

Beach rock and paleogeography in the North Adriatic Sea*

by

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The North Adriatic is really a large gulf, open towards the south. The west coast is flat, characterized by the presence of several river estuaries, and two main lagoons. From the Po to the Isonzo delta there are only beaches of fine, clean, sand and no rocks on the land; from the Isonzo to Yugoslavia the coast is rocky, indented and high, sometimes with cliffs. The sea bottom in general is gently dipping from the Italian to the Yugoslavian coast, close to which occur the maximum depths. The sea bottom morphology seems to be complex [16] but detailed bathimetric charts have not yet been published. The available nautical charts do not show too many features and the area is also lacking a very detailed, scientific work on the nature of the sea floor.

The present work is concerned with the presence on the North Adriatic sea floor of a number of beach rock outcrops, most of which are unreported [3; 32; 33]. The research work already carried out has confirmed the hypothesis already formulated and helped to delineate the trend of the planned studies.

The outcrop areas already found are lying at different depths, in different areas. Two off Lignano Beach, the first about 6 miles off and 13 meters deep, the second 1/2 mile off and 6 meters deep; one off Caorle Beach about 3 miles off and 12 meters deep; two off Lido Beach (Venice), the first 1 mile off and 9 meters deep, the second 1 mile and a half off and 13 meters deep. The outcrops are usually found close together and grouped in restricted areas in which they seem to be mostly of the same type. Size and shape are quite different from place to place and in the rock the content and the ratio between quartz, carbonates and shells (more or less broken) are also variable. Each outcrop, strictly speaking, is very small and it is sometimes represented by a single stone. They are usually in the form of a group of blocks or a ridge isolated on the sandy or muddy bottom, sometimes in the form of a pavement of irregularly shaped rock slabs. In a few cases the blocks, almost always the slabs, seem to have been eroded and polished by wave or wind action. On the polished surfaces are planted large communities of small, living fouling organisms. The blocks can reach a thickness of one meter and a volume of a few cubic meters, sometimes with a squared shape. A very rich fauna and flora is generally planted over the largest ones, covering them. Indeed, local fishermen think in most cases they are the remains of ancient, submerged towns (among fishermen there is a tale about a church tower which can be seen from a boat when the water is particularly clear). The ridges, usually rising less than half a meter on the sea floor, are generally formed by the broken edge of one or several rock beds gently dipping into the bottom sediments. The pavement-type outcrop is formed by several rock slabs, grouped together, lying flat on the bottom; some of them can be heaped one upon the other. The thickness is from one to ten centimeters, the width up to a few square meters. The shape can vary considerably, from regular (rare) to extremely irregular; the edges and sometimes the surfaces of the slabs are rounded by erosion, often with elegant, convex and concave

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forms. The surfaces are smooth and perfectly polished in the parts where they are not covered by fouling organisms (mostly bryozoa and serpulidae) and where they are free of fouling, they seem to have been preserved by a loose sediment cover.

The bottom areas already scouted and the others to be investigated in the near future have been selected primarily from information gathered among local fishermen. A good picture of the number of the outcrops has been given by a professional diver who worked some time ago for three years (from early spring to fall) in the area, entrusted with finding archeologic remains. He states of having found no evidence of human activities but only thousands of rock outcrops (he is able to describe them quite vividly) grouped in several different areas and at different depths. Unfortunately, as they were of no interest to him, they were not mapped or marked out in any way.

At present the research work is carried out with the main purpose of finding as many outcrops as possible, as well as the different areas of interest and of taking good samples for C14 age determinations. In the near future — when the proper equipment and tools are obtained — it is planned to study in detail the most interesting outcrops, map them, and study their relationships with the surrounding sediments. The orientation and the dip of the most significant rock beds and the shell beds will be investigated with great care and detail in order to obtain positive information on the local beach orientation. All these data will be necessary to solve and explain the problems of paleogeography and evolution.

It is already proved that beach rock can form only very close to the intertidal zone (1). Therefore in an area such as the North Adriatic Sea, where beach rock outcrops are found at different depths and in different areas, it is possible to outline the trend of ancient coastlines. Furthermore C14 age determinations performed on the rock will add the time parameter to the picture of the paleogeography.

The most interesting and provocative data has already been achieved : a C14 age determination performed on an oyster shell dug out from a beach rock outcrop off Lignano Beach proved that there was a beach 3.840 ± 90 years ago, where now the sea is 13 meters deep and the shoreline 6 miles far away. Since the sea level cannot have raised 13 meters in the last 4.000 years, subsidence must be taken in account.

The data already obtained seem to suggest that the beach rock outcrops scattered on the North Adriatic Sea floor are not of the same age; they probably belong to different coastlines witnessing different environments and climates [11]. If the information gathered among fishermen is correct, the outcrops close to the Po delta seem to be deeper than others of the same age. If this is so, it will be possible to speculate also in terms of differential subsidence in the area concerned with delta activities.

Therefore it is hoped it will be possible to sketch in detail the morphological and paleogeographical evolution of the western coast of the North Adriatic Sea and to determine with accuracy the variations in subsidence from the last few thousand years up to the present.

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