Mapping Sediments around the Estuary of the Tagliamento River (N. Adriatic Sea) by petrophysical Bottom Trail Logs

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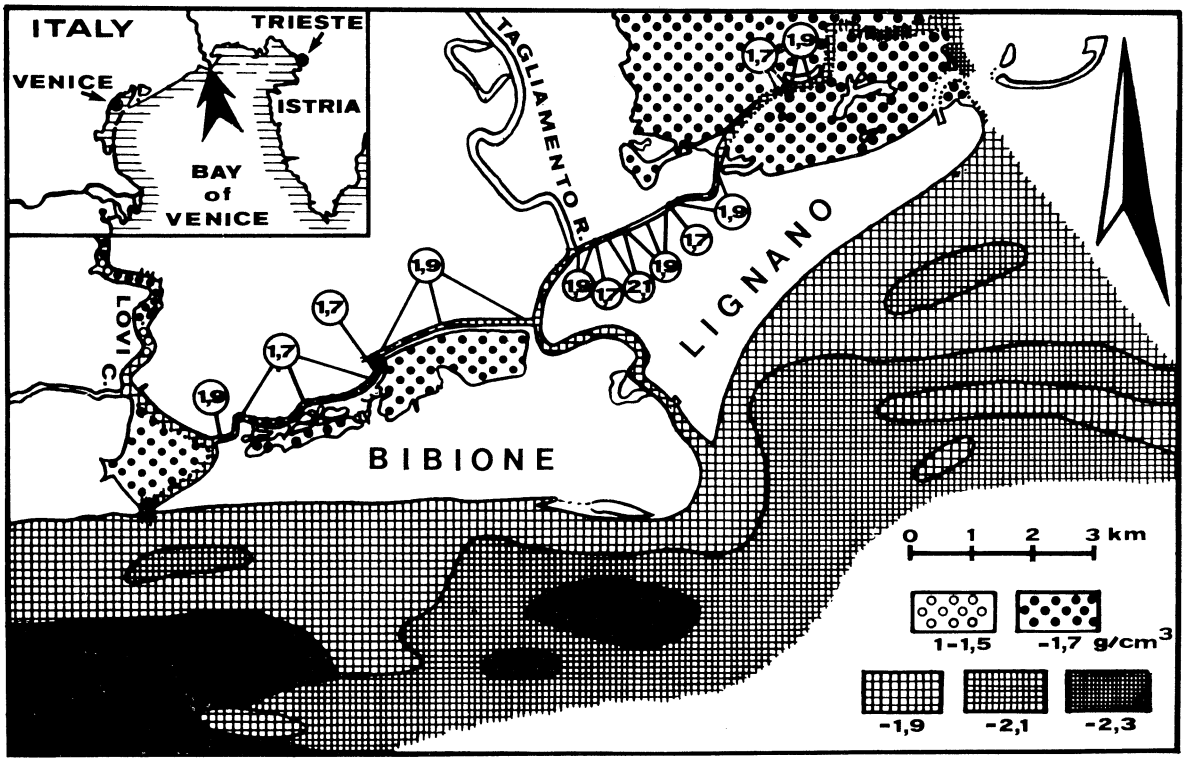
The region where these methods have been tried comprises the estuary of the river and of its old branches; an area of ponds and lagoons, and a strip of about six kilometres width along the shore. All types of clastic sediments from gravel to soft mud, and all grades of salinity from fresh river water to marine



Estuary of the Tagliamento River. Map of Sediment Densities.

water occur in that district. The *bottom trail logs* used for these surveys have been derived mostly from bore hole logging, and had to be adapted to the geometric and physical conditions on the sea floor. In general, electric, nuclear, acoustic, optic and topometric methods have been tried out. The probes used for bottom trail logging contain three or four different logging systems each. The *logging boat* is a small barge made from reinforced plastic material and has been fitted out with special equipment for registration, orientation, echo sounding and radio transmission. The boat is driven by an outboard motor of 9 ½ H.P.; the logging speed averages 5 km/h.

Rapp. Comm. int. Mer Médit., **23**, 4a, pp. 287-288, 1 fig., (1975).

The *probes* are made from plastic material and metal. Their optimal form has been tested in laboratory and field work. They are weighted with lead, and steering fins keep them in contact with the sediment during logging operations. Nuclear logging methods have proved to be very useful for mapping the sea floor, for logging sands with interesting contents of heavy minerals, and for purposes of technical engineering onshore and offshore. The most useful nuclear logging systems have proved to be gamma/gamma, neutron/neutron and natural gamma logging.

The *gamma/gamma* probe contains a source of Caesium-137 and a regular scintillometer. The count rate of the scintillometer corresponds to the density of the sediment. With sands and sandstones, density is regularly a function of porosity. With muds and clay, density is a function of their grade of compaction. The *neutron/neutron* probe contains a source of americium/beryllium and a scintillometer with a crystal of LiJ. The count rate corresponds to the water content of the sediment. Crossplots of gamma/gamma and neutron/neutron logs usually show all points lying on a straight line or within a narrow band. Groups of outside points usually belong to sands with an interesting content of heavy minerals like titanite ores, magnetite or hematite.

There are still some difficulties in logging natural gamma rays. The most common radioactive isotopes occuring in sediments are kalium- 40 and elements belonging to the group of uranium, radium and thorium. Relatively high contents of kalium-40 are found in muds, mudstones and clay. Radium and uranium salts are often enriches in black, marine and bituminous muds. High activities of thorium isotopes are found in monacite sands, thus enabling prospectors to find, map and evaluate such sands by logging with a counter for natural gamma rays.

Usual scintillations counters are not sensible enough for natural gamma surveys. Tests are under way with a relatively big plastic scintillator.

A kind of grain size analysis was made by means of a so-called *scrape* microphone. This system contains a steel pin which scrapes over the sea flor, while a microphone on the inner end of the steel pin converts this noise into electric signals. The amplitudes of these signals correspond fairly well to the hardness of the material, and the frequency band resembles a grain size analysis. Another survey was made by means of a focussed *resistivity log*, which records the resistivity of the sediment and of the water at the same time, while the formation resistivity factor is calculated automatically by a simple type of electronic computer. The formation resistivity factors of such sediments vary with their porosity or with their water content.

Up to now all surveys were made in relatively flat litoral waters, not exceeding 50 metres depth. Logging in deeper waters would need longer and very expensive cables and a bigger logging boat. Besides, part of the electronics that up to now were situated on board the logging boat should better be built into the probe itself to avoid induction of signals then.

Special literature on bottom trail logging :

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