Student article

Depositional Environment Analysis of Kali Banyumeneng, Mranggen, Kabupaten Demak

Samuel R.N. Simorangkir, Fahmi Abdillah, Zul Hayuddin and Galang Virgiawan
Geological Engineering Department, Diponegoro University, Semarang
Corresponding Author: samsimorangkir@live.com

INTRODUCTION

Kali Banyumeneng is located in Mranggen, Demak (Central Java province). The studied outcrop is located approximately 11.25 km to the SE of Semarang city and at the geographic coordinate of 100° 28' 59.65" E and 7° 02' 43.45" S (Figure 1).

The study area is geologically located in Kendeng Zone, which is also often referred as Kendeng Mountains, an east-west trending anticlinorium in the northern part of Java. The northern border of the Kendeng Zone is Randublatung Depression, while the southern border comprises a line of volcanoes called Solo Zone. Kendeng zone is a continuation of the Northern Mountains Serayu Zone that developed in Central Java. The Salatiga section of the Kendeng zone extends towards the east to Mojokerto and plunges under the Brantas river. The continuation of these mountains can still be tracked under the Madura Strait.

Van Bemmelen (1949) subdivided Kendeng Mountains into 3 parts that consist of the western part, which lies between Mt. Ungaran and Solo (north Ngawi); the central part that lies between Solo and Jombang and the eastern part that extends from east Jombang to Brantas River Delta and continuously to Madura Bay. The study area occurs in the western Kendeng Zone.

Previous work (e.g. van Bemmelen, 1949) shows that the study area consists of two lithostratigraphic units called Kerek and Kalibeng Formations. Kerek Formation consists of interbedded sandstones, claystones, and sandy limestones with observed sedimentary structures such as graded bedding, ripple mark and convolute. Kalibeng Formation is subdivided into lower and upper parts. The lower part of Kalibeng Formation consists of sandstones that shows turbiditic nature. The upper part of Kalibeng Formation is composed of breccias with fragments formed by limestone. The Upper Kalibeng Formation also contains forams, molluscs, corals and algae and it shows a bedding structure.

Observations were carried out to determine the depositional environment model of Kali Banyumeneng area based on lithology, sedimentary structures and fossils.

METHODOLOGY

The observation began with data collection in the field. The field data collection was carried out with stratigraphic section measurement followed by an analysis to determine the depositional environment of the outcrops.

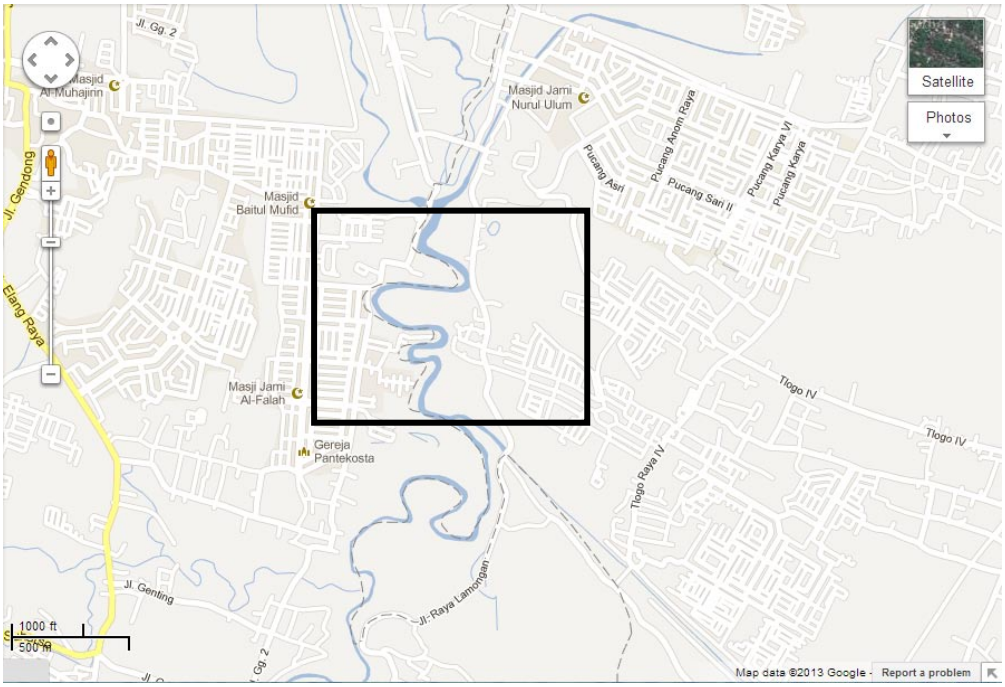


Figure 1. *Location map of Kali Banyumeneng outcrop discussed in the article (Google Maps, 2013).*

STRATIGRAPHIC DESCRIPTION FORM
GEOLOGICAL ENGINEERING DEPARTMENT
DIPONEGORO UNIVERSITY

DATE/TIME : 20th March 2013 / 10.00 WIB
LOCATION/STA-LP : K. Mranggen, Banyumeneng, Demak, Central Java
SCALE : 1 : 300

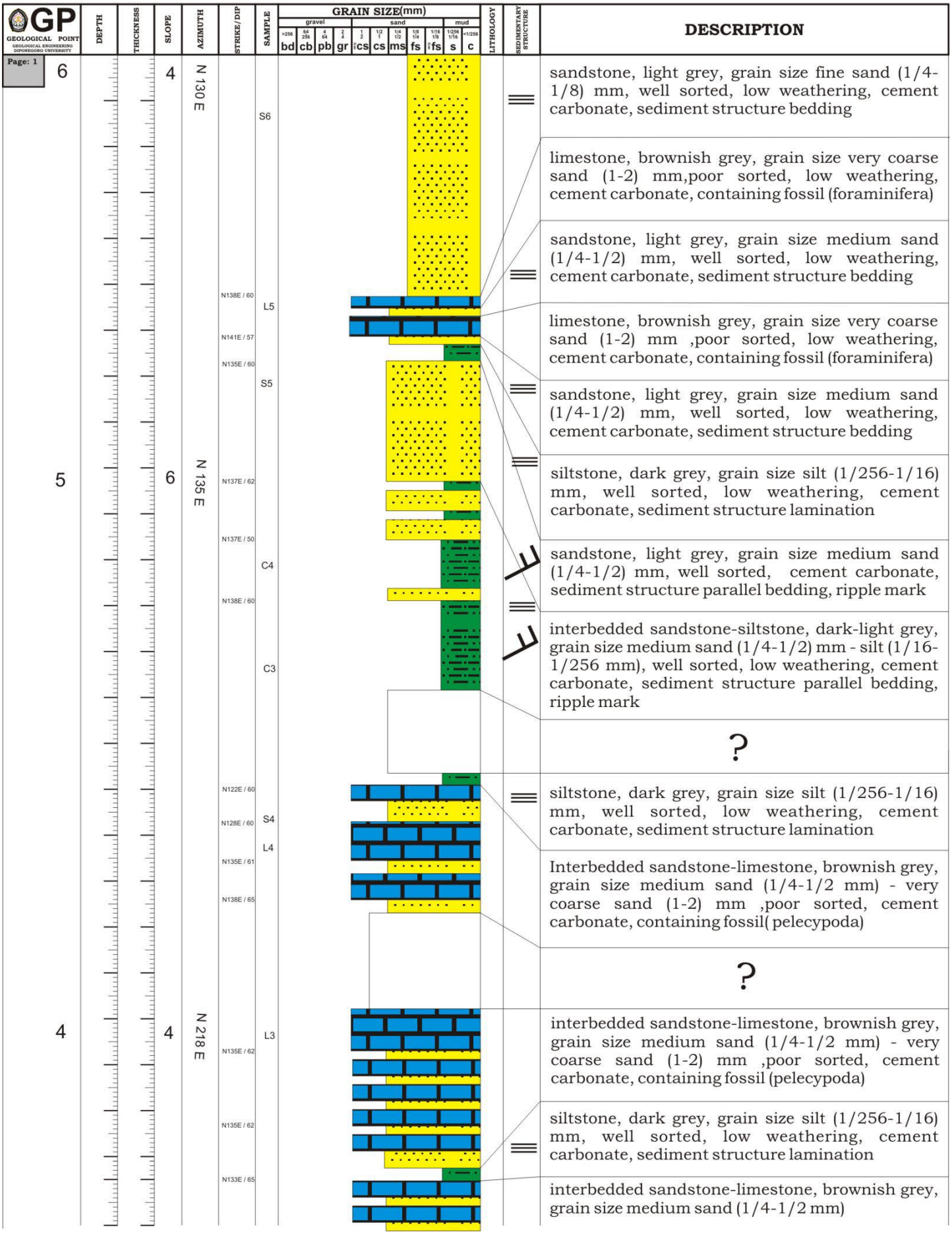


Figure 2. *Sedimentological description of Kali Banyumeneng outcrop (to be continued to the next page).*

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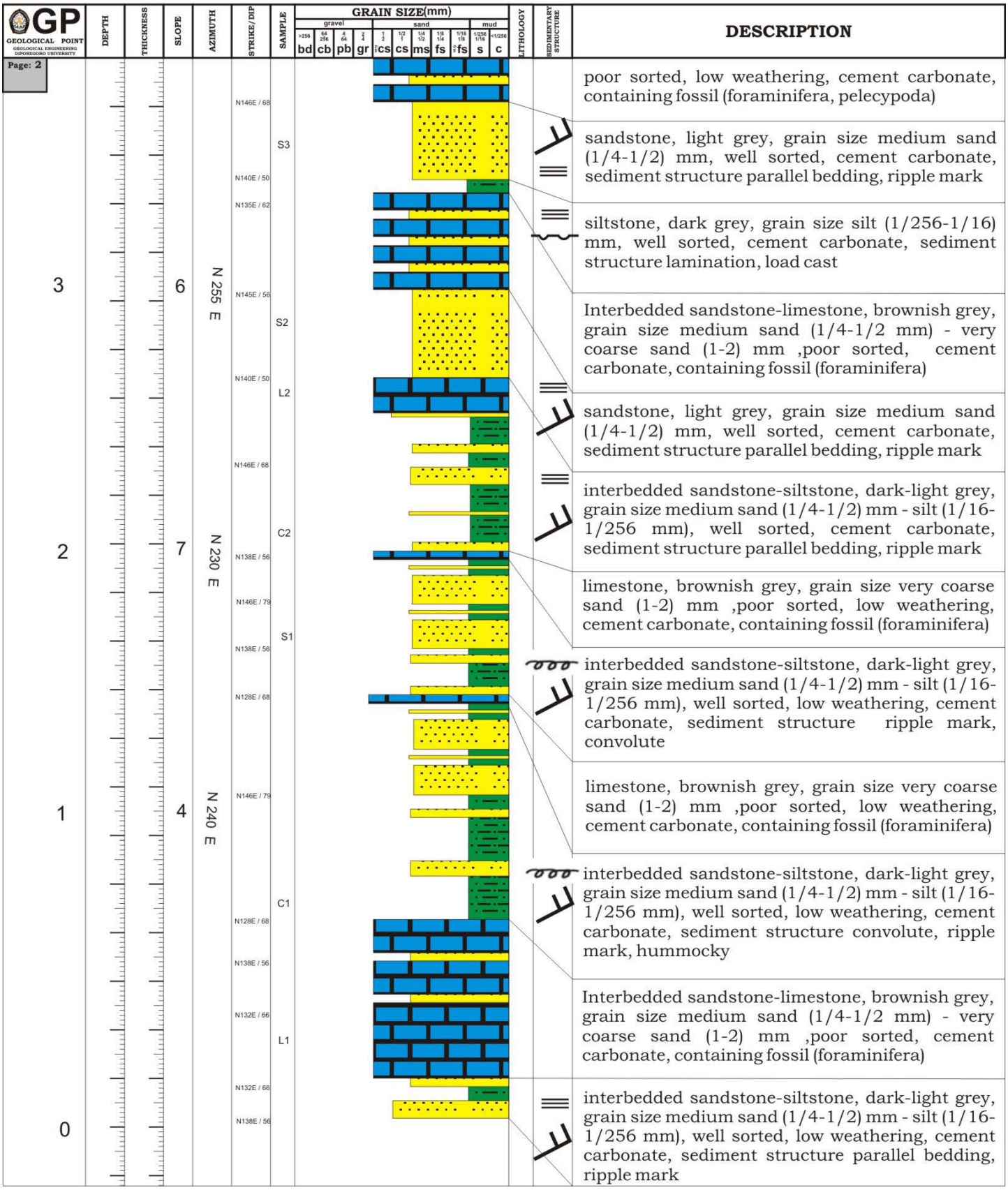


Figure 2. *Sedimentological description of Kali Banyumeneng outcrop.*

RESULTS

From the results of the 100 meter section measurement, it can be seen that the constituent lithologies are sandstones, limestones, and siltstones (Figures 2 & 3). Sandstones in this area are bright brown in color, with layering structure, and fine to medium in grain size, well sorted and calcareous. The limestone is characterized by gray colour, laminated structure, with coarser grain, poorly sorted, and composed of *Pelecypoda* macrofossil as well as foraminifera fossils. The siltstones in this outcrop are characterized by grayish brown color, no-sedimentary structure, with a silty grain size, well sorted and calcareous.



Figure 3. *Interbedded of limestones and sandstones. Bed thickness increases towards the upstream direction.*

The sedimentary structures observed in the Kali Banyumeneng area include bedding, lamination, cross stratification, convolute, load casts, hummocky and ripple marks found on sandstones (Figure 4). Hydrodynamic sedimentary structures are indication of gravitational flow (Boggs, 1987). In addition, the hummocky cross-stratification indicate that the sequence was deposited under storm influence. Mudcracks and rainmarks are also visible in younger sediments probably of Quaternary age.

ANALYSIS

Based on our field observation, the Banyumeneng outcrops are interpreted as having deposited in shallow marine to deep water settings. This is indicated by the presence of sedimentary structures exposed on the ground in the form of convolute (identifier slope areas) and the presence of *Pelecypoda*, which usually lives in shallow marine setting. Other indications include sedimentary structures such as hummocky cross-stratification that developed in the area, which have been described above.

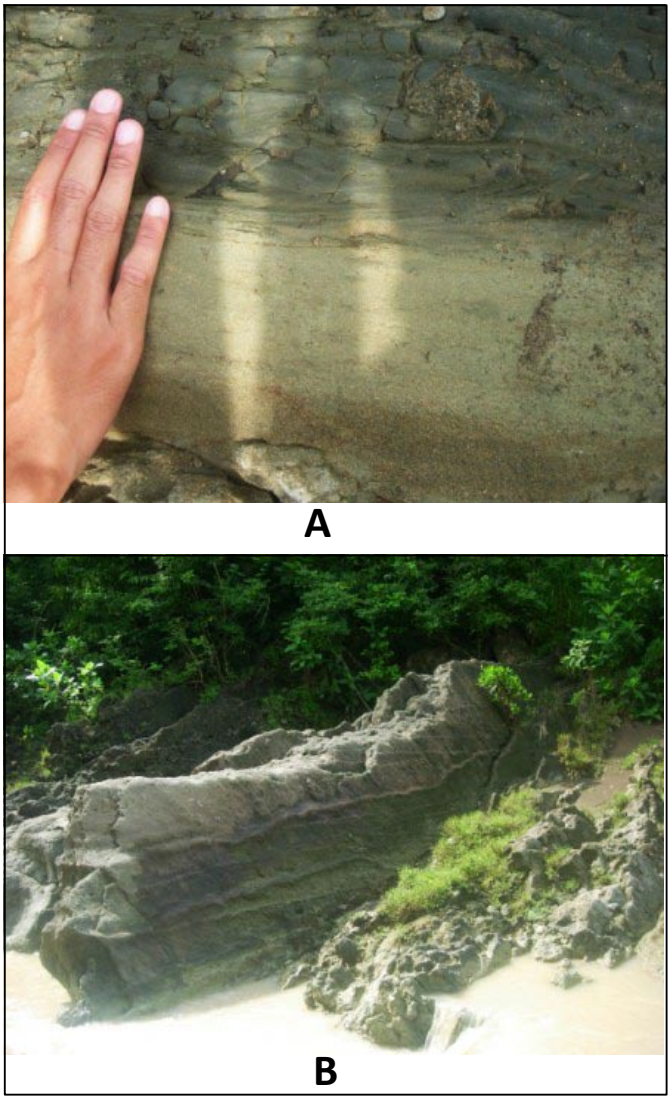


Figure 4. *Sedimentary structures in sandstone, (A) parallel bedding and (B) ripple marks.*

We have also identified the following foraminifera species from the outcrops: *Globigerinoides immaturus, Globigerina venezuelana, Hastigerina acquilezeralis, Globigerinoides sicanus, Globigerina obligus, Globorotalia multicamerata, Globigerinoides ruber, Globigerinoides diminutus, Globigerinoides trilobus, Globorotalia obesa, Cassigerinella chipolensis, Globigerinoides primodius and Praerbulina glomerosa*. These assemblages of foraminifera species indicate sediments of most likely Middle Miocene age.

REFERENCES

Boggs, Sam Jr., 1987, Principles of Sedimentology and Stratigraphy: Merrill Publishing Company, Columbia.

Staff Asisten Sedimentologi dan Stratigrafi, 2011, Panduan Praktikum Sedimentologi dan Stratigrafi: Teknik Geologi UNDIP, Semarang.

Van Bemmelen, R., 1949, The Geology of Indonesia Volume 1A: Government Printing Office, The Hague, Netherlands.