

## Action Plan SCUFN34/VTC03/33. By M.-F Lequentrec-Lalancette

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## 1- Introduction

Given the existence of names such as Luzon Plateau (GEBCO Gazetteer), Benham Rise (scientific literature), and Philippine Rise (Philippine government and scientific literature) for an apparently identical entity, the almost identical size of the proposed entity and Luzon Plateau, and the complexity of the region, Apolaki CALDERA's proposal is kept as pending to allow more time for SCUFN members to define the appropriate way forward. To answer the questions of SCUFN, the paper is divided in two parts: the first on the analyses of arguments, and the second to recommendations. Ref 1 and Ref 2 are:

**Ref 1:** Jenny Barretto, Ray Wood, John Milsom, 2020, Benham Rise unveiled: Morphology and structure of an Eocene large igneous province in the West Philippine Basin, *Marine Geology*, Volume 419, 2020, 106052, ISSN 0025-3227, <https://doi.org/10.1016/j.margeo.2019.106052>  
<https://www.sciencedirect.com/science/article/pii/S0025322719300684>)

**Ref 2:** Commission on the Limits of the Continental Shelf, 2012. Recommendations of the Commission on the Limits of the Continental Shelf in Regard to the Submission Made by the Philippines in Respect of the Benham Rise Region on 8 April 2009.  
[http://www.un.org/depts/los/clcs\\_new/submissions\\_files/phl22\\_09/phl\\_rec.pdf](http://www.un.org/depts/los/clcs_new/submissions_files/phl22_09/phl_rec.pdf).

## 2 - Ref 1 Analysis

The analysis is based first on the most recent paper on the region from Barreto et al., 2020. This article synthesizes the geodynamics of the region and its relationship with the mapped morphology. In support of the hypotheses and therefore of the proposed toponymy of **Apolaki Caldera**, the authors describe and interpret all the available geophysical data (seismic, gravity, magnetics, scientific ocean drilling, etc.). From the abstract :“Multibeam bathymetry with nearly 100% coverage revealed the morphology of the Benham Rise for the first time. It consists of a main body (~310 km by 330 km) with the Narra, Loro, and Molave spurs extending 100-200 km on its eastern side. It is built on a shield platform from ~5200 m to ~3800 m below the sea. The flanks of the platform consist of terraces 3-15 km wide with escarpments 100-300 m high. The platform is topped by a ridge with caldera morphology at an average depth of 2500 m. The ridge is called Caldera Apolaki and may be the largest known

caldera in the world with a diameter of 150 km. Features such as a broken rim, intra-caldera benches, and a resurgent dome indicate a multiphase volcanic history composed of quiet and explosive eruptions.“ Figures 1 and 2 (Barretto et al's Figures 1 and 11) illustrate the tectonic setting and detailed morphostructural characteristics of the Apolaki caldera, respectively.

Several arguments developed in this article support this hypothesis: the morphology including a significant ridge (600 to 800m above the platform with steep flanks of 2° to 7°), and in intra-caldera several levels suggesting collapse of the terrestrial and planar shields near the calderas. Moreover, stages of post-caldera and late stage volcanism are highlighted (seamounts, ridges formed by ring dykes, dome shape, and steep flanks etc.). The magma chamber would be of the same size as the caldera (150 km). The morphology as well as the thickness of the crust confirm previous studies implying a volcanic origin resulting from interactions between a hot-spot and oceanic rift. Moreover, comparisons made by the authors between the morphology of this area and comparable caldera morphologies such as Mount Olympus on Mars or Kilauea show strong similarities. The authors formulate a model of tectonic evolution of the Benham Rise with the following three major stages: caldera construction, collapse, and post-caldera volcanism (see Fig 3).

Several recommendations in the conclusions include the need for further observations to understand the processes at the formation of Benham Rise as a large igneous province defined in the revised definition of the limits of continental shelf (ref 2), as well as the impact of caldera (from 45 Ma to 26 Ma of Fig3) on the Eocene and Oligocene local and regional environment. **The caldera hypothesis on the other hand is supported by geological, geophysical, and geochemical studies of the region.**

Figure 1 shows the major structures and the slopes on two profiles (A-A' and B-B')

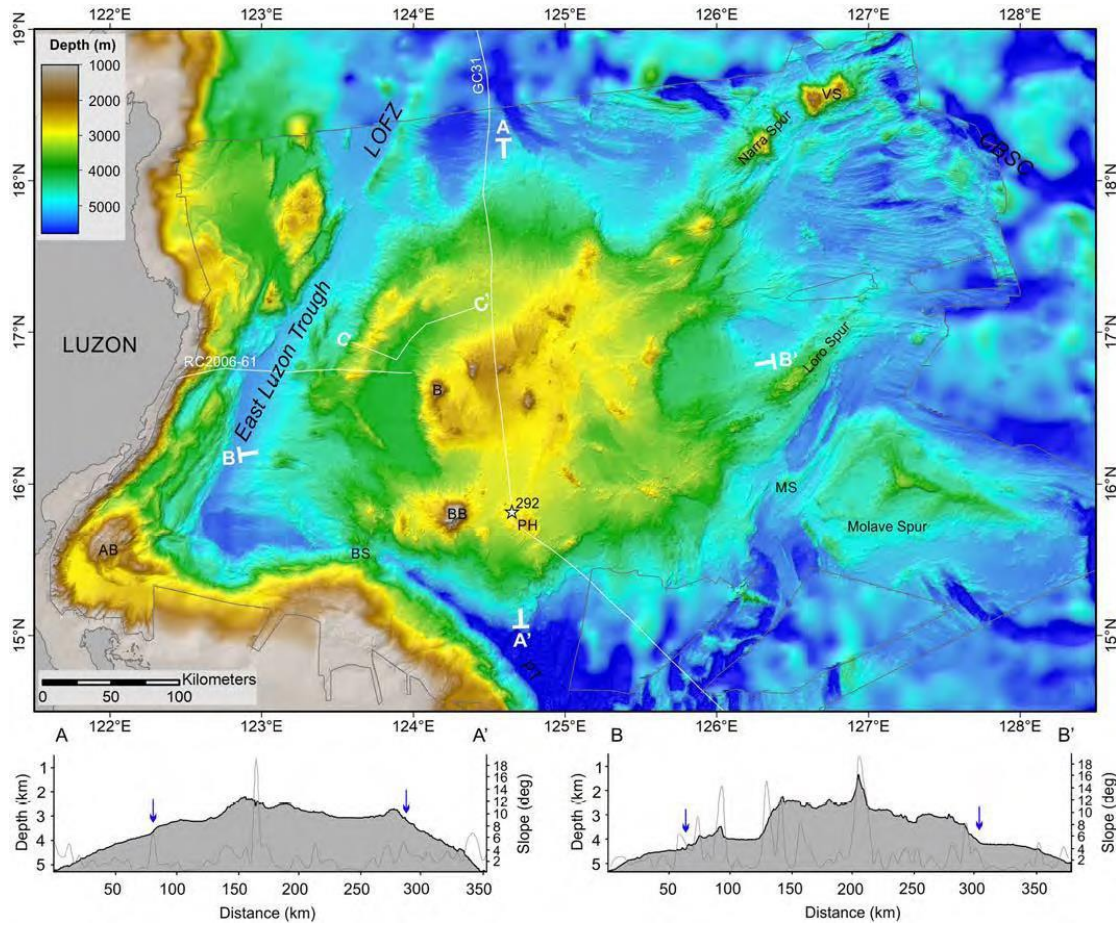
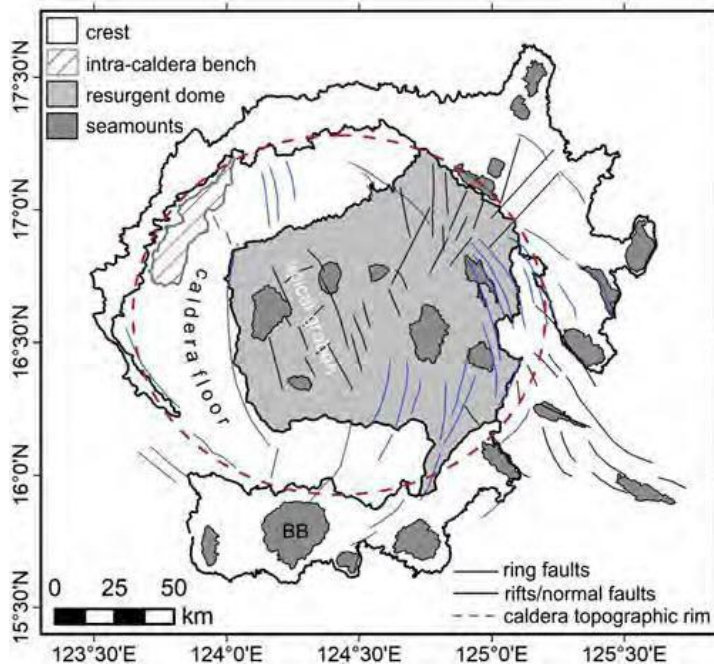


Fig 2: Morphostructural characteristics of the Apolaki caldera outlined in red . BB = Benham Bank:



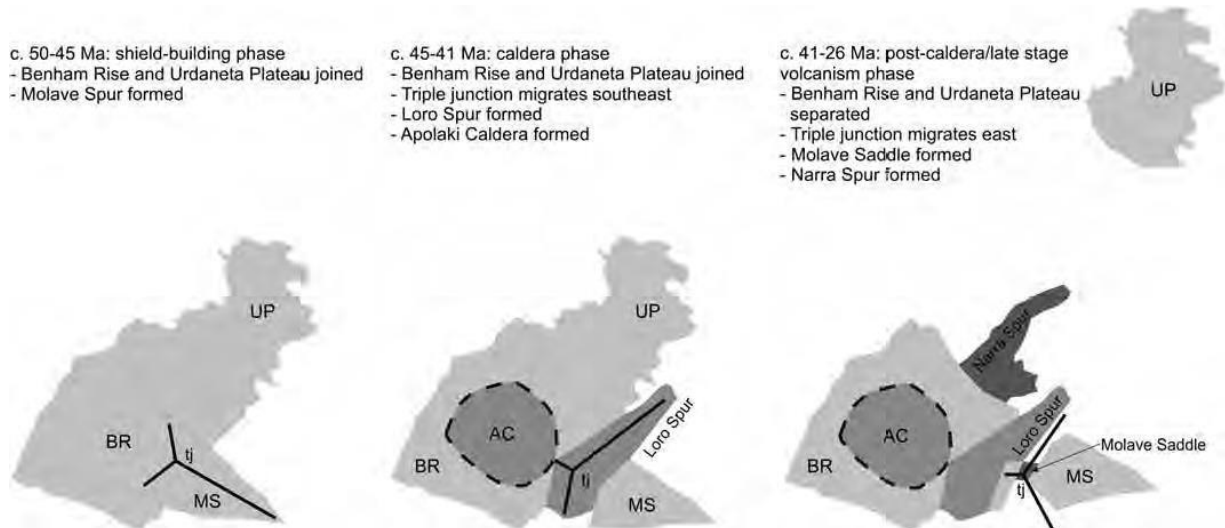


Figure 3 : History of Benham Rise evolution and caldera creation

### 3 - Ref 2 Analyses

In Ref 2, Philippine proposal and commission's recommended for the limits on continental shelf are described and also the approval of the limits including Benham Rise and its spurs ;

#### 3. Submerged prolongation of the land mass and entitlement to the continental shelf beyond 200 M

- 7 The Philippine islands, including Luzon, constitute the land mass in the region. The Benham Rise and its subsidiaries, the Molave and Narra spurs, form a composite morphological feature that constitutes the submarine prolongation of that land mass by way of the FOS envelope.
- 8 The outer edge of the continental margin, established from the FOS of the Benham Rise Region by applying the provisions of article 76, paragraph 4, of the Convention, extends beyond the 200 M limits of the Philippines. On this basis, the Commission recognises the legal entitlement of the Philippines to delineate the outer limits of its continental shelf beyond its 200 M limits in this region.

*From ref 2*

### 4 - Conclusion and Recommendation for SCUFN:

Based on Figure 3 that shows the limits of the proposal caldera, the choice of the generic term Caldera could be approved if SCFUN members agree to accept the arguments in favor of this hypothesis. Ref 1 is a peer reviewed paper demonstrating that the results of the study have generated a consensus within the scientific community for a caldera with a geometry in agreement with the one proposed. If the proposal were to be rejected, then the names in this area published in 2020 would not officially be in use, which would be a significant drawback. I recommend that SCUFN accept the generic term Caldera. The Benham Rise caldera would be the most extensive (150 km) yet described globally, hence the choice of the specific term Apolaki (Giant Lord who is the Philippine mythical God of the sun and war).

