due to volcanic fracturing zones (Mitchell, 2001).

In addition to its varying shape and size, the bottom of a submarine volcano is generally circular with a diameter of less than one kilometer to several kilometers, with average slope 20º and maximum approximately 40º, and the shape of the peak is relatively flat. These volcanoes, generally have a single eruptive center, the vent is relatively small, some can also develop into composite volcanoes and come to the surface as volcanic arcs. Variations in shape and size depend on the growth mechanism and geometry of the conduits (Batiza and Vanko, 1983), the process of interaction between magma or lava - water (Wohletz and Sheridan, 1983), and confining (hydrostatic) pressure.

One area that has traces of submarine volcanic eruptions that can be clearly observed is South Tasikmalaya, West Java Province, Indonesia. In the description of rock formations on the Karangnunggal Quadrangle Geological Map (Supriatna *et al.*, 1992) it is stated that, the Tasikmalaya area is composed of volcanic rocks formed by subaqueous and subaerial eruption. The southern part of Tasikmalaya, generally composed by volcanic rocks of Oligocene-Miocene, and carbonaceous sedimentary rocks of Middle Miocene – Late Miocene (Fig. 1).

The purpose of this research is to identify evidence of eruptions and submarine volcanic products found in the South Tasikmalaya area, for further assessment of the potential of geological diversity as a geological heritage.

METHODS

According to van Bemmellen (1949), the southern part of Tasikmalaya is physiographically included in the southern mountainous zone of Western Java. The research area consists of polymic breccia and tuffs with intercalation of lava and limestones members of the Jampang Formation and Genteng Members of the Jampang Formation of the Oligocene - Middle Miocene, as well as calcarenites, calcilutites, and marl of Limestone Members of the Pamutuan Formation of Middle Miocene - Late Miocene (Supriatna et al., 1992).

The method used in this research is field data collection, quantitative and qualitative data analysis. Field data collection is carried out by recognizing, observing and describing outcrops in detail, including coordinate data retrieval and photo documentation. Furthermore, quantitative data analysis was carried out related to the

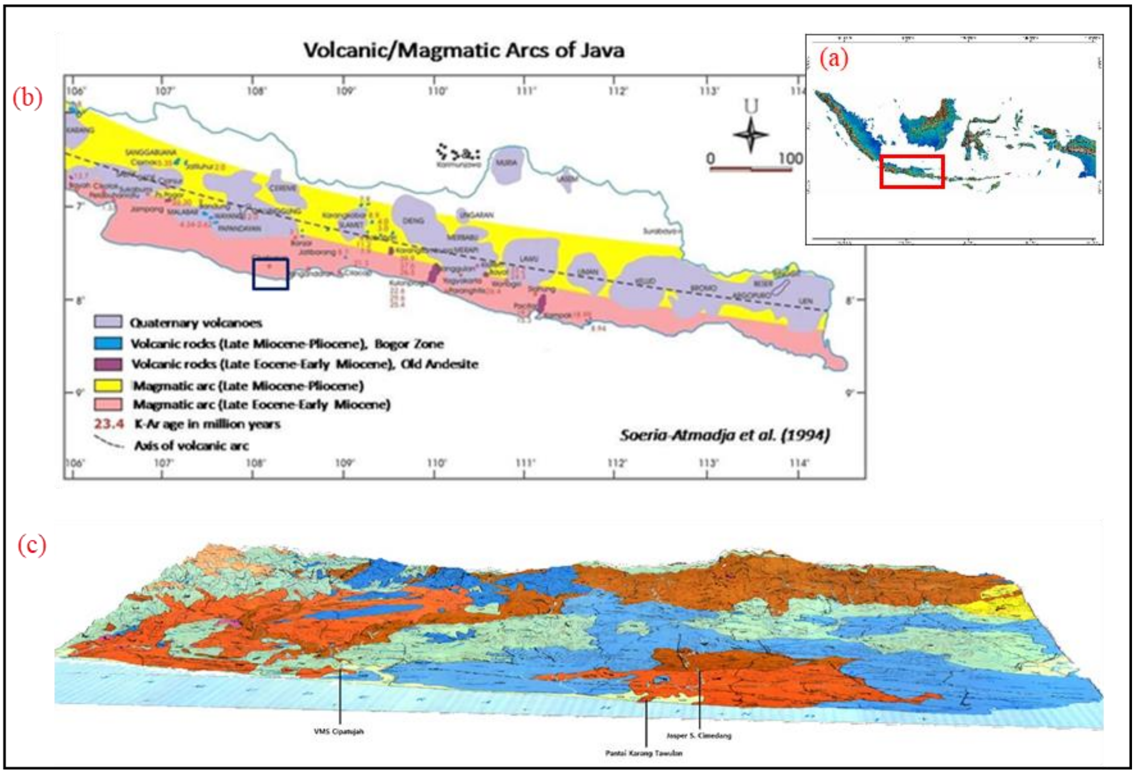

Figure 1. (a) Indonesian map index; (b) The research area includes South Tasikmalaya, West Java, Indonesia (Soeria-Atmadja et al., 1994 with modifications); (c) geological map of South Tasikmalaya.

Table 1. Classification of Geological Heritage Assessment based on scientific, educational, tourism and risk of degradation assessments (Bidang Geosains Pusat Survei Geologi, 2017).

Number of Values	Scientific Assessment
< 200	Low
201 – 300	Keep
301 – 400	Good

potential of a geological diversity location as a geological heritage site, which includes scientific value, education, tourism and risk of degradation as in Table 1. The qualitative assessment is based on the Technical Guidelines for Assessment of Geological Heritage Resources (Bidang Geosains Pusat Survei Geologi, 2017).

The percentage calculations are made based on these parameters: scientific values which include locations that representing the geological frameworks, main research locations, scientific understanding, geological site conditions, geodiversity, the existence of geological heritage sites in one region, and barriers to location use.

Education values include vulnerability of geological heritage sites, location achievements, barriers to site utilization, security facilities, supporting facilities, population density, relationship with other values, location status, peculiarities, conditions on the observation of geological elements, educational information potential, and geological diversity.

Tourism values criteria are included vulnerability, location achievements, barriers to site utilization, security facilities, supporting facilities, population density, relationship with other values, location status, peculiarities, conditions on the observation of geological elements, interpretative potential, economic level, and close to recreation area.

The last criteria is degradation value. These criteria are included damage to geological elements, adjacent to areas/ activities that have the potential to cause degradation, legal protection, accessibility, and population density.

RESULTS AND DISCUSSION

As result of data collection in three locations in the South Tasikmalaya, West Java Province, Indonesia, submarine volcanic products were found in the form of peperite and andesite basaltic lava Karang Tawulan Beach, hydrothermal alteration and mineralization of Jasper in Panca

Tengah, and Cipatujah massive sulfide ore deposits.

1. Peperite-Hyaloclastite-Basaltic Andesite Lava Karang Tawulan Beach

Peperite is a genetic term applied to heterogeneous rocks formed in situ, where magma is intruded and mingling with unconsolidated or poorly consolidated sediments (White et al., 2000; Skilling et al. 2002; White and Houghton, 2006). Peperites consist of fragments of lava and sediment, characterized by a clastic texture where both components can form a matrix (McPhie et al., 1993).

Peperite has an appearance and unique texture that distinguishes the peperite from other similar volcanic rocks, which are commonly found along the contact between sediment and lava. The peperite outcrop found on Karang Tawulan Beach is in the form of dispersed peperite, fluidal peperite, with juvenile clast in the form of andesite embedded in tuffaceous sandstone matrix and is non-carbonate (Fig. 2a). Juvenile clast has a sub-angular – rounded shape, with sizes from gravel to boulder, with fluidal clast morphology. The morphological forms of the fluidal clast are amoeboid, elongate globule, and globular (Fig. 2b). Tuffaceous sandstone matrix is greenish-brown (likely to have been altered into zeolite), grain size 1/4 - 1/2 mm, and there is some fracturing that has been filled by marine sedimentary material and glassy lava. There is no bedded or laminated in the tuffaceous sandstone matrix, but in some places, sediment fluidisation is found that evidenced by the presence of narrow and localized, zones along igneous-sediment contacts (Fig. 2c), which reflects the sediment in an unconsolidated or poor consolidated at the time of fragmentation forming a peperite.

Several clasts were found that showed a quench fragmented structure, consisting of a radial fracture which reflects thermal tensile stress, contraction and cracking of the glass, perlithic cracks, glassy structure, and the presence of rim or cortex formed at the edge of the clast or also called "chilled margin" (Fig. 2d). Quench fragmentation or thermal granulation occurs when magma or lava direct contatc with cold liquid (like water, unconsolidated or poorly consolidated sediments), and when magma and water interact explosively during eruptions of phreatomagmatic (Kokelaar, 1986; Wohletz, 1986; Cas and Wright, 1987).

Figure 2. (a) Fluidal peperite at Karang Tawulan Beach; (b) The morphology of the fluidal clast is globular; (c) Sediment fluidisation on peperites; (d) quench fragmented on the peperite clast (red dashed line).

Figure 3. (a) Lava outcrops and peperite on Karang Tawulan Beach; (b) Columnar joint structure on the lava; (c) Vesicular structute in the lava, which are formed due to the interaction between the hot lava surface and seawater; (d) the surface of the columnar joint, where the joint planes are filled with marine sedimentary material and glassy lava.

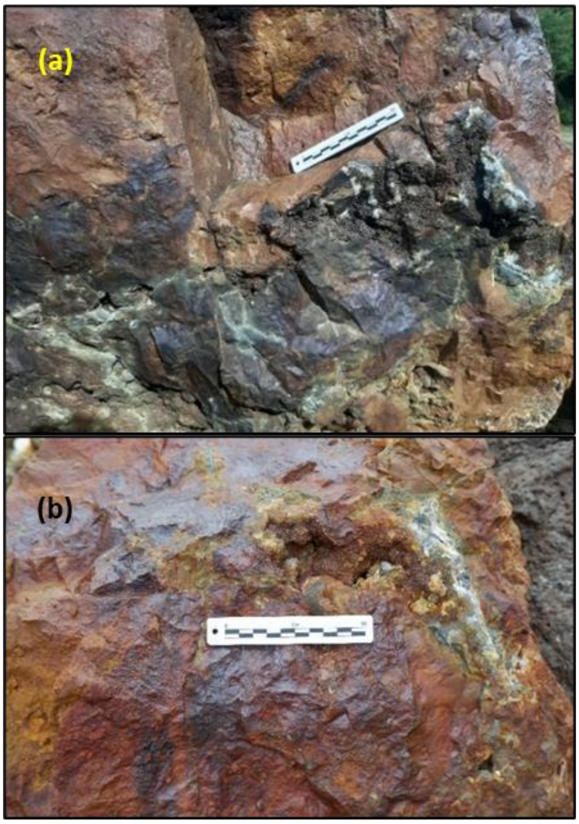

Figure 4. (a) Color variations of jaspers in the Cimedang River, Panca Tengah; (b) quartz mineralization showing saccharoidal texture.

In addition to peperites, on the Karang Tawulan Beach there are also outcrops of basaltic andesite lava (Fig. 3a) which form sheeting joint and columnar joint structures (Fig. 3b). The columnar joint on the lava reflects traces of lavacontraction at the time of cooling, where the joint planes are perpendicular to the cooling planes. There are several lava surfaces encountered vesicular vents, and uneven surfaces (resembling bread crust structure), which are formed due to the interaction between the hot lava surface and seawater during the cooling process (Fig. 3c).

There are fracturing and vesicular vents in lava filled with marine sedimentary material and glassy lava (Fig. 3d), reflecting the fragmentation process between lava and wet sediments. This location is interpreted as the central facies of the ancient submarine volcano.

From macroscopic observation, fresh lava is blackish gray, porphyroaphanitic texture; hypohyaline; inequigranular; and granular allotriomorphic; crystalline form: subhedral – anhedral; structure: vesicular-massive, containing mafic minerals such as pyroxine, and glass groundmass.

2. Jasper Cimedang River, Panca Tengah
In Cimedang River, Panca Tengah found traces of hydrothermal alteration in the form of jasper minerals. Jaspers found in Panca Tengah area are generally brown, red, yellow, and black, with one or more color combinations (Fig. 4a), are not translucent (opaque), solid, and hardness ranging from 6.5 – 7 Mohs scale. In some jasper boulders, there are several parts that show quite varied color combinations (some even to 5 colors). This is probably caused by the presence of impurities in jasper, which are derived from the composition of lava and peperite-forming marine sediments, and hydrothermal solutions. Jasper in the most common area among gemstone lovers as "Panca Warna" which means five colors.

Jasper in the Cimedang River is found associated with peperite–hyaloclastite (Fig. 5). This indicates that the formation of jasper is associated with the subaqueous setting. In this area there is also quartz mineralization that fills the fracturing (cavity filling) in the peperite to form a vuggy and saccharoidal structure (Fig. 5b).

3. Cipatujah Massive Sulphide Ore Deposits
Volcanogenic Massive Sulphide (VMS) deposits are important sources of copper (Cu), zinc (Zn), tin (Pb), gold (Au), and silver (Ag). These deposits formed near sites of circulating hydrothermal fluids driven by magmatic heat are quenched through mixing with bottom waters or pore waters in near-seafloor lithologies (Shank III and Radolph, 2012). In other words, VMS is a massive sulfide deposit that forms in the submarine volcanoes environment, both in the convergent zone and the divergent zone (mid-ocean ridge and continental rift) (Fig. 6).

The forming of VMS deposits rich in sulfide ores is generally caused by the presence of seawater as a good catalyst because it has a certain chemical composition, infiltrated through fracturing on the ocean floor due to the increasing hydrostatic pressure. Magmatic fluid that has been mixed with seawater then heated by a heat

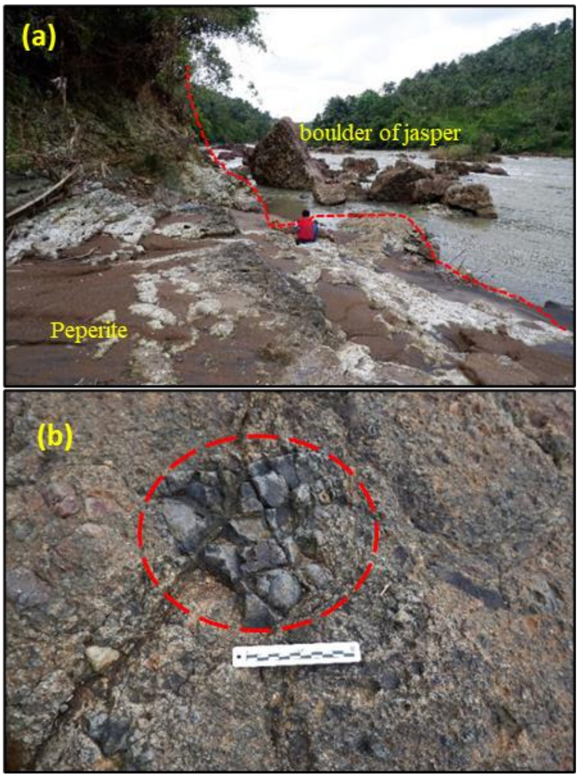

Figure 5. (a) The outcrop of peperite and jasper boulders in the Cimedang River; (b) peperite with hyaloclastite fragments (red circle).

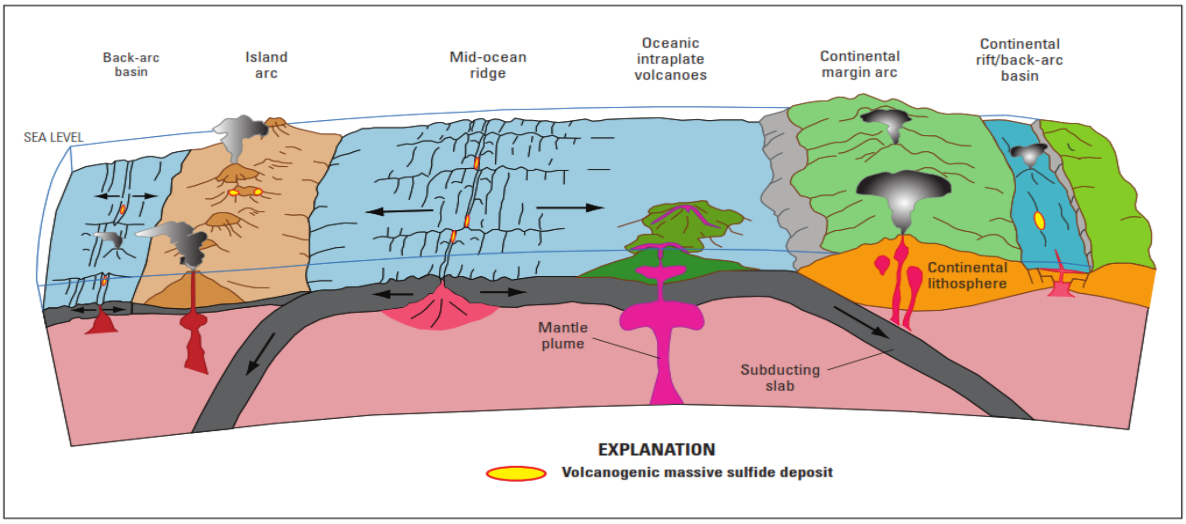

Figure 6. VMS deposits formation environment (Shank III, 2012).

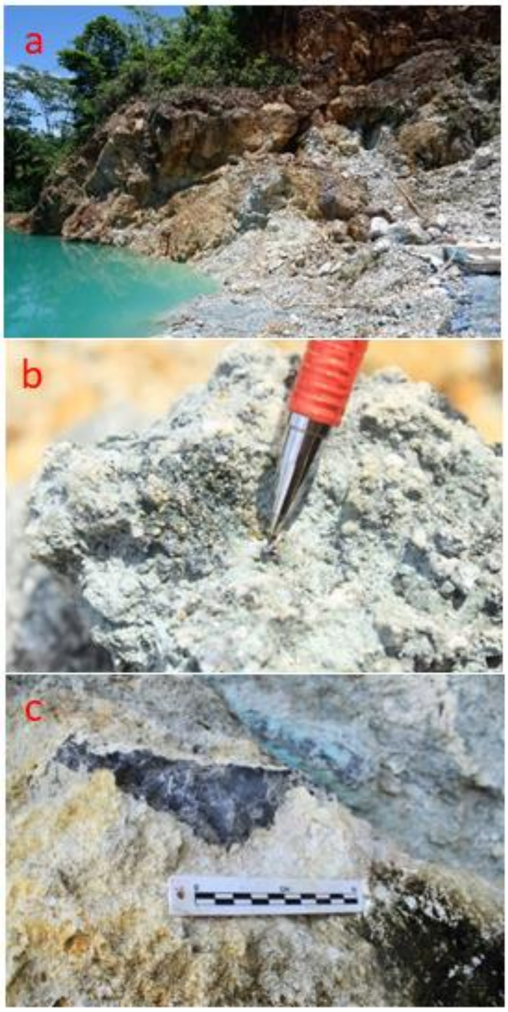

Figure 7. (a) Massive sulfide ore deposits in the Cipatujah area that have been mined by the local community; (b) mineralization of chalcopyrite, pyrite, bornite, and anhydrite; (c) Chalcedony minerals are blackish gray.

source (it can be magma) at temperatures from 400 °C - 650 °C. The mixing reaction between the two fluids causes high levels of sulfides and sulfates. The hot fluid slowly rises to the surface due to temperature differences and then radiates to the surface and forms VMS deposits.Massive sulfide lenses vary in shape and size, resembling petals and sheets, generally stratiform and lenses (Fig. 7). Massive ores in VMS deposits consist of > 40 % sulphide, usually pyrite, pyrrhotite, chalcopyrite, sphalerite, galena, non-sulfide gangue minerals such as quartz, barite, anhydrite, iron oxide, chlorite, sericite, and talk. The ore composition is dominated by Pb-Zn-, Cu-Zn-, or Pb-Cu-Zn-, and some deposits are zoned vertically and laterally (Shank III and Radolph, 2012). In the modern ocean, VMS is very similar to sulphur tongues called black smokers.

From the description above, an assessment of the potential for geological diversity as a geological heritage was carried out, based on the Technical Guidelines for the Assessment of Geological Heritage Resources (Bidang Geosains Pusat Survei Geologi, 2017). The results of the assessment of the four elements mentioned above can be seen in Table 2, Table 3, Table 4, and Table 5 obtained the total value for the Karang Tawulan Beach peperite is 316.25%, the Panca Tengah jasper is 281.25%, and the Cipatujah VMS Hill is 302.5%. Based on this percentage value, geological diversity in the research area has a scientific assessment of "medium - high".

Table 2. Scores for various criteria used for the assessment of geological heritage sites based on scientific values.

	Criteria	Score (%)		
		Karang Tawulan	Panca Tengah	Cipatujah
A.	Locations representing geological frameworks	30	30	30
B.	Main research locations	5	10	5
C.	Scientific understanding	1.25	3.75	1.25
D.	Site / geological sites conditions	15	11.25	3.75
E.	Geodiversity	3.75	3.75	3.75
F.	The existence of geological heritage sites in one region	15	15	15
G.	Barriers to location use	10	10	7.5
	Total	80	83.75	66.25

Table 3. Scores for various criteria used for the assessment of geological heritage sites based on educational values.

	Criteria	Score (%)		
		Karang Tawulan	Panca Tengah	Cipatujah
A.	Vulnerability	10	10	5
B.	Location achievements	10	2.5	10
C.	Barriers to site utilization	5	5	2.5
D.	Security facilities	7.5	5	7.5
E.	Supporting facilities	5	3.75	5
F.	Population density	3.75	2.5	3.75
G.	Relationship with other values	5	3.75	5
H.	Location status	5	2.5	1.25
I.	Peculiarities	3.75	3.75	3.75
J.	Conditions on the observation of geological elements	10	10	10
K.	Educational/ research information potential	10	15	10
L.	Geological diversity	7.5	7.5	7.5
	Total	82.5	71.25	71.25

Table 4. Scores for various criteria used for the assessment of geological heritage sites based on tourism values.

	Criteria	Score (%)		
		Karang Tawulan	Panca Tengah	Cipatujah
A.	Vulnerability	10	10	5
B.	Location achievements	10	2.5	10
C.	Barriers to site utilization	5	5	2.5
D.	Security facilities	7.5	5	7.5
E.	Supporting facilities	5	3.75	5
F.	Population density	3.75	2.5	3.75
G.	Relationship with other values	5	3.75	5
H.	Location status	15	7.5	3.75
I.	Peculiarities	7.5	7.5	7.5
J.	Conditions on the observation of geological elements	5	5	5
K.	Interpretive potential	7.5	7.5	5
L.	Economic level	2.5	2.5	2.5
M.	Close to recreation area	5	3.75	5
	Total	88.75	66.25	67.5

Table 5. Scores for various criteria used for the assessment of geological heritage sites based on the values of the risk of degradation.

	Criteria	Score (%)		
		Karang Tawulan	Panca Tengah	Cipatujah
A.	Damage to geological elements	17.5	26.25	35
B.	Adjacent to areas / activities that have the potential to cause degradation	5	5	20
C.	Legal protection	20	20	20
D.	Accessibility	15	3.75	15
E.	Population density	7.5	5	7.5
	Total	65	60	97.5

CONCLUSIONS

In the Southern Tasikmalaya area, West Java Province, Indonesia, traces of submarine volcanoes like peperite and basaltic andesite lava Karang Tawulan Beach, hydrothermal alteration and mineralization such jasper Panca Tengah, and massive sulfide ore deposits of Cipatujah was found. This is one of the evidence that in the past, the southern part of Java Island, especially South Tasikmalaya was part of the volcanic arc, which developed into an island arc. From some geological diversity found in the research area, a quantitative assessment of the potential of geological diversity as a geological heritage was carried out, and the calculation results showed a medium - high scientific value. This means that the areas have evidence or scientific record of an event on earth that has occurred or is currently occurring. In addition, it can be used for research and educational tourism, so that it can be proposed as a geological heritage (Geoheritage).

ACKNOWLEDGMENT
The author would like to thank the Geological Museum for funding this research. We also would like to express our special thanks to colleagues at the Geological Museum who have provided input and assisted in data collection in the field.

REFERENCES

Batiza, R. and Vanko, D., 1983. Volcanic development of small oceanic central volcanoes on the flanks of the East Pacific Rise inferred from narrow beam echo-sounder surveys, *Marine Geology*, 54(1-2), pp.53-90. DOI: https://doi.org/10.1016/0025-3227(83)90008-7

Bidang Geosains Pusat Survei Geologi, 2017. *Petunjuk Teknis Asesmen Sumberdaya Warisan Geologi*. Bandung: Geological Survey Center.

van Bemmellen, R.W., 1949. *The Geology of Indonesia, vol.1A. General Geology of Indonesia and Adjacent Archipelagoes*. Martinus nijhof, The Hague.

Cas, R.A.F. and Wright, J.V., 1987. *Volcanic Succession: Modern and Ancient*. London: Allen & Unwin.

Hall, R., 2009. Southeast Asia's changing palaeogeography, *Blumea- Biodiversity, Evolution and Biogeography of Plants*, 54(1-3), pp.148-161. DOI: https://doi.org/10.3767/000651909X475941

Hall, R., 2013. The Palaeogeography of Sundaland and Wallacea Since the Late Jurassic, *Journal of Limnology*, 72(s2), 1-17. DOI: https://doi.org/10.4081/jlimnol.2013.s2.e1

Kokelaar, B.P., 1986. Magma-water interactions in subaqueous and emergent basaltic volcanism. *Bulletin of Volcanology*, 48, pp.275–289. DOI: https://doi.org/10.1007/BF01081756

McPhie, J., Doyle, M.G. and Allen, R., 1993. *Volcanic Textures: A Guide to the Interpretation of Textures in Volcanic Rocks*. Hobart: University of Tasmania.

Mitchell, N.C., 2001. Transition from circular to stellate forms of submarine volcanoes. *Journal of Geophysical Research*, 106(B2), pp.1987-2004.

Shank III, W.C.P., 2012. *Historical Evolution of Descriptive and Genetic Knowledge and Concepts in Volcanogenic Massive Sulfide Occurrence Model*. Scientific Investigations Report. Virginia: US Geological Survey.

Shank III, W.C. P. and Radolph A.K., 2012. *Introduction in Volcanogenic Massive Sulfide Occurrence Model*. Scientific Investigations Report. Virginia: US Geological Survey.

Silvestri, S.C., 1963. *Proposal for a genetic classification of hyaloclastites*. Bulletin Volcanologique, 25, 315-321.

Skilling, I.P., White, J.D.L. and McPhie, J. (2002). Peperite: A Review of Magma–Sediment Mingling. *Journal of Volcanology and Geothermal Research*, 114(1-2), pp.1-17. DOI: https://doi.org/10.1016/S0377-0273(01)00278-5

Soeria-Atmadja, R., Maury, R.C., Bellon, H., Pringgoprawiro, H., Polve, M. and Priadi, B., 1994. The Tertiary Magmatic Belts in Java. *Journal of Southeast Asian Earth Sciences*, 9(1-2), pp.13-27. DOI: https://doi.org/10.1016/0743-9547(94)90062-0

Supriatna, S., Sarmili, L., Sudana, D. and Koswara, A., 1992. Geological Map of The Karangnunggal Quadrangle, Jawa at 1:100,000. Bandung: Geological Research and Development Centre.

White, J.D.L., McPhie, J. and Skilling, I., 2000. Peperite: A Useful Genetic Term. *Bulletin of Volcanology*, 62, pp.65-66.

White, J. and Houghton, B., 2006. Primary Volcaniclastic Rocks. *Geology*, 34(8), pp.677-680. DOI: https://doi.org/10.1130/G22346.1

Wohletz, K.H. and Sheridan, M.F., 1983. Hydrovolcanic Explosions II: Evolution of Basalt Tuff-Rings and Tuff-Cones. *American Journal of Science*, 283(5), pp.385-413. DOI: https://doi.org/10.2475/ajs.283.5.385

Wohletz, K.H., 1986. Explosive magma-water interactions: thermodynamics, explosion mechanisms, and field studies. Bulletin of Volcanology, 48, pp.245–264.