

Indonesian Stratigraphic Lexicon: past, present, and future

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ABSTRACT

The Stratigraphic Lexicon is an important source of regional geological information. Due to the development of the science and the geological understanding, the lexicon needs to be updated. Following the first Indonesian Stratigraphic Lexicon by Marks (1957), Harahap et al. (2003) made an update to the lexicon. The latter version was later published online as a website. A GIS format of the lexicon will soon be available for geoscientists to use. This paper also provides suggestions for improving the lexicon, which includes the preparation of logs type for each section. A systematic approach to periodically ever greening the lexicon is necessary. The Geological Survey of Indonesia and the Indonesian Association of Geologists should be involved in the future improvement of the lexicon.

Keywords: *stratigraphic lexicon, Indonesian stratigraphy*

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INTRODUCTION

The stratigraphic lexicon is an important document to geoscientists since it has become a preliminary guidebook to understand the geology of a certain area. The lexicon is helpful in showing all the existing lithostratigraphic terminologies of a respective area. The lexicon contains the name of the formations, the type localities, a brief description of the lithology, age of the formation including the index fossils and references.

In Indonesia, the stratigraphic lexicon was initially published by Marks (1957) and was updated by Harahap et al. (2003). The Indonesian Stratigraphic Lexicon contains information on the lithostratigraphic units, either formal or informal, in the following aspects: names, age, nomenclature, type locality, description, fossil content, thickness, distribution, depositional environment, tectonic setting, economic aspect, remark, boundaries with the underlying and overlying Formations, and related references. In some cases, the lexicon also describes the lateral relationship with the other Formations. Therefore, it is important to update the stratigraphic lexicon.

PAST

The first Stratigraphic Lexicon was compiled by Marks (1957) with 146 type locations. This publication described the lithological composition of the Formations, including the identified fossils. It includes the references, type locality, and geographical distribution. The ages were stated for most of the Formations. Some

Formations had more description than others. An atlas of the lexicon was published in 1961. It consists of 116 geological maps indicating the locations of various rock units that is subdivided into Groups, Formations, Members, Beds, and Layers, as detailed in P. Marks (1957). It also includes almost all regions in Indonesia with age range from Carboniferous (Paleozoic) found in Sumatra to the youngest Pleistocene in Java. These publications are available as paper copies with hard covers (Figure 1).

Since the outset of the PELITA 1 (the first Five-Year Development Program) in 1969, various geological research activities were carried out by governmental institutions (either with or without the support of foreign institutions), mining companies, petroleum companies, academicians, and individual earth scientists. This has brought a fast-growing accumulation of new geological information in Indonesia, including stratigraphic nomenclatures and concepts. Therefore, with these developments, the lexicon of Marks (1957) has been left far behind and an update was made.

The Center for Geological Survey, Indonesian Geological Agency updated the lexicon in 2003 (Harahap et al., 2003) and reported 1,856 lithostratigraphic units. This number was more than 10 times larger than the publication of Marks (1957). Compared to the first publication, Harahap et al. (2003) covered wider study areas, as the access to the interior had improved significantly. This great number of lithostratigraphic units might be caused by the complexity of the geology of the region. It might also be explained by the occurrences of synonymy of the same

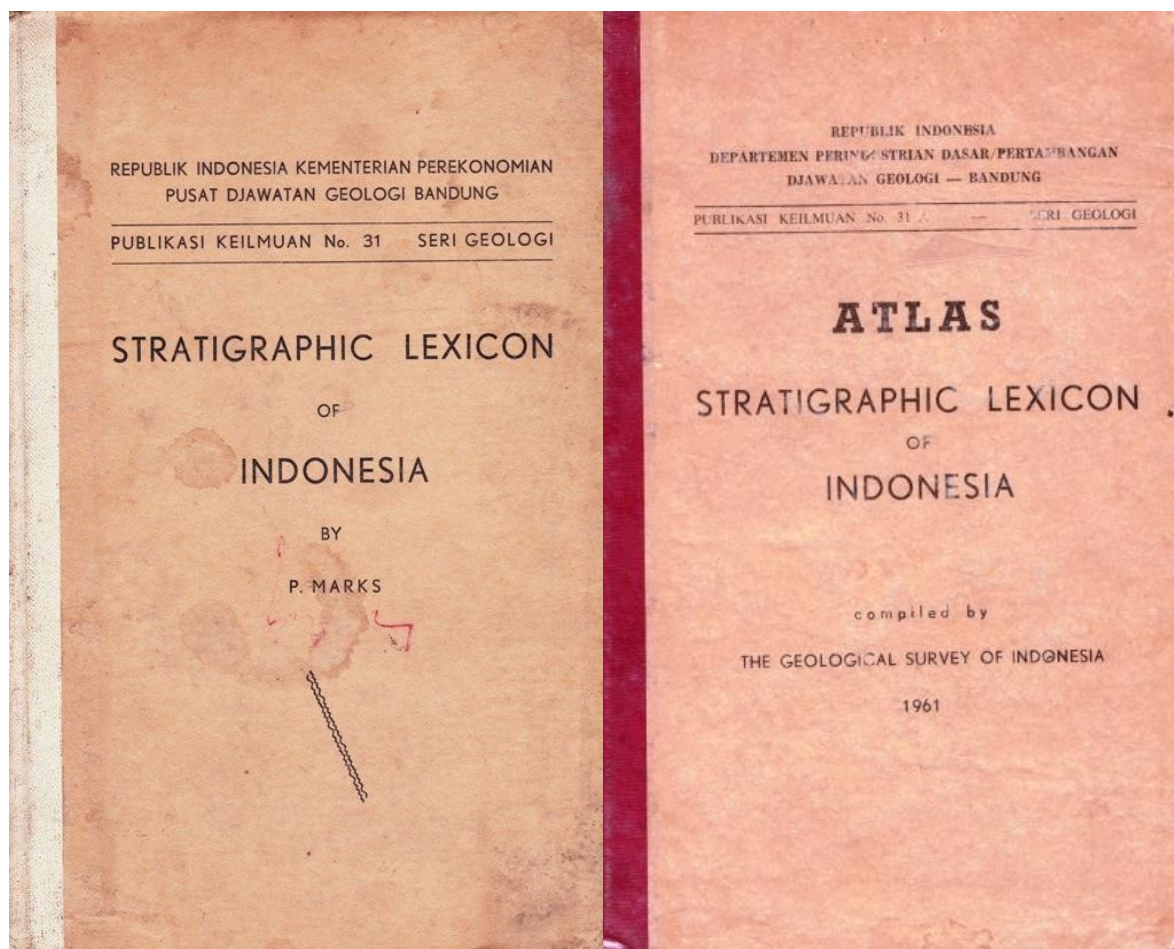


Figure 1: The cover of the first stratigraphic lexicon, published by P. Marks in 1957 (left) and the atlas (right), published in 1961.

lithostratigraphic units, given rise by different concepts among workers or simply due to their ignorance.

By November 2001, a bound draft of the stratigraphic lexicon of the Eastern of Indonesia entitled “Nomenclature Compilation of the Stratigraphy of the Eastern Indonesian Region” was completed, followed by that of the Western part entitled the “Nomenclature Compilation of the Stratigraphy of the Western Indonesian Region”. The drafts have been exposed for discussions in some meetings, which were held by universities, the Indonesian Association of Geologists (IAGI), and the Center for Geological

Survey. During such meetings, invaluable comments, suggestions, and criticisms were obtained. In 2003, Harahap et al. (2003) completed the second stratigraphic lexicon. The main source of this lexicon was the 239 systematic geological maps produced by the Center for Geological Survey (formerly Geological Research and Development Center/GRDC), covering Jawa and Madura Islands at a scale of 1:100.000 and other regions at a scale of 1:250.000.

PRESENT

The Indonesian Stratigraphic Lexicon is now available on the website

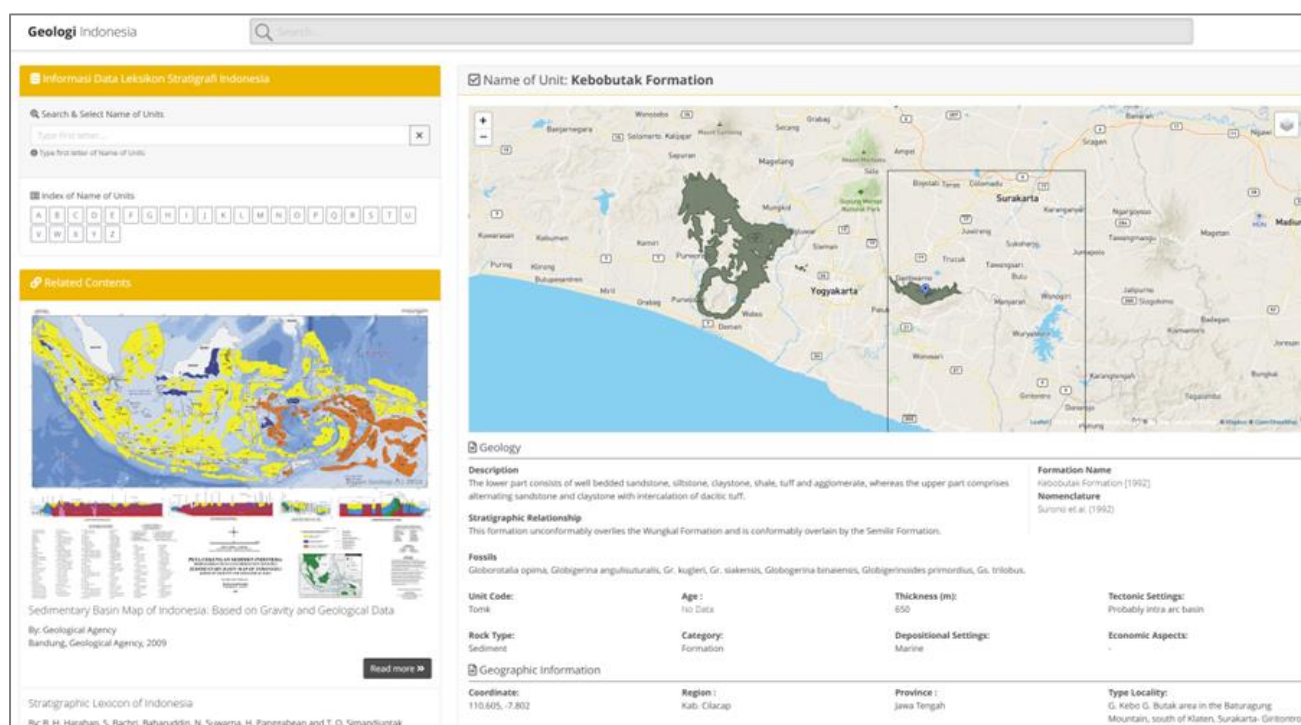


Figure 2: A display of the web-based stratigraphic lexicon of Indonesia, published by the Geological Survey of Indonesia

(<https://geologi.esdm.go.id/geolindo/lexicon/index>). Users can simply type the name of the formation and the distribution map, age, thickness, rock type, depositional and tectonic setting, economic aspects, and the index fossil will appear. The map on the website is interactive, as the user can retrieve the source of the formation information (Figure 2).

INDOGEO Social Enterprise has recently completed a GIS (Geographic Information System) layer of stratigraphic location types, which is downloadable from their website (www.indogeo.org) in the first quarter of 2024. Figure 3 shows a comparison of digitised type locations in Marks (1957) and Harahap et al. (2003). The shape file provided will also have a hyperlink to connect to the web-based lexicon mentioned in the previous paragraph. During the shapefile/GIS layer preparation, some problems were exposed,

and they were documented in the attribute of the GIS shape file.

With GIS, users can overlay the stratigraphic location types with geological maps, topographic maps, satellite images, etc. This will be very useful for detailed geological studies. Figure 4 shows an example of how the type locations are overlaid on top of the geological map and depicts the attribute of the GIS layer. If there is a problem, such as a website broken link or error, or typo error in the lexicon, a note will be provided in the remark's column.

FUTURE

Each formation is described well in the lexicon with some information on the type location (Marks, 1957; Harahap et al., 2003). This study proposes that the development of a web-based lexicon and

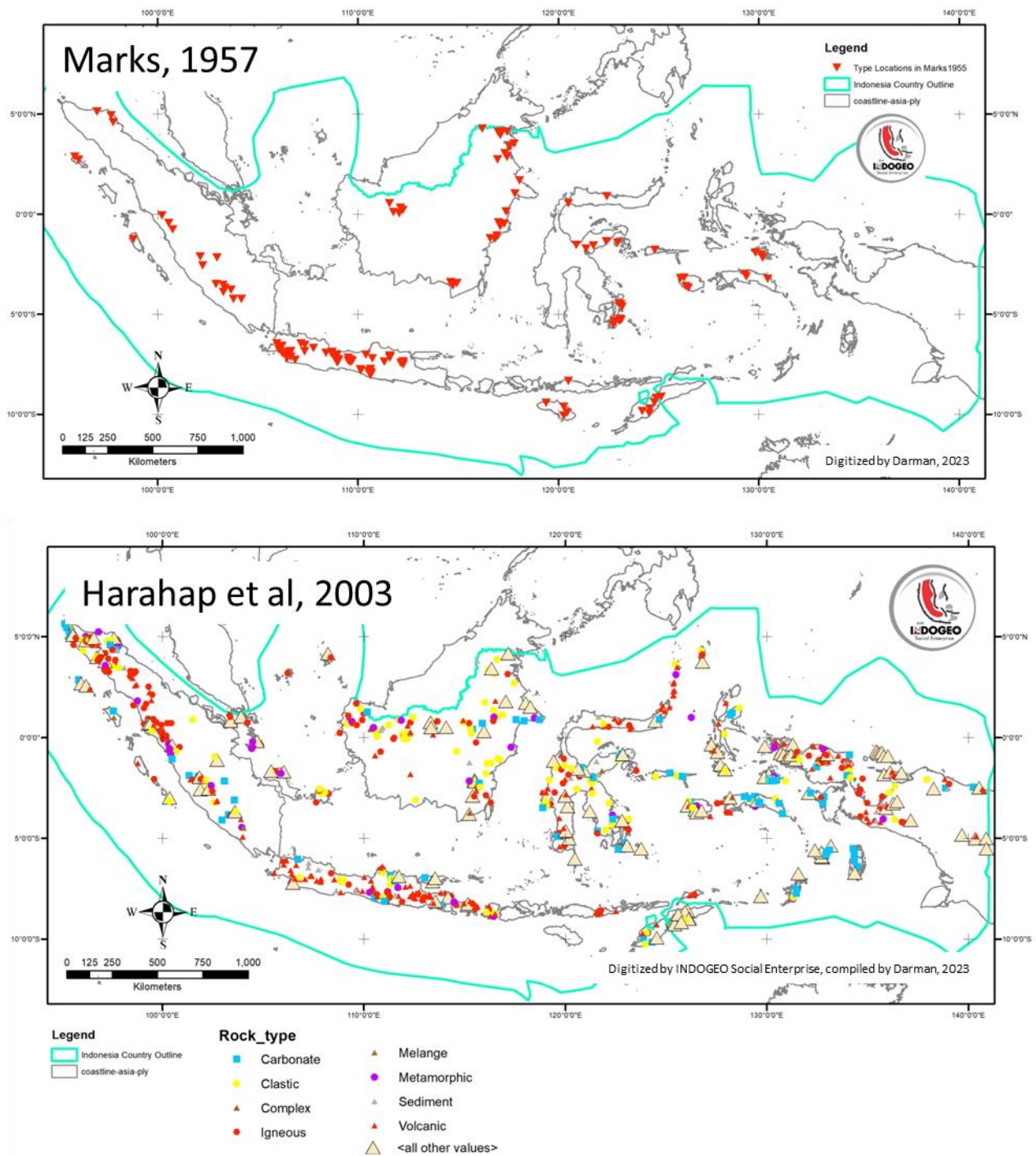


Figure 3: Distribution map of type locations documented in Marks, 1957 (146 locations, above) and in Harahap et al. (2003) [1856 units, 829 locations]. Both are digitised by INDOGEO Social Enterprise.

GIS-based digitation of type locations should be followed by the documentation of stratigraphic sections of the type locations, or stratotypes. The stratotypes

may originate from outcrop and subsurface studies.

As an example, in 1988, IUGS-UNESCO published Triassic outcrop sections in the

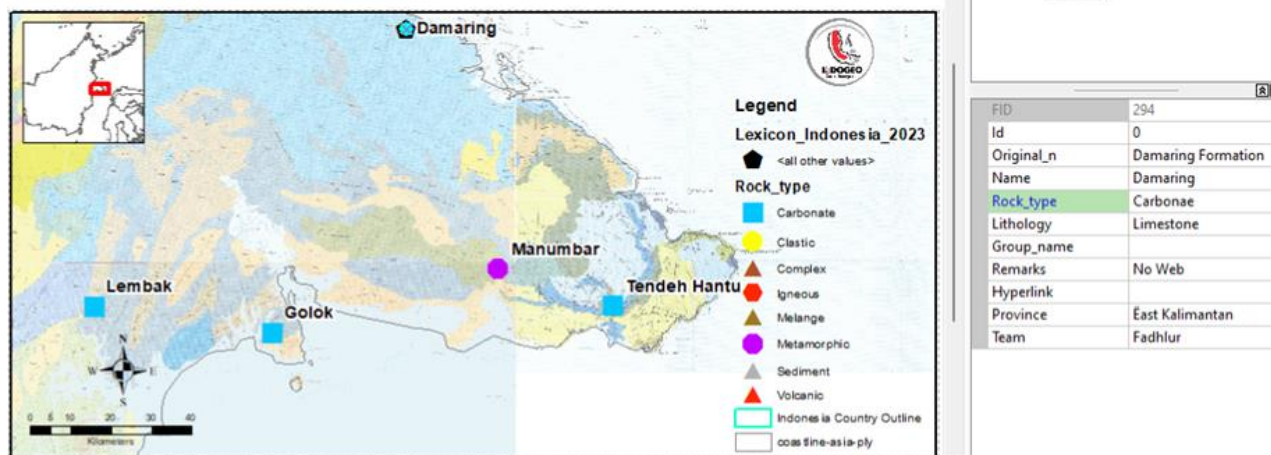


Figure 4: An example of the GIS display of the location type data in Mangkalihat Peninsula, East Kalimantan. A 1:250,000 scale geological map is displayed as a backdrop of the type of location map (left) and the attribute table of each location (right). Note that Damaring Formation in the north of the map only occur in *Lexicon Map of Harahap et al. (2003)*, but no description in the text.

Asia Pacific region. The report included 5 stratotypes published from Timor Leste, which was part of Indonesia at that time. These sections were drawn using a standard legend (Figure 5). The legend will help in maintaining the consistency of different researchers or geoscientists who are reporting the stratotype. Additional outcrop pictures will make it better.

Collaboration between IAGI and the universities, as well as the research institutes and agencies, should be able to provide consistent stratotypes across Indonesia. These stratotypes are important to be documented because they do not last forever, as rapid development in Indonesia may destroy the original stratotypes.

Maintenance of the web-based lexicon is important to be conducted in the future. As mentioned earlier, the web-based lexicon contained errors, which were noted in the GIS layer. The web-based lexicon needs to have a contact person since it is important

to collect feedback from users for improving the website.

The type locations should be available to the geoscientists who work in the field. With the geographic information, the type locations could be displayed in hand-held instruments (e.g. Through Gear-ID, <https://gearid-geo.com/>).

CONCLUSION

As a matter of course, the present edition of the lexicon is beyond perfection and, therefore, one may find it unsatisfactory to their need. Issues on the lexicon that need improvements include inconsistencies, synonymies, lack of proper information, and unavoidable mistakes. They should be dealt with in the future edition. For this, further suggestions, criticisms, and contributions from those who are involved in the stratigraphy of Indonesia are required.

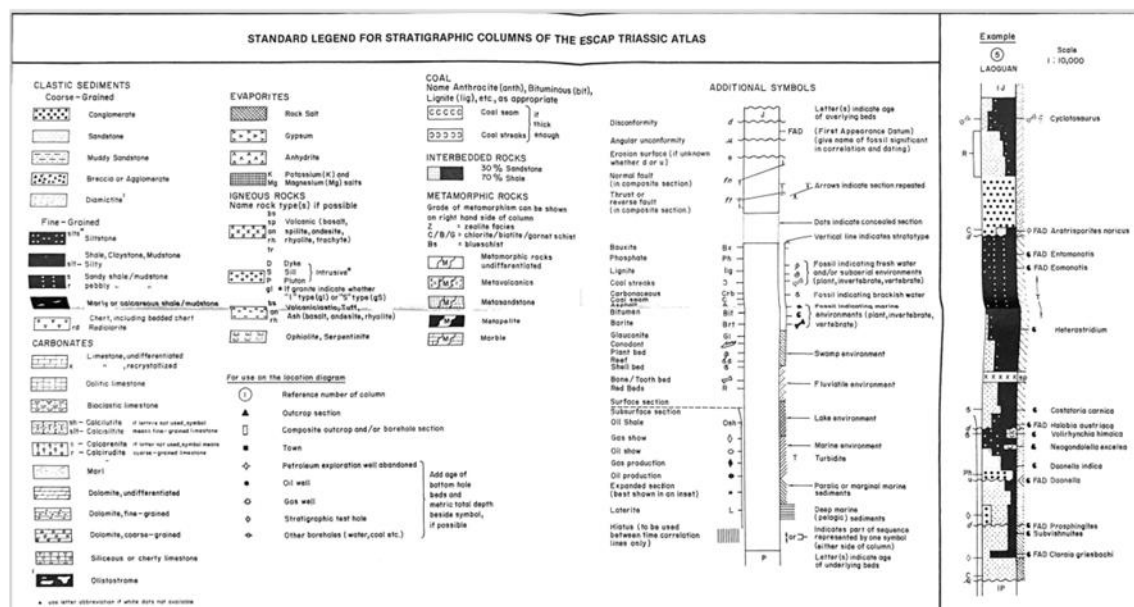
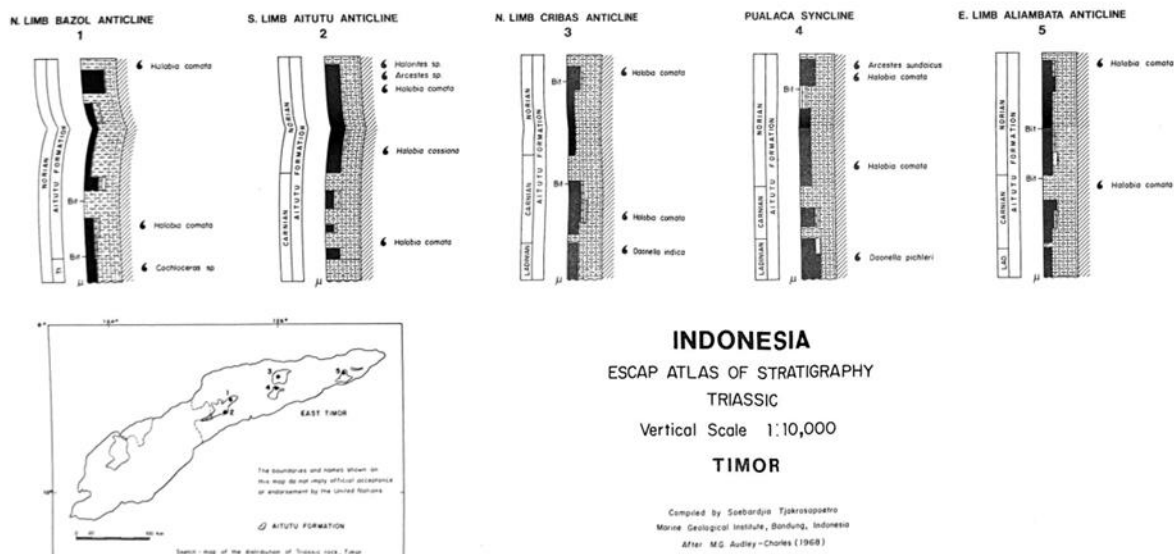


Figure 5: Type logs or stratotypes of several Triassic type locations in Timor Leste (was registered as Indonesia, in 1988 IUGS-UNESCO report, above). The logs in the report used a standard legend (below) to maintain the consistency of all sections in the report.

The lexicon needs systematic updates and improvement. Currently, it is handled by the Geological Survey of Indonesia which is limited in terms of budget and resources. The Indonesian Association of Geologists (IAGI) could organize some support by organizing scientific discussions during their annual meeting or other special events and facilitating discussions among

their members. Regular meetings, such as sessions in PIT-IAGI (Pertemuan Ilmiah Tahunan or Annual Scientific Meeting of IAGI) are probably a good forum to discuss the stratigraphy of Indonesia.

The universities in Indonesia could contribute by providing type logs from their studied area. They were supposed to

publish type logs of their research areas using a common type log template and published them.

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