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## Concluding Remarks

J. A. Steers

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## Concluding remarks

BY J. A. STEERS

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The Great Barrier Reef Expedition of 1928–29 and the Royal Society and Universities of Queensland Expedition of 1973 are separated in time by only 44 years. In that period coral reef studies expanded greatly and the geomorphology of reefs and reef areas became a major theme of research. Up to 1928 it is almost true to say that no work had been done on coral islands, and the writings on reefs were almost entirely biological.

W. M. Davis's *The Coral Reef Problem* appeared in 1928. It was the first book that examined coral reefs from a geomorphological point of view. Davis made extensive use of deductive reasoning, but he did not examine, on the ground, the structure and formation of coral islands, although he travelled widely in coral regions and made great use of charts. He did, however, emphasize and discuss at length the importance of studying reefs in relation to the coast of the land they border. Thus he enlarged on the point, first made by Dana, that drowned valleys imply not only subsidence of the land they traverse but also of the foundation of the reefs in front of that land. This was a major contribution. Two other comments made by Davis are only of subsidiary importance – the unconformable contacts of reefs on the rocks on which they rest, and the disposal of detritus in lagoons, especially in subsiding areas. Davis's conclusion was that Darwin's theory of subsidence was the most convincing explanation of the way in which barrier reefs and atolls are formed. He also, rightly, acknowledged the force of Daly's glacial control theory, but fluctuations of sea level in the Quaternary were regarded as relatively minor incidents in comparison with the much greater subsidence that was necessary to explain deep drowned valleys and the evidence of the Funafuti bore. Incidentally this bore and the much shallower one on Michaelmas Reef were the only ones that were made before 1928. Davis also demonstrated the significance of cliffing in the marginal belts and the general absence of cliffs within reefs in the truly coral seas. In short, up to about 1928 discussions on the origin of coral reefs were wholly theoretical; despite the swing towards Darwin's hypothesis there were still supporters of the theories propounded by Murray, Agassiz, Gardiner and others.

The Expedition of 1928–29 was primarily biological, but its organizers sought help from the Royal Geographical Society. That Society asked me to join the Expedition as a geographer and invited Michael Spender to accompany me. We were to work independently of the main expedition which was based at Low Isles, where living accommodation and field laboratories had been built. (Sir) Maurice Yonge, the leader, and some others visited more distant parts of the reef, and Spender and Marchant (who joined the geographical party at Cooktown) both stayed at Low Isles after my return and, with the help of other members of the expedition, compiled two large scale and very detailed maps of Low Isles and Three Isles.

The point I want to emphasize is that when Spender and I began work on the reefs we had no definite idea of what there was to do, and how we were to do it! Discussions with geographers and biologists before we left England were optimistic rather than helpful, because no one interested in geomorphology had visited the Barrier. However, I arrived at Townsville, after very helpful discussions with Professor H. C. Richards and his colleagues at Brisbane. Since Spender travelled a little later than I did, I was able to make a short visit to the Bunker and

Capricorn Islands on the lighthouse ship *Cape Leeuwin*, and then was put ashore at Mackay and went on to Townsville by train. Spender arrived on 22 August, and we began our cruise on 29 August. We covered the coast and inner reefs between the Whitsunday group of islands and Flinders Island. We had to find our problems as we sailed along the coast. Many features impressed us: both the presence and absence of cliffs on parts of the mainland and high islands, the raised platforms on the mainland and rocky islands, dead and elevated fringing reefs, shingle and sparsely scattered sand cays, sand and shingle spits, and the low wooded islands with their shingle ramparts, 'promenades', mangroves, reef flat and sand cay. We stayed a short while at Low Isles – the most southerly of the low wooded islands – with the main party and were then able to have some useful discussions on reef problems.

Earlier writers had described reefs, and atolls figure largely in the literature. But little had been said about the islands as distinct from the reefs on which they rest. Along the Queensland coast the low wooded islands (or island reefs) are unique. Somewhat similar but by no means identical islands are found in other coral seas, and J. H. F. Umbgrove and P. H. Kuenen (of the *Snellius* Expedition) were studying those in the Bay of Batavia (Djakarta) at much the same time.

The work we were able to do in 1928 provoked interest in the study of reef islands off Queensland. Earlier geological work by E. C. Andrews, H. C. Richards, C. Hedley, G. A. V. Stanley, F. Jardine, W. H. Bryan and others had called attention to the general nature and structure of the mainland coast and high islands, but virtually no work had been done on the less spectacular, but by no means less interesting, coastal features and islands.

In 1936 I was asked to revisit the reefs and continue work begun in 1928. F. E. Kemp accompanied me as surveyor. We started from Brisbane in the schooner *Cambria* on 7 May and sailed for the Bunker and Capricorn Islands, low sand and shingle islands but quite unlike the low wooded islands. Thence we sailed as far north as Cape Direction and mapped many cays and low wooded islands.

Since then and especially since the end of the 1939–45 war, a considerable amount of geomorphological work has been done on the Queensland coast by R. W. Fairbridge, W. G. H. Maxwell, E. C. F. Bird, D. Hopley and others. There was, however, need for a much more detailed examination of the northern part of the reef area. In 1967 I was able to discuss this with friends in Brisbane and Townsville and found that they viewed the possibility of another expedition with interest. On my return to England I was able to discuss the suggestion with Sir Maurice Yonge and the Southern Zone Research Committee of the Royal Society. After the Pacific Science Congress in Sydney in 1971, Sir Maurice Yonge and I visited Brisbane and Townsville for further discussion. Within a few months funds had been found to launch the 1973 Expedition with Dr David Stoddart as leader.

Since 1928 many countries, particularly America and France, have sent expeditions or research workers to many coral seas. During and after the war several deep bores were put down on atolls, new techniques of dating and analysing deposits were invented, geophysical methods of obtaining sub-surface information are now in general use, and in the last two or three decades astonishing advances in our knowledge of the oceans and seas have been made. Our views on the structure of the globe have been revolutionized. The coral reef problem remains, and must be considered afresh. With this background – and with modern instruments and techniques – the Stoddart Expedition has been able to extend the pioneer investigations of 1928 and 1936.

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