Short Communication: No Jurassic Sediments on Sumba Island?

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Introduction and Summary

Roggeveen (1929) described a small ammonite fragment from SW Sumba Island, provisionally identified as a Middle Jurassic species. It is associated with *Inoceramus*-type bivalves. The presence of Jurassic age sediments within the intensely deformed Mesozoic section of Sumba was accepted by some authors (e.g. Van Bemmelen, 1949; Nishimura et al., 1981) and this presence of Jurassic ammonites and bivalves was used to support the presence of Australian continental basement crust on Sumba and South Sulawesi (Hall, 2011; 2012).

However, subsequent workers on the geology of Sumba have been unable to find additional fossil evidence for the presence of Jurassic sediments on Sumba; the oldest rocks that could be reliably dated are of Late Cretaceous age.

Three ammonite specialists were consulted to check the identification of the ammonite illustrated from Sumba by Roggeveen (1929). They concluded that the fragment could not be reliably identified and could well be a Cretaceous species, and also suggested that the associated *Inoceramus* looked like Cretaceous species. There is therefore no reliable evidence for the presence of any rocks older than Late Cretaceous on Sumba, and it remains to be demonstrated whether basement of Sumba contains any Australia-derived continental material.

Plate Tectonic Setting of Sumba

The origin of Sumba island as a detached terrane from SE Sundaland (or a fragment of the Late Cretaceous–Paleogene 'Great Indonesian Volcanic Arc System' near the margin of SE Sundaland) has been accepted by most authors since Hamilton (1979) (Djumhana & Rumlan, 1992; Simandjuntak, 1993; Wensink, 1994; 1997; Soeria-Atmadja et al., 1998; Abdullah et al., 2000; Rutherford et al., 2001; Satyana, 2003; Harris, 2006; Prasetyadi et al., 2006; Satyana and Purwaningsih, 2011; and Hall, 2011; 2012).

For details on the similarities between the Cretaceous–Miocene stratigraphy of Sumba and SW Sulawesi (both with extensive evidence of Late Cretaceous and Paleogene arc volcanism), see the comprehensive review of Sumba Island by Satyana and Purwaningsih (2011). For detailed reference lists see Van Gorsel (2012).

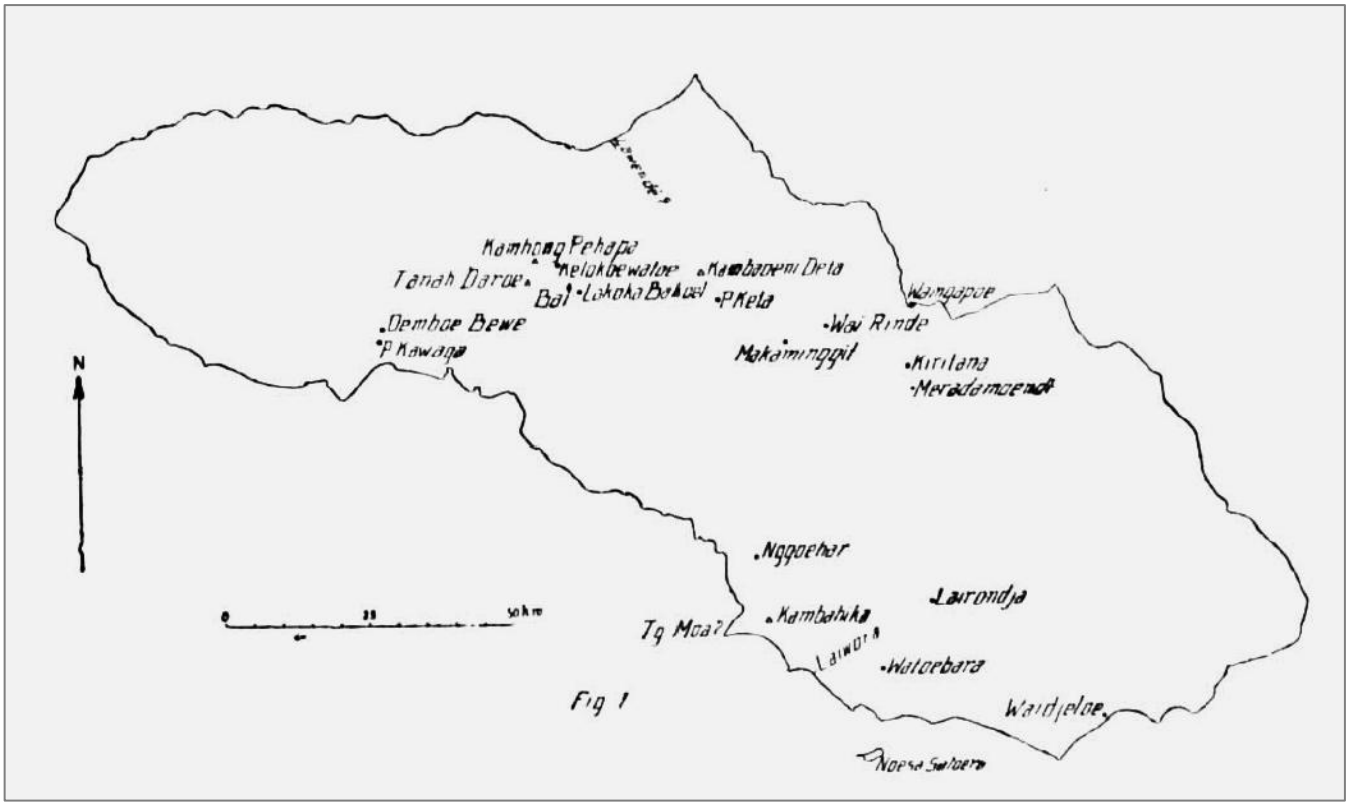


Figure 1. *Map of localities visited by Witkamp, showing Oemboe Bewe village in SW Sumba (from Roggeveen, 1932)*

Pre-Tertiary Geology of Sumba

The Pre-Tertiary section of Sumba is represented by dark grey, intensely folded, mostly unfossiliferous 'flysch-type' clastic sediments with tuffs and volcanic agglomerates, named Lasipu Formation by Prasetyo (1981, in Von der Borch et al., 1983). There is widespread contact metamorphism around Late Cretaceous–Paleocene granite intrusions. They are unconformably overlain by relatively little-deformed Middle–Late Eocene shallow marine limestones and Miocene limestones, clastics and volcanics.

Burollet and Salle (1982), Von der Borch et al. (1983) and Effendi and Arpandi (1994) recognized these oldest beds on Sumba as submarine fan deposits, with principal fossils Late Cretaceous planktonic foraminifera and bivalve mollusks.

Jurassic- or Cretaceous-age of Macrofossils?

Roggeveen (1929) illustrated a small ammonite fragment, collected by Witkamp in 1910 from Oembu Bewe village near the south coast of West Sumba Island (Figures 1 and 2). It is associated with *Inoceramus*-type bivalves and fragments of shark teeth. In the opinion of Kruizinga it was "not quite impossible that it is a young *Hammatoceras molukkanum"*, a species described by him from the Middle Jurassic of the Sula Islands in 1926. Roggeveen added that "considering the very fragmentary character…and the fact that the resemblance is not complete it is advisable not to give a specific determination".

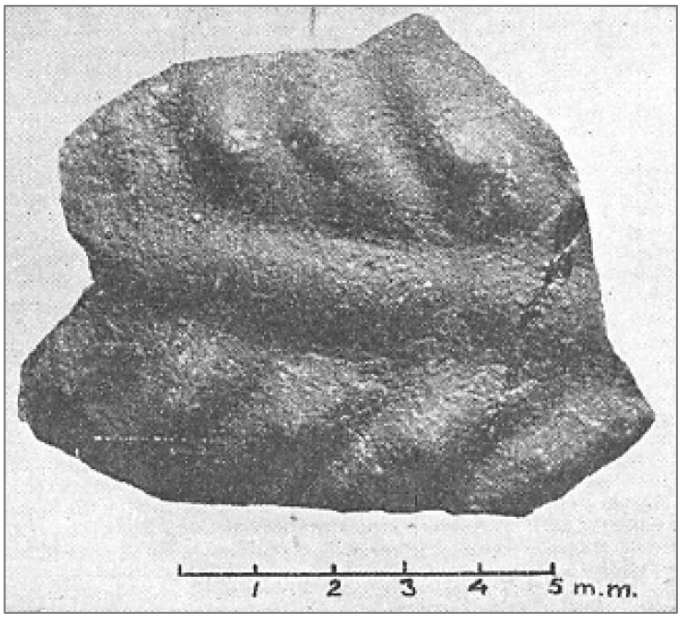


Figure 2. *Fragment of ammonite from SW Sumba, provisionally identified as Jurassic Hammatoceras molukkanum by Roggeveen (1929)*

Wanner (1931) described he had the opportunity to examine Roggeveen's ammonite fragment at the University of Utrecht. In his opinion the fragment is indeterminate, and looked more like a *Harpoceras* (also of Jurassic age).

Three ammonite specialists were consulted in July 2011 to check the identification and age interpretation of the Roggeveen (1929) ammonite from Sumba. They concluded that the fragment could not be reliably identified, and could also be a Cretaceous species:

- Dr. Jack Grant-Mackie (University of Auckland): "Roggeveen's illustration is most unlikely to be of *Hammatoceras*, which has a more compressed ventral area with a sub-triangular whorl section, not the broad venter shown in the photo. And there are Cretaceous genera with this type of venter";
- Dr. Fauzie Hasibuan (Geological Survey, Bandung): "small fragment of Ammonite is too small to be certain";
- Dr. Christian Meister (Natural History Museum, Geneva): "ventral area could correspond to a *Hammatoceras* s.l. but it also could be a part of a Cretaceous ammonite, like for example a *Mortoniceras*".

The associated *Inoceramus* described by Roggeveen (1929) (Figure 3) was believed to be an Upper Cretaceous species by its collector Witkamp. It also looks more like a Cretaceous species, possibly *Inoceramus everesti* or *Inoceramus carsoni*, to F. Hasibuan and J. Grant-Mackie (pers. comm., July 2011).

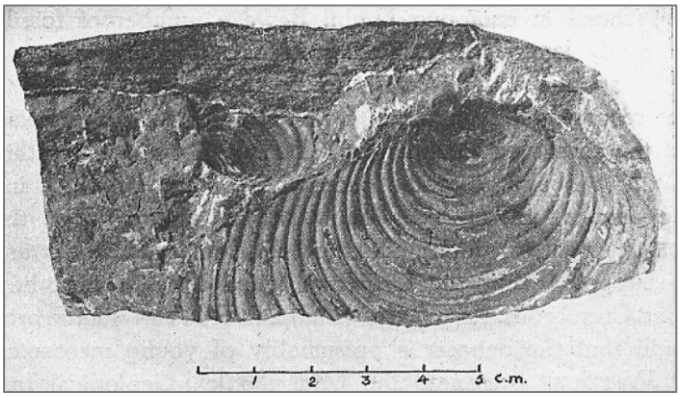


Figure 3. *Inoceramus bivalves from SW Sumba (Roggeveen, 1929)*

Kauffman (in Von der Borch et al., 1983) reported additional bivalve genera from the Cretaceous sediments of Sumba, including *Inoceramus*. He noted the tropical, Tethyan nature of the fauna, but offered no more precise age interpretations.

Conclusion

The presence of Jurassic sediments on Sumba Island has not been proven: (1) the 'Jurassic' ammonite fragment cannot be reliably identified and may well be a Cretaceous species; (2) associated *Inoceramus* suggest a more likely Cretaceous age and (3) all micropaleontological analyses of the Pre-Tertiary of Sumba by subsequent workers only yielded Late Cretaceous microfaunas. There is therefore no reliable evidence for the presence of any rocks older than Late Cretaceous in outcrops on Sumba.

Sumba is frequently viewed as a microcontinental fragment, but whether Sumba basement contains any Australia-derived continental material remains to be demonstrated. It may have simply originated as part of the Cretaceous accretionary melange/ volcanic arc complex along the SE Sundaland margin, called the 'Great Indonesian Arc' (Abdullah et al., 2000; Lytwyn et al., 2012, Rutherford et al., 2001; Harris, 2006; 2011).

The Mesozoic succession outcropping on Sumba may be entirely correlative to the Upper Cretaceous flysch-type successions of the Balangbaru and Malawa Formations of SW Sulawesi, which happens to be another area with a similar 'rumor' of Jurassic ammonites. Sukamto (1986) and Sukamto and Westermann (1992) reported the presence of Early Jurassic ammonites (*Funiceras*) in the 'Paremba Sandstone' of South Sulawesi. Descriptions of these ammonites were never published and the expert credited with identification in 1979 has no recollection of studying these (J. Grant-Mackie, pers. comm. July 2011). Here too, the presence of Jurassic ammonites has been used to support the presence of (Australian) continental crust, but real evidence of such continental basement in SW Sulawesi is still elusive.

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