ABSTRACT

This thesis presents an investigation of recent sediments of the Lithuanian coastal zone, SE Baltic Sea. The main focus is upon the detailed documentation of grain size and mineralogy and the development of analytical methods using these essential and most common sediment parameters. Mineralogical composition of surface samples was determined by X-ray diffraction (XRD) and grain-size distribution was obtained by standard dry sieving and pipette techniques. The overall grain-size distribution and interrelations between grain-size statistical parameters of 712 sediment samples are used to interpret transport processes in the nearshore zone. Then, two different approaches to specify sedimentologic conditions and sediment transport pathways based on spatial trends in grain size data are applied: 1) a transport vector method focused upon successive changes along possible transport pathways, and 2) a population anomalies method based on comparison of the spatial deviations of the sample sites in comparison with local population statistics in order to estimate balance between erosion and deposition. Mineralogical analyses of the silt and clay fraction of sandy deposits of 37 surface samples is interpreted to identify sediment source types. Contributions from the identified sources are then derived by simultaneous equations for each specific mineral or group of minerals. "Pure" end-members are resolved using multiple samples and calculating the maximum contribution of each source type.

The sediments closest to the Lithuanian shoreline represent a balance between erosion and accumulation processes. Some areas of local shore erosion occur at Klaipėda, in the southernmost part of the study area, and north of Palanga. The influence of wave activity is predominant within the entire central part of the study area (Klaipėda – Palanga) and near the coast in the north and south. Increasing depth (1-5 m) correlates with the decreasing strength and variability of wave-induced turbulence, allowing accumulation within continuous shore-parallel zones along the entire coastline. Seaward of the accumulation zone exists a coast-parallel area (5-13 m) where sediment transport is predominant, with little erosion or accumulation. Longshore currents and occasional storm-wave turbulence rework these sediments. The greatest variability of all parameters, including the coarsest, most positively skewed and worst sorted deposit, is found at 13-20 m depth. These sediments are interpreted to be derived from till erosion in northern offshore areas. Deposits at more than 20 m water depth south of Klaipėda have the finest grain size and accumulate below normal wave base.

The main sources supplying sediment to the area are: 1) the Sambian Peninsula to the south (erosion of Pleistocene till and "Blue Earth" Paleogene sediments), supplying approximately 33% of the fine-grained fraction, 2) the Nemunas River, which discharges through Curonian Lagoon, and supplies an estimated 17% of the fine fraction, and 3) Pleistocene till, eroded on the sea floor in the north and at the Olando Kepurė shore cliff to contribute an average of 50% of the fine sediment.

Detailed grain-size distributions allow interpretations of transport pathways and site dynamics. Combining quantified source contributions with the identified transport pathways helps to complete the source to basin modelling that many sedimentological studies aim to achieve. Spatial trends in grain size complement mineralogical data for this purpose.

Keywords: Baltic Sea, Lithuanian coast, sandy deposits, sediment transport, grain size, quantitative provenance, mineralogy, fine-grained sediments