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Bathymetrical features of the Bali-Lombok Strait

by

ANTON F. BRUUN and A. KIILERICH

Precipitation, evaporation and energy exchange at the surface of the
southeast Asian waters

by

KLAUS WYRTKI

The coastal current south of Java

by

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BATHYMETRICAL FEATURES OF THE BALI-LOMBOK STRAIT

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ANTON F. BRUUN and A. KIILERICH

The University of Copenhagen

I. INTRODUCTION

Whenever a biologist thinks about the Bali-Lombok Strait his thoughts turn back to A. R. WALLACE or rather he just starts seeing before himself the Wallace-Line, the all-important boundary between the Oriental and Australian faunal regions.

We may use his own words from one of his later books (WALLACE 1892, p. 4-5) : "In the Malay Archipelago there are two islands, named Bali and Lombok, each about as large as Corsica, and separated by a strait only fifteen miles wide at its narrowest part. Yet these islands differ far more from each other in their birds and quadrupeds than do England and Japan. The birds of the one are extremely unlike those of the other, the difference being such as to strike even the most ordinary observer. Bali has red and green woodpeckers, barbets, weaver-birds, and black-and-white magpie-robins, none of which are found in Lombok, where, however, we find screaming cockatoos and friar-birds, and the strange mound-building megapodes, which are all equally unknown in Bali. Many of the kingfishers, crow-shrikes, and other birds, though of the same general form, are of very distinct species; and though a considerable number of birds are the same in both islands the difference is none the less remarkable as proving that mere distance is one of the least important of the causes which have determined the likeness or unlikeness in the animals of different countries".

But this important discovery was already clear in his mind when he visited Bali and Lombok in 1858 (WALLACE 1908, p. 187). It is not our intention to review the very extensive literature about the Wallace-Line. A general account was given by TWEEDIE (1953), but a few words may be added from MYERS (1951) to emphasize how well the Wallace-Line has stood up against time.

MYERS (1951, p. 13) writes: "South of Makassar Strait, Wallace's Line is not quite so spectacular, since the primary fresh-water fish fauna

of West Java is much smaller than that of Borneo, whilst that of East Java and Bali seems to be impoverished. Comparing Java as a whole with Lombok, Sumbawa and Flores, we find 12 families and nearly 100 species of primary fresh-water fishes immediately to the west of Wallace's Line (data mostly from DAMMERMAN, 1929) and but four families and five species of primary fresh-water fishes to the east of it (de Beaufort, 1913). Of these five, at least three have probably been carried across by man as food fishes, and it is notable that two of them are the same species that have crossed Makassar Strait into Celebes. The remaining two primary species which have crossed to the east of Lombok Strait are small fishes of two Cyprinid genera (RASBORA and PUNTIUS) which perhaps have crossed sea barriers elsewhere".

In his conclusions (p. 18) he suggests that "in the great Indo-Australian Archipelago the fish evidence very strongly supports the conclusion that there has been no dry land connection whatsoever between the islands of the Asiatic continental shelf (Sundaland) with Celebes or Lombok, or any of the islands to the eastward of these, during the entire Cenozoic". And furthermore "that even in the Mesozoic, there was never a dry land connection between Asia and Australia". While: "The islands between Wallace's Line and the New Guinean-Australian continental shelf, and most of the Philippines (save the Palawan-Calamianes chain and Mindanao, which were part of Sundaland) are populated chiefly by freshwater fishes of fairly recent marine origin, and which therefore give no indication of past land connections".

These statements, which in our opinion are very convincing, must be sufficient to justify our great interest in adding to the knowledge of the bathymetrical features of the Bali-Lombok Strait, when we passed it aboard the Galathea on the Danish Deep Sea Expedition Round the World 1950-52 on 13. September 1951.

2. THE SOUNDINGS

The soundings were carried out with a KELWIN-HUGHES registering echo-sounder. The weather was fairly quiet and current only moderate, so the conditions were altogether quite good.

Three sections were made in an east-westerly direction, the first one to the south of the strait itself, the second one across the southern part, and the third one close to the centre of the strait, from where the course was set towards the northwest out of the strait. The speed of the ship was about 10 knots.

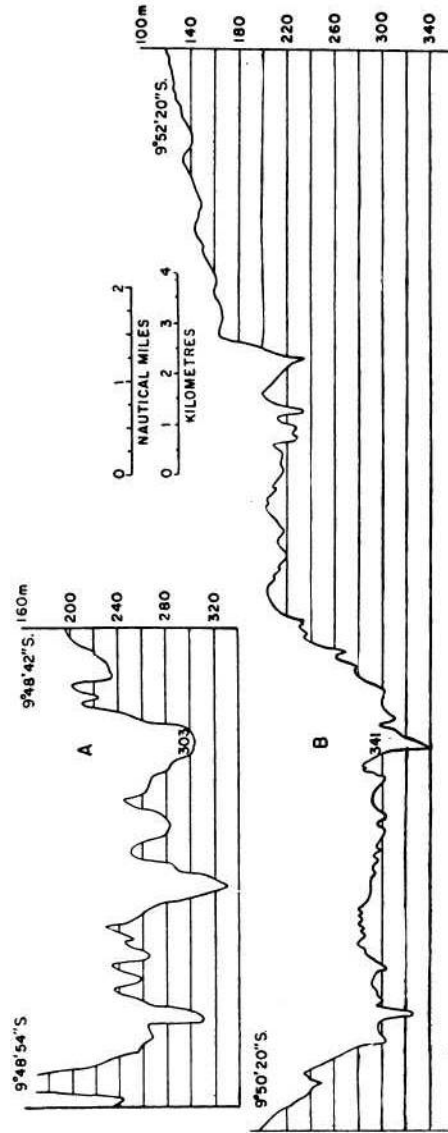


FIG. 1. Two sections across the deep channel of the Bali-Lombok Strait obtained from echo records. For the positions of the sections see fig. 2, depth in meters, vertical exaggeration 1:18,5

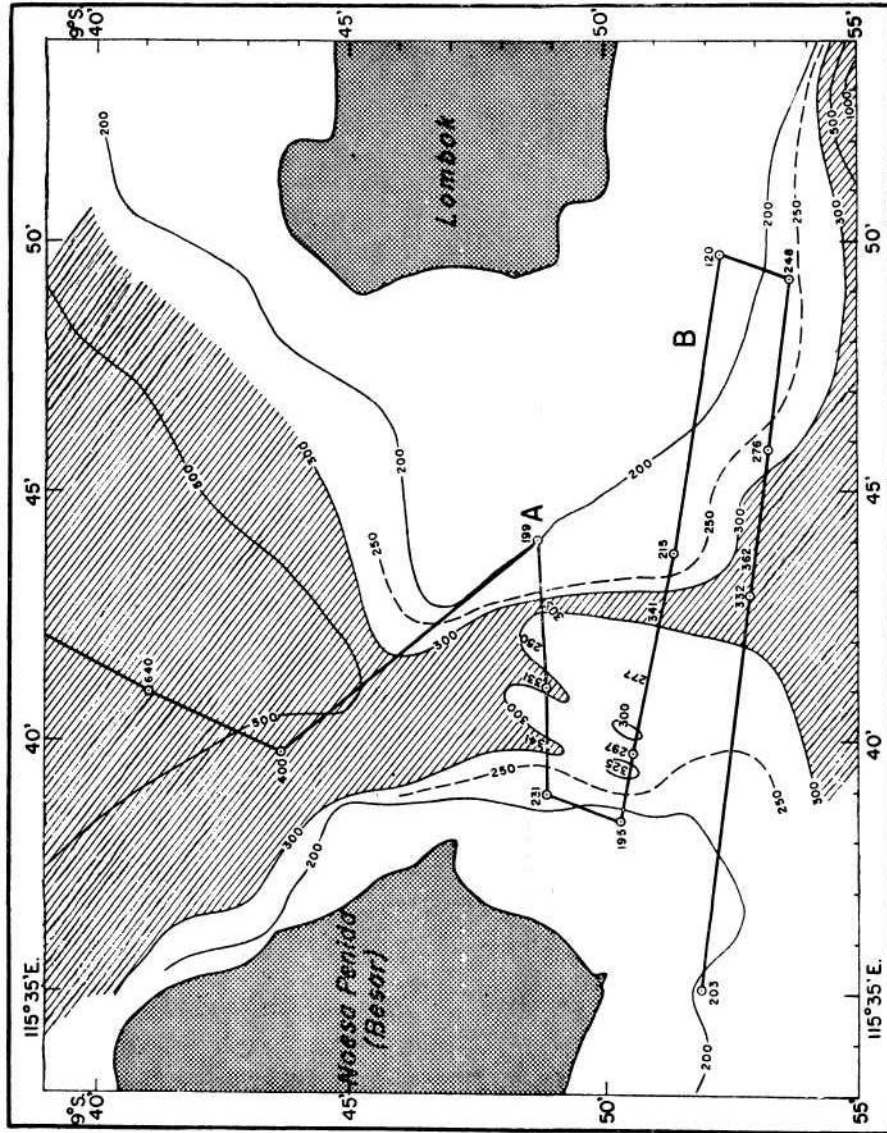


FIG. 2. Bathymetric chart of the Bali-Lombok Strait drawn from echo soundings of the Galathea and from available sea charts. Full line indicates the course of the ship.

The bottom relief showed up to be very rugged, so that a detailed survey of the strait would require several more sections than our schedule could include.

The two sections across the strait are given in fig. 1, in which the vertical exaggeration of scale is 18.5 times.

The chart (fig. 2) has been drawn from the echogrammes of the Galathea, but with due consideration of existing soundings from available sea-charts. The figures show a very narrow channel with depths exceeding 300 m. It cuts the ridge, which otherwise would connect the two islands with depths somewhat less. In section B the distance between the two curves of 300 m of depth is about 1300 m. But it is only in the western part that the depth is essentially more than 300 m, the maximum depth being 341 m.

In the northern section A, the deep channel is seen again, but here the distance between the 300 m-curves is only 500 m, and the greatest depth 303 m. Towards west two deeper areas appear, apparently connected to the north; here the maximum depths are 331 m and 311 m. It seems certain that they have no connection with the Indian Ocean.

In the northern part of the strait the channel broadens out, and the depths slope down past 500 m before we leave the strait.

While the channel at depths greater than 300 m is fairly narrow, both sections show a broad passage of 6-8 km with depths exceeding 250 m. In the southern section B, the profile is fairly even at about 290 m, while in the northern section A, the depths are about 260 m, but the profile is much more rugged. Towards the east and west of this passage the depths decrease abruptly to the depths of the present shelf around the island, about 200 m.

3. CONCLUDING REMARKS

We are presenting this additional information about the bathymetry of the Bali-Lombok Straits, hoping that it may be useful for studies of the water exchange between the Indian Ocean and the Indonesian Seas.

But we would especially stress the importance of the strait in considerations about past sea-levels.

We would like to support the conclusions of MYERS as given above, The consequence must be that no figure for the sea-level after Mesozoic time must be much lower than 250 m below the present. It could not exceed 300 m, except in the case that strong geological evidence would indicate that the present submarine connection between the two islands was correspondingly depressed.

We think that especially the considerations about the sea-level in Glacial Time must always use the Bali-Lombok Strait as a testing stone.

It is not our intention to discuss the very many ideas which have been put forward about this central problem, the distribution of land and sea in past times, but we would like just to mention a recent case.

HOLTEDAHL (1955) has brought together most interesting information about the coastal and submarine features around the Norwegian Sea. On p. 56 he concludes: "One must therefore consider the 270 m level as a possible former marine base-level present over a considerable area, but it is difficult to adjudge whether this presumed sea-level dates from pre-glacial or from Pleistocene times. It should, however, be mentioned that such a lowering of sea-level would exceed that which is calculated for the maximum glaciation on the basis of ice accumulation alone".

HOLTEDAHL is writing his conclusions from observations covering such a big area that it is difficult to consider them without drawing the Sunda Shelf into the picture.

From the description of the Bali-Lombok Strait and its being the southern boundary or the Wallace Line our conclusion must be that HOLTEDAHL'S figure in the very lowest a biogeographer could allow without a lowering of the bottom of the strait at the same time.

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