

THE INDIAN OCEAN BUBBLE

Many many years ago there was a grand enterprise that came to be known as the South Sea Bubble. A vast speculative venture, its Directors outbid the Bank of England for exclusive monopolies in trade with the Pacific Islands and South America, in return for which their company assumed the whole of the National Debt. In the ruin which eventually overtook this preposterous scheme, many thousands of small investors lost their savings; not even all of the big fish were able to evade responsibility and prosecution.

The Special Committee on Oceanographic Research (SCOR) has endorsed an international cooperative program of oceanographic research and survey work in the Indian Ocean for the near future. 1961 is the year most often referred to. Although a number of features of the plans must necessarily be made on a high international executive level, it also seems desirable that oceanographers on a working level - who actually think they might be interested or involved in the work at sea - should exchange ideas and suggestions, and make tentative plans of just what they would like to try to do in the Indian Ocean. For this purpose, THE INDIAN OCEAN BUBBLE has been established, as an informal journal for exchanging views and ideas. Brief communications are herewith invited.

A LETTER FROM Henry Stommel, WHOI, Woods Hole, Massachusetts USA

Dear Sir:

From a physical oceanographical point of view the chief interest of the Indian Ocean is the reversing of the Monsoon wind system, and its consequences on the oceanic circulation. There are four types of reversing current which appear to exist in the Indian Ocean, each of which are rather different and would involve differently planned surveys.

(1) The first type of reversing current appears to be the broad alternating cyclonic and anticyclonic gyres in the Arabian Sea, Bay of Bengal, and the South China Sea. These reversals are definitely indicated on Pilot Charts and climatological-type atlases (for example the Royal Dutch Meteorological Institute series). LaFond has made a study of the western margins of the Bay of Bengal, and it appears that the variations of salinity there are so immense that it is not at all obvious how much of the reversal is due to salinity changes due to river runoff and how much is due to the monsoons. Therefore I am inclined to think that the Bay of Bengal is not a good place to concentrate upon first of all; instead I would think that perhaps the Arabian Sea would be better; presumably the latter is not so complex. The question which we would like to

resolve is how much does the internal density structure of one of these semi-enclosed basins respond to the variations in wind stress? A clear cut observational answer would be an interesting test of theoretical ideas about the oceanic circulation. Not a conclusive test, to be sure, but suggestive. I recently looked over the collection of bathythermograms at Scripps with the intention of trying to determine something about the variable temperature structure at depth from one season to another. For example one might expect that during and following the Southwest Monsoon, the warm surface waters might pile up a bit on the eastern side of the Arabian Sea- up against the eastern coast of India. Thus the highest temperatures at 300-400 feet along the Indian Coast might be between June and October. On the basis of about 80 BT records that looked suitable to me, it seemed as though the precise opposite happens, but this is far too few data to do much with - as the oceanographer-readers who have used BTs well know.

(2) Even more interesting than the above example, is the reversal of currents along the Equator. Bob Arthur and I looked into this and find that there is something peculiar about the Indian Ocean. At no season are there zonal components of wind-stress along the Equator of the Indian Ocean at all comparable with those in the Pacific or Atlantic Oceans. What is more, the Albatross hydrographic data suggest that there is no pressure gradient toward the east in the Indian Ocean in the upper layers of the water at the Equator, such as there is in the Atlantic and Pacific Oceans. One would suppose therefore that there is something very special about the regime at the equator in the Indian Ocean which should bear investigation. With no pressure gradient can there be an undercurrent like the Cromwell Current in the Pacific. Elementary dynamical reasoning indicates that there is no such current in the Indian Ocean. But is the elementary reasoning correct? It will be interesting and useful to get precise data from the Indian Ocean equatorial regions because then any theoretical explanation of the nature of the circulation in equatorial regions will have to explain two probably different type cases. It may be rather difficult to decide just where to make sections across the equator in the Indian Ocean. The Maldivé Is. are in a most awkward place astride the equator. Existing BT data is hopelessly scarce at the equator in the Indian Ocean.

(3) A third type of reversing current - and perhaps the most easily observed - is the reversing western boundary current. There appears to be one just off Vietnam at 13°N - perhaps the Scripps expedition to Thailand in 1959-61 will be able to explore this feature a bit. But even more extremely clear cut appears to be the current off Italian Somaliland. According to ship observations this current flows toward the south during the Northeast monsoon, and toward the north during the Southwest monsoon. It appears to be strong, intense and narrow - ideal for repeated hydrographic sections season by season. Welander's computations indicate that this ought to be the world's most strongly oscillating current system - the difference in South and North flows amounting to about 61 million cubic meters per second.

Each of these current systems is interesting...if too diverse a program of surveying is attempted can we hope to get definitive data on any one of them? And if not, which shall we concentrate upon?

(4) The fourth type of seasonally variable current - actually the most conspicuous of all on the charts of Schott - is the South Equatorial Countercurrent in the Indian Ocean. This phenomenon is not peculiar to the Indian Ocean - the North Equatorial Counter Current in the Atlantic is said to vary seasonally and should be more accessible to study there. Bob Arthur has pointed out to me that there is some doubt about the reality of the South Equatorial Current in the Indian Ocean. To me it looks like the least interesting of the seasonally variable phenomena which may or may not exist in the Indian Ocean.

A LETTER FROM Ignatius Donnelly:

Dear Sirs:

Do you think it would be possible for some of those interested in surveying the Indian Ocean to meet in a Bar, or other relaxing place, during one of the less enthralling sessions of the Oceanographic Congress in New York next September?

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