

## DISTRIBUTION PATTERN DIFFERENCES OF KALIWANGU FORMATION IN UJUNGJAYA DAN PASIR MALATI, SUMEDANG, WEST JAVA

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### ABSTRACT

The distribution of Kaliwangu Formation sediment in West Java generally follows the structure of Java fold thrust belt, which directed west-east. The Java fold thrust belt was effectively formed during Pleio-Pleistocene tectonics events, in which all of the Cenozoic sediment were deformed by compression stress in north-south direction. In Ujungjaya area, Kaliwangu Formation has northwest-southeast direction, while in Pasir Malati, the formation was arced relatively in north-south direction. Kaliwangu Formation distribution in Ujungjaya was influenced by the massive compression tectonics occurred in Java. This tectonic event were occurred during Pleio-Pleistocene which resulted in Java thrust fold structure pattern including Baribis Faults. Unlike in Ujungjaya, the distribution of Kaliwangu Formation in Pasir Malati was arced in north-south direction which caused by its fold structure. There is no indication of regional fault in Pasir Malati area although a lot of fault structure was found as a part of regional structure.

Keyword: *fold thrus belt*, compressional, deformation, lipatan sesar, kaliwangu.

### Introduction

Kaliwangu Formation is one of the Formation in West Java which formed during Late Pleiocene. The distinct characteristic of this Formation is the mollucs fossil abundance found in the grey-blackish clay layer. The existence of this Formation indicated the end of Bogor Basin Formation in West Java due to the finding of fluviatile sediment of Citalang Formation aged Pleio-Pleistocene overlaid the Kaliwangu Formation. Moreover, there are Quarternary volcanic to alluvium overlaid the Citalang Formation with younger age.

Generally, Kaliwangu Formation is exposed in Northern part of West Java which distributed in west-east direction. In regional physiography map of West Java (van Bemmelen, 1949), this formation is located in the transitional area between Bogor and Jakarta backrest Zone. Ujungjaya, which located in that transitional area, has Kaliwangu Formation distribution directed relatively west northwest – east northeast (WNW-ESE). To the southern part, there are clay unit of Subang Formation with Upper Miocene to Late Pleiocene age which are older than the Kaliwangu Formation. In the distance of 10 km to the south of Ujungjya area, Kaliwangu Formation was exposed with a distinct distribution pattern. The distribution pattern in this area was arced with relative direction of north-south (Figure 1). This

phenomenon leads to the interesting questions of why the distribution differences occurred. Was it due to the regional fault structure, or are there any other cause? Therefore, this research was aimed to identify the caused of differences in the distribution pattern of Kaliwangu Formation in Ujungjaya and Pasir Malati area.

### Regional Geology

Kaliwangu Formation is marine sediment formed in the Bogor Basin (Martodjojo, 1984). This Formation was the last marine sediment formed in the Basin because there is river sediment of Citalang Formation with a younger age (Pleio-Pleistocene) overlaid the formation (Djuri, 1975; Martodjojo, 1984). Regionally, the distribution of both Formations was located in close proximity with relative direction of west-east and located in transitional zone of Bogor and Jakarta Backrest (Djuri, 1975).

According to the structure, the area is also located in the Baribis thrust fold (Haryanto, 2014).

Kaliwangu Formation was formed in the neritic to transitional environment, dominated by grey-blackish clay with high organic matter content. The composition of this Formation indicated the depositional environment of calmed sea. This condition, moreover, exhibited the stable tectonis conditions with

no significant magmatism/volcanism activity during sedimentation. This stable tectonic condition seemed to have appeared since the formation of Subang Formation. Subang Formation is a marine sediment aged Upper Miocene to Late Pleiocene which formed in the calmed sea condition. This was indicated by the flaked clay with abundant foraminifera fossil.

Bogor basin was started to close in the Late Pliocene, indicated by the formation of fluvial Citalang Formation. The silting of the basin was mainly caused by intensive compression followed by high activity of magmatism/volcanism. Both of these geological processes seemed to be the main factor of the Bogor basin uplift to the surface. The compression activity formed the fold structure as well as the fold thrust belt which are close in proximity. These phenomena were followed by the formation of strike slip fault and normal fault in several different locations. These structures were also becoming the controlling factors of rock distributions in the surface. Generally, the rock distribution in West Java has west-east direction. However, differences could appear locally as the result of fault structure as it can be seen in Cikijing area. In this particular location, the distribution pattern has northwest – southeast directions due to the occurrence of Citanduy dextral fault (Figure 1).

#### **Position and Distribution of Kaliwangu Formation in Ujungjaya Area**

Most of Ujungjaya area has moderate sloping hills to wavy backrest morphologies. The hill morphology consists of Subang, Kaliwangu, and Citalang Formations sediment. Moreover, the northern part with wavy backrest morphology consists of Quarternary sediment came from young volcanic and alluvium.

Kaliwangu Formation was finely exposed along Cibayak River which flowed from west to east direction. This river disemboques in Cipelang river wick exposed Subang, Kaliwangu, dan Citalang Formations sediment. In this location, the dominant rock is grey-blackish clay with sandy clay to rough sand insertion. Mollusc fossils were found within the clay layer, which consists Turitela and Lepidocilina. The position of the fossil shell is open upward, indicating the condition of the basin in a calm condition (suspension).

The position of rock layer measured in several location, generally, showed almost vertical position which ranged between N 110°E – N 130°E with 75° to 87° slope. Minor fault was found with several centimeters shift having

horizontal sliding characteristic. Fold structure mostly found as shear joint, ekstensional joint and cleavage. The cleavage is generally diagonal against strike of bedding, indicating the corresponding formation with the fold structure. The slickenside was found in the position of N115°E/70°, with 85° SW pitch of left thrust movement. According to the earlier structural data, it can be concluded that the exposed rock in Cibayawak River located in the thrust fault zone. The thrust fault zone in Ujungjaya is moderately wide because faulting indication still found within 2 km to the north of Cipelang river with Citalang Formation rock sloped more than 50°.

The stream pattern in Ujungjaya is generally sub-dendritic, rectangular, and parallel. This pattern was generally controlled by fold and fault structures. The position of Cibayawak river stream formed a line alignment parallel to the ridge pattern, which is relatively east-west in direction. Based on Moody & Hill (1956) that applied in West Java, the fault structure in west-east direction is concluded as thrust fault or normal fault. Field data found in Cibayawak river showed the relation to the tectonic compression, that indicates as thrust fault. Therefore, structural traces in Cibayawak river could be used and evidence of Sesar Baribis presence.

#### **Distribution and Position of Kaliwangu Formation in Pasir Malati area**

Pasir Malati is located around 15 km to the south of Ujungjaya with hills and wavy flatland. The backarc pattern of Pasir Malati hills are distinct to the common backarc pattern in Indonesia, which showed an arcing pattern resembles the shape of a circle that opens to the north. There are two facies of Kaliwangu Formation found in Pasir Malati, which are clay and sand facies. Clay facies are older in age and mostly exposed in the valley of Cilutung River, while sand facies, located above the clay is forming moderate hills morphology.

Regionally, geological structure developed in Pasir Malati and its surrounding is dominated by fold and fold thrust structures. These structures showed similarity with the one developed in Ujungjaya that possibly occurred since they are both part of Java thrust fold belt. However, their fold structures in Pasir Malati and Ujungjaya are quite different. The fold pattern in Pasir Malati were arced in north-south direction, with several Northwest-Southeast variation in certain area. There is also variation in the rock layers slope showed by sloping dip less than 30° in the valley area while hills area in the west has more than 40° dip that went higher to 70° in several areas.

Within Pasir Malati complex, none of regional fault structures were found to affect the rock distribution pattern and morphology, whereas the fold structure affected them rather than other geological aspects

### Tectonic Analysis

Most of the sediment within Upper Neogene age like Subang, Kaliwangu, and Citalang Formations are exposed more in the northern part of West Java while others found in center part like Cikijing (Majalengka) and Tanjungkerta (Sumedang). In the southern part, the sediments are also exposed in smaller scale distribution in Ciamis, Tasikmalaya, and Garut.

Subang and Kaliwanu Formations are sediment outcrops located within Bogor Basin, while the presence of Citalang Formations indicates the closing of the basin. On the basis of the Kaliwangu Formation outcrop distribution, the sediment deposits were not only occurred in the Northern part of Bogor Basin, rather they all distributed in all of Bogor Basin area in the time the basin had pendangkalan menjadi paparan.

According to the previous explanation, it can be concluded that both Subang and Kaliwangu Formation exposed in the northern part are not a part of Bogor Basin margin. Although, turbidite sediment as part of Kaliwangu Formation sandstone exposed in Tanjungkerta-Sumedang only occurred locally. This, moreover, indicates that during the deposition, a deeper local sub-basin was formed.

The silting up of Bogor Basin occurred gradually. This is due to the finding of texture characteristics and sedimentary structure of Subang and Kaliwangu Formation that indicates calmed sea condition. During the uplift, basin condition was in still in marine environment that already become shallower in conjunction with molluscs fossil finding in Kaliwangu Formation. Finally, fluvial sediment was developed during Pleio-Pleistocene which also represent the end of Bogor Basin.

The closure of Bogor Basin was followed by the formation of massive orogenesis in Java island. During the time, all Cenozoic sediment were folded and faulted in the same pattern which formed the fold thrust belt. This structure pattern were very well developed in Ujungjaya and Jatigede area which dominated by the parallel of fold and thrust fault. In Ujungjaya, sesar naik regional were developed that named Baribis fault, whereas in Jatigede, thrust complex of Jatigede and

Cipeles were formed. Although geological structure in Jatigede area belong to the fold thrust belt, its appearance was not recorded in Pasir Malati area. The structure pattern in Pasir Malati had no relation with the fold thrust belt, meaning that the geological structure in this area has a younger age. The distribution pattern in Kaliwanu Formation arced due to deformation of those rock within Pasir Malati Basin by younger tectonics. These later tectonics were also reactivated the earlier formed geological structures.

### Conclusion

Differences in the distribution pattern of Kaliwangu Formation in Ujungjaya and Pasir Malati area were occurred based on the following caused

- Kaliwangu Formation distribution in Ujungjaya related to the regional tectonics occurred during Pleio-Pleistocene. This tectonic formed orogenesis that resulted in fold thrust belt in west-east direction that moreover controlled the hills morphology in West Java.
- Kaliwangu Formation distribution in Pasir Malati was not related to the fold thrust belt during Pleio-Pleistocene. Its distribution was caused by locally deformation within Pasir Malati basin. This basin in also occurred as a local basin in Bogor Basin, in which its formation mechanism is still being debated.

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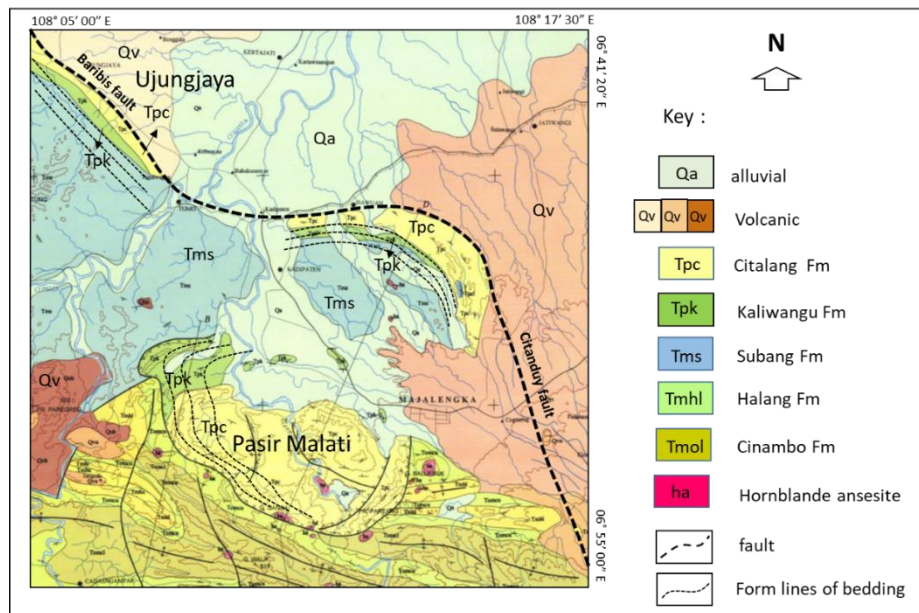


Figure 1. Geology map of Ujungjaya-Pasir Malati (source : Geologi Map of Arjawinangun, Djuri 1995; Modified)

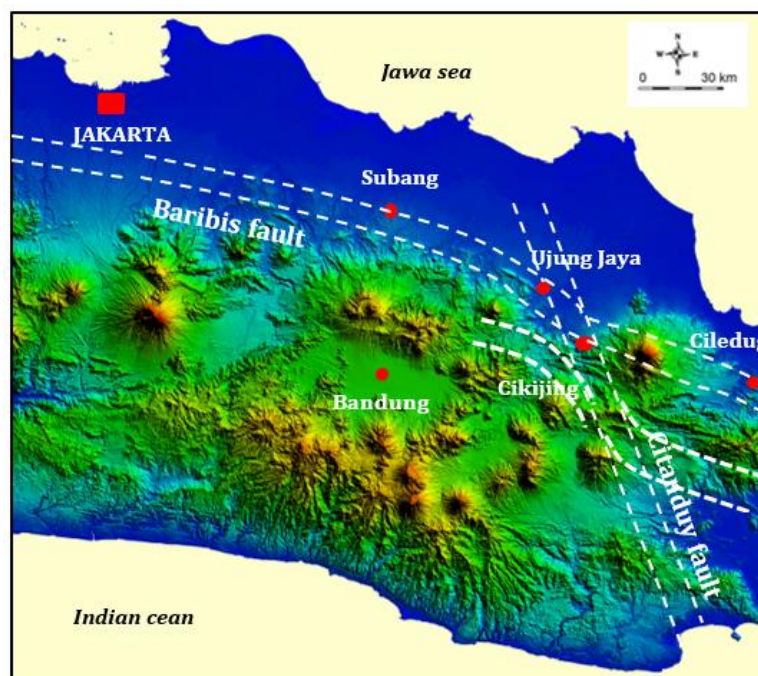


Figure 2. regional drag fold akibat sesar strike slip of citanduy fault, daerah cikijing. (Haryanto, 2014; modified)