

INVESTIGATIONS IN AND AROUND THE RIA DE AROSA, NORTH-WEST SPAIN, 1962—1964.

INTRODUCTION

BY

L. D. BRONGERSMA ¹⁾ AND A. J. PANNEKOEK ²⁾

SUMARIO

Investigaciones en la Ría de Arosa y sus alrededores, 1962—1964. Introducción.

En los veranos de 1962 y 1963 y en el invierno y verano de 1964 un grupo científico holandés hizo investigaciones sedimentológicas, oceanográficas, zoológicas y botánicas en la Ría de Arosa y sus alrededores. Se tomaron muestras en 934 localidades indicadas en el mapa (Apéndice I). Los nombres de los participantes han sido mencionados en el Apéndice II. El centro de las investigaciones era la fábrica de Don Luis Losada Lago en la Punta Preguntoiro en Villajuán cerca de Villagarcía de Arosa. En el texto siguiente se mencionan los periódicos en que serán publicados los resultados.

SCOPE

In the summers of 1962 and 1963 and in the winter and summer of 1964, scientists from the Netherlands carried out combined sedimentological, oceanographical, and biological investigations in and around the Ría de Arosa, one of the largest deep bays on the northwestern coast of Spain. This area promised to fulfil the requirements necessary for executing a combined program of all these disciplines. First of all, the area around the Ría de Arosa seemed favourable for investigating part of the sedimentary cycle: weathering — denudation — fluvial transport — deposition in bays, estuaries and on beaches. Secondly, the area seemed suitable for chemical and physical oceanographic work, which would in time be helpful for the study of the sedimentary processes taking place below sea-level. Thirdly, because of the relative scarcity of faunistic and floristic information concerning the deep bays of this coast, work in these fields promised interesting results, and furthermore, a combination of such data with results obtained by sedimentologists and oceanographers might prove to give important ecological information.

The leaders and participants in the various investigations are indicated in Appendix II.

SAMPLING

The field work was performed in the following periods: July 6—August 9, 1962; July 1 to August 1, 1963; January 28—February 7, 1964, and July 15—August 15, 1964. The number of participants, including scientific workers, technicians, and students, varied from 25—28 during the summer campaigns; 5 persons stayed at the ria during the short winter campaign.

The main camp during all campaigns was established in and around the packing factory of Don Luis Losada Lago at Punta Preguntoiro, Villajuán, near Villagarcía de Arosa. The factory provided the necessary space,

furniture, and equipment for setting up a temporary laboratory.

Samples were taken or observations made at 934 localities in the ria proper and in two rivers, Río Ulla and Río Umia (the number of these stations begin with 1.), and at 175 localities on the shores of the ria (the numbers of these land stations begin with 0.). These locations are indicated on the accompanying map (Appendix I); not indicated are the localities on land where geological samples were taken and higher plants were collected.



Temporary laboratory and camping site at Punta Preguntoiro. Ría de Arosa and northern shore in the background.

The following boats were hired locally:

- a. a fishing motor vessel, the „Flor da Ponte” (length about 12 m, with a crew of three), on which winches were fitted for handling the coring and sampling equipment and the oceanographical apparatus (available during all campaigns);

¹⁾ Rijksmuseum van Natuurlijke Historie, Leiden.

²⁾ Department of Geology and Mineralogy, University of Leiden.

- b. a flat-bottomed motor sloop with a crew of two (2nd and 3d summers);
- c. a larger salvage steamer, on which an echograph was fitted, with a crew of three, was used during the 3d summer in order to carry out some borings. In addition, a rubber boat, which could be transported by car to various places along the coast and which was equipped with an outboard motor, was available all the time.

Sedimentology

Collecting of sediment samples was carried out with a small bottom sampler and a punch corer in all summer campaigns. In the summer of 1964 a piston corer was also used and some borings were performed to a depth of 12 m.

Oceanography

In 1962 a rather modest program was carried out, data being collected on salinity, temperature, oxygen, and content of suspended matter. In 1963 and 1964 the program was larger, including determinations of pH and of current velocity with buoys (small flags and balloons fitted on bottles or on wooden crosses), and in the winter and summer of 1964 also of phosphate and nitrate. The discharge of the river Ulla was measured in the summer of 1963 and in the winter and summer of 1964. Furthermore, a limited meteorological program was carried out.



The „Flor da Ponte” after a Sunday trip. Villagarcía de Arosa and Mt. Giabre (641 m) in the background.

Zoology

Collecting in the deeper parts of the ria and in the mouth of the Río Ulla was done with a triangular dredge and bottom samplers of various sizes. From all bottom samples part of the superficial layer was removed for the study of Foraminifera and diatoms. The remainder was washed on sieves with meshes of various sizes to collect the animals living on and in the sediment. In shallow water and in the shallow parts of the Ulla River, dip-nets and a very small bottom sampler were used. Occasionally, a seine-net was used. At low tide specimens were picked up from the rocks and flats that had fallen dry. Some attention

was also given to the land fauna of the islands lying in the ria. Some plankton samples were taken.

Botany

Samples of algae were collected with the dredge and with the bottom samplers. Algae were also collected from the rocks at low tide, and divers studied the algal vegetation in parts of the ria to a depth of 27 m.

TOPOGRAPHY

The Ría de Arosa is one of the „rias bajas” or „lower ria's”, deep bays on the west coast of Galicia, north of the Portuguese frontier. There are four larger rias: from north to south, the Ría de Muros y Noya; the Ría de Arosa, the Ría de Pontevedra, and the Ría de Vigo. The Ría de Arosa differs from the others in various respects: it is wider, the surrounding country is mostly lower, and it contains a greater number of islands, some of them large, several kilometers in length, and many smaller ones, as well as swarms of rocks, partly submerged at high tide.

The total length, from the island of Salvora at the entrance, to the estuary of the Ulla at its upper end, amounts to some 25 km in a straight line. The width is very variable, owing to the presence of peninsulas with deep bays between them. Near the entrance the main channel is relatively narrow (4.7 km). It is confined between the peninsula of El Grove, which is attached to the SW shore by a sandy bar with dunes, and the island of Salvora, separated from the NW shore by shallows and rocky islands.

With respect to the bottom topography, the most conspicuous feature is the central channel which is more than 60 m deep near the entrance of the ria. The depth diminishes 7.5 km inwards to less than 50 m due to a transverse ridge, but then increases again to more than 60 m. North of the Isla de Arosa this channel seems to end at a depth of about 30 m. On both sides of the central channel, and also in the inner part of the ria, the bottom gradually rises, though very irregularly owing to the presence of many shoals, some of which rise above sea level to form small islands. To a certain degree the bottom topography is a continuation of the subaerial topography, which also shows many rounded hills and rocks typical of a granite relief.

The coastal features show wide variation. There is a rapid alternation of rocky cliffs, soft slopes, and sandy beaches. The rocks exposed on the coasts are for the greater part granites, the rest being, especially on the northwest and north shores, gneisses and mica-schists. The protected bay behind the peninsula of El Grove, south of the island of La Toja, contains extensive tidal flats with some salt marshes along the margins.

The main river is the Ulla, which enters the Ría de Arosa at its upper end. The estuary of the Ulla has a width of 2.5 km where it enters the ria, but it gradually narrows upstream; at Padrón, which is situated 18 km from the mouth, the tides are still noticeable.

The Ríu Ulla has to a great extent silted up its estuary and the inner part of the ría.

The same applies to the small Ríu Beluso, which has silted up the northernmost extension of the inner part of the ría. The second largest river is the Ríu Umia, which is filling up an estuary and building a delta in the protected southwestern bay opposite the island of La Toja.

PUBLICATION OF THE RESULTS

The scientific results of the four groups of investigations will be published in the following periodicals.

Sedimentology and geomorphology

Leidse Geologische Mededelingen, vol. 37, published by the Geology Department of the University of Leiden.

This volume will contain papers on the geomorphology of the area by A. J. Pannekoek, on the beaches by C.E.S. Arps & H. M. Kluyver and by J. D. de Jong, Mrs E. H. Bisdom-Dedert & H. H. Poortman, on the bottom sediments by W. S. Koldijk, on granite weathering by E. B. A. Bisdom, and a short summary of the solid geology by P. Floor.

Oceanography

Netherlands Journal of Sea Research, published by the Netherlands Zoological Society, Official Journal of the Netherlands Institute for Sea Research, Den Helder.

Papers are being prepared by L. Otto and collaborators on the physical properties and circulation of the waters of the ría, and by M. Brongersma-Sanders and collaborators on the chemical properties.

Zoology

Zoologische Mededelingen, and *Zoologische Verhandelingen*, published by the Rijksmuseum van Natuurlijke Historie, Leiden. Papers are being prepared on the Foraminifera by J. H. van Voorthuysen, on the Ostracoda by C. W. Wagner and M. J. M. Bless, on the Mollusca Gastropoda (except the Nudibranchiata) by G. C. Cadée; on the Gastropoda Nudibranchiata by F. J. van Iren; on the Crustacea Decapoda and Isopoda by L. B. Holthuis, and on the Crustacea Copepoda by W. Vervoort. A paper dealing with the subspeciation of *Lacerta hispanica* on the islands in the Ría de Arosa is being prepared by M. S. Hoogmoed. One short paper describing a new genus and species (*Saduriella losadai*) of Isopoda Valvifera, named after Don Luis Losada Lago, has already been published (L.B. Holthuis, *Zoolog. Med. Mus. Leiden*, vol. 40, 1964, pp. 29—35, 2 figs.).

Botany

Netherlands Journal of Sea Research.

Papers on higher algae are being prepared by C. van

den Hoek and M. Donze, and on diatoms by A. van der Werff. A short paper has been published already: C. van den Hoek & M. Donze: A contribution to the knowledge of *Ulva rhacodes* (Chlorophyceae, Ulvotrichales), *Nova Hedwigia*, 10, 1966, pp. 495—498, 24 figs.

It is intended, wherever possible, to collect the papers dealing with the Ría de Arosa in a separate volume or issue of each of the periodicals.

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Don Luis Losada Lago.

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