NEW GEOLOGICAL MAPPING ASSISTS COASTAL MANAGEMENT

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Abstract

New coastal Quaternary geology mapping data produced by the Geological Survey of NSW (GSNSW) has provided a major advance in detail, spatial accuracy and geological reliability of mapping of NSW Quaternary deposits. The mapping incorporates both surface and underlying near-subsurface units mapped at 1:25 000 scale integrated with the best available bedrock geology mapping. The mapping and accompanying data are available as GIS data sets within a packaged DVD product and report (Troedson & Hashimoto, 2008). A variety of derivative maps can be produced from the coastal Quaternary geology data to address coastal management issues. Also available are a series of paper maps for the NSW north coast (Hashimoto & Troedson, 2008) with a matching series for the south coast in preparation. Together these products can serve as valuable tools in coastal environmental management, land-use planning and resource assessment studies.

Introduction

An urgent need for better base data to inform land-use planning and natural resource management in regional coastal areas prompted the NSW Government to fund the Comprehensive Coastal Assessment (CCA) in 2001. The CCA project areas encompassed coastal regions from Tweed LGA to Port Stephens LGA on the NSW north coast and from Shellharbour LGA to Bega LGA on the NSW south coast. Coordinated by the former Department of Infrastructure, Planning and Natural Resources, a number of government agencies worked on supporting projects.

For the CCA, the Geological Survey of New South Wales undertook high-resolution (1:25 000 or better) mapping of Quaternary deposits associated with sandy coastlines, estuaries and coastal alluvial plains across the state (excluding the Greater Sydney region), with a view to compiling a baseline geological data set for future land-use planning and coastal management. The output of the project represents a vast improvement on hitherto available geological mapping in the coastal lowland areas of New South Wales, due to its greater degree of differentiation of depositional units, and a unique methodology and GIS data structure that has enabled the simultaneous mapping of surface and shallow sub-surface sedimentary deposits.

Mapping Methodology

The project was implemented in two phases. Phase 1 involved the assembly and integration of published and draft geoscience mapping into a GIS environment. This process revealed that the existing mapping of Quaternary coastal geology was of

highly variable vintage, quality, detail and spatial accuracy, and that no consistent classification scheme existed. Phase 2 involved the mapping of Quaternary coastal deposits at 1:25 000 scale using the best available remotely-sensed data and supporting data sets. While this phase built on the geological understanding provided by existing studies and associated depositional models, the mapping is based primarily on new aerial photograph interpretation. Other data sets used included Landsat data and, where available, geophysical survey data, in addition to subsurface information from water bores, RTA reports, theses and relevant publications. Field observations were made at 847 coastal localities, and laboratory analyses were conducted on 478 samples to characterise sediment properties.

The Mapping

The key product of the mapping project is a seamless, internally consistent, GIS-based map data set for the Quaternary deposits of the northern and southern CCA project areas produced for use at 1:25 000 scale. The mapping incorporates both surface and near-surface underlying geological units, with up to three geological units recorded for each map polygon.

Deposits are classified firstly on the basis of depositional system (alluvial plain, estuarine plain, coastal barrier, anthropogenic) with each depositional system consisting of a number of individual mapping units distinct in terms of geomorphology, depositional processes, and/or sediment properties (e.g. dune, channel, swamp, sand flat). Mapped units are also differentiated according to age where possible (Holocene, Pleistocene or undifferentiated). This distinction is more than academic as the older Pleistocene deposits typically have a stiffer consistency than Holocene material.

In order to facilitate the application of the data to different issues, the geological units are rated on the basis of a number of sediment characteristics. These derivative attributes include dominant texture, sand provenance, pyrite content, carbonate content and organic carbon content, which comprise individual fields within the map database. This allows maps of these characteristics to be created, along with more traditional geological maps based on geological unit, geological age, and depositional system, all for both surface and subsurface deposits.

Data Applications for Coastal Management

The coastal Quaternary geology GIS data has potential application to a variety of coastal management issues associated with land use capability, geohazards and resource potential. Some examples include coastal and riverbank erosion and sedimentation, potential acid sulfate soils distribution, the geotechnical assessment of substrates, the spatial distribution of extractive resources, and the management of historic (mostly heavy mineral sands) mining areas.

The example in figure 1 illustrates how the map data may be used to understand coastal erosion risk. Figure 1a shows the Sawtell area south of Coffs Harbour, where the Holocene coastal barrier is immediately underlain by Pleistocene deposits. These Pleistocene deposits are likely to provide some resistance to coastal erosion and reduce the risk of rapid coastal recession in the event of sea level rise. In contrast, the Bellinger River coastal plain (Fig. 1b) is largely underlain by easily-eroded Holocene sands so represents a high risk area for coastal erosion under rising sea levels. Note that the subsurface maps in particular are based on limited sampling data and are

largely predictive. Such maps would be most useful in the preliminary stages of an investigation to identify likely broad-scale spatial trends or areas of interest.

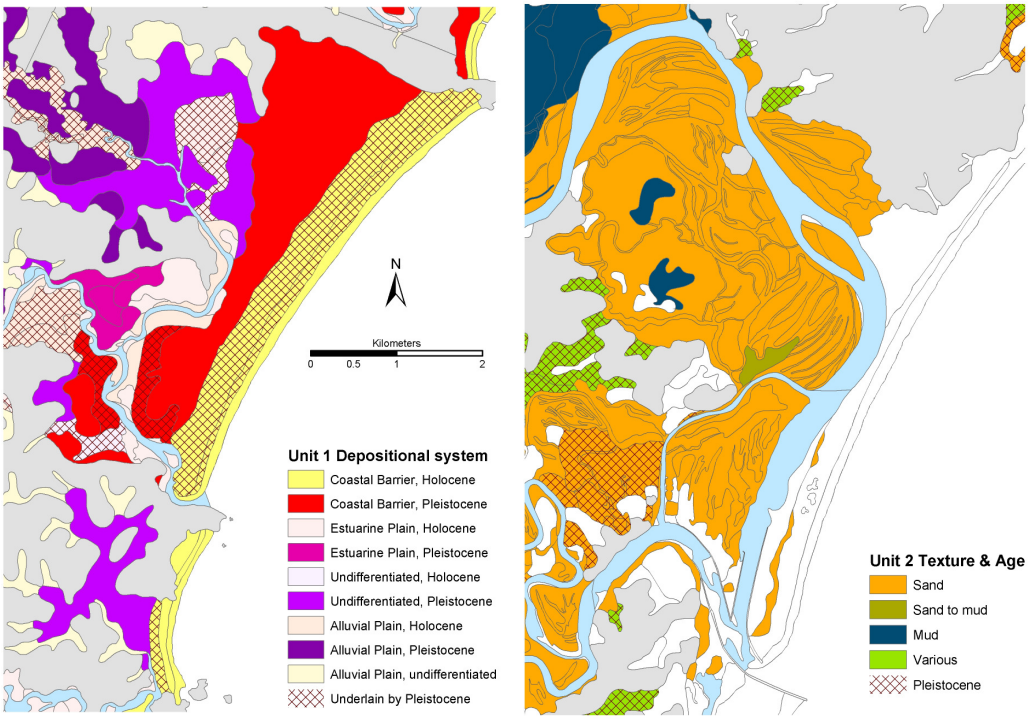

Figure 1. a) Quaternary geology map of Sawtell area showing unit 1 (surface) depositional systems and subsurface Pleistocene deposits; b) Quaternary geology map of Bellinger River coastal plain area showing unit 2 (shallow subsurface) sediment texture and age. Grey areas are bedrock.

Products Available

The Coastal Quaternary Geology data is available from the GSNSW as a bulletin with accompanying DVD data package (Troedson & Hashimoto, 2008). The DVD data package incorporates the following:

1) Seamless geology coverage consisting of
   - 1:25 000 scale Quaternary geology with surface and subsurface units
   - Quaternary sediment and field analysis data
   - Integrated best available 1:250 000 bedrock maps

2) Resource assessment data including
   - Section 117 notifications
   - Past heavy mineral sand mining paths
   - Metallic, industrial mineral and construction material occurrences and resources

3) The north coast Quaternary map series (see below) as nine PDF files; and

4) Bulletin 34, Coastal Quaternary geology – north and south coast of NSW, as a PDF.

The map and resource assessment data are provided as ESRI shape files.

Nine stand-alone paper geology maps are also available for the northern CCA area divided up as shown in Figure 2 (Hashimoto & Troedson, 2008). Each map sheet shows the Quatenary geology for the entire sheet at 1:100 000 scale and selected regions of interest centred on urban areas at 1:25 000. A suite of such maps depicting the southern CCA area Quaternary geology is currently in preparation.

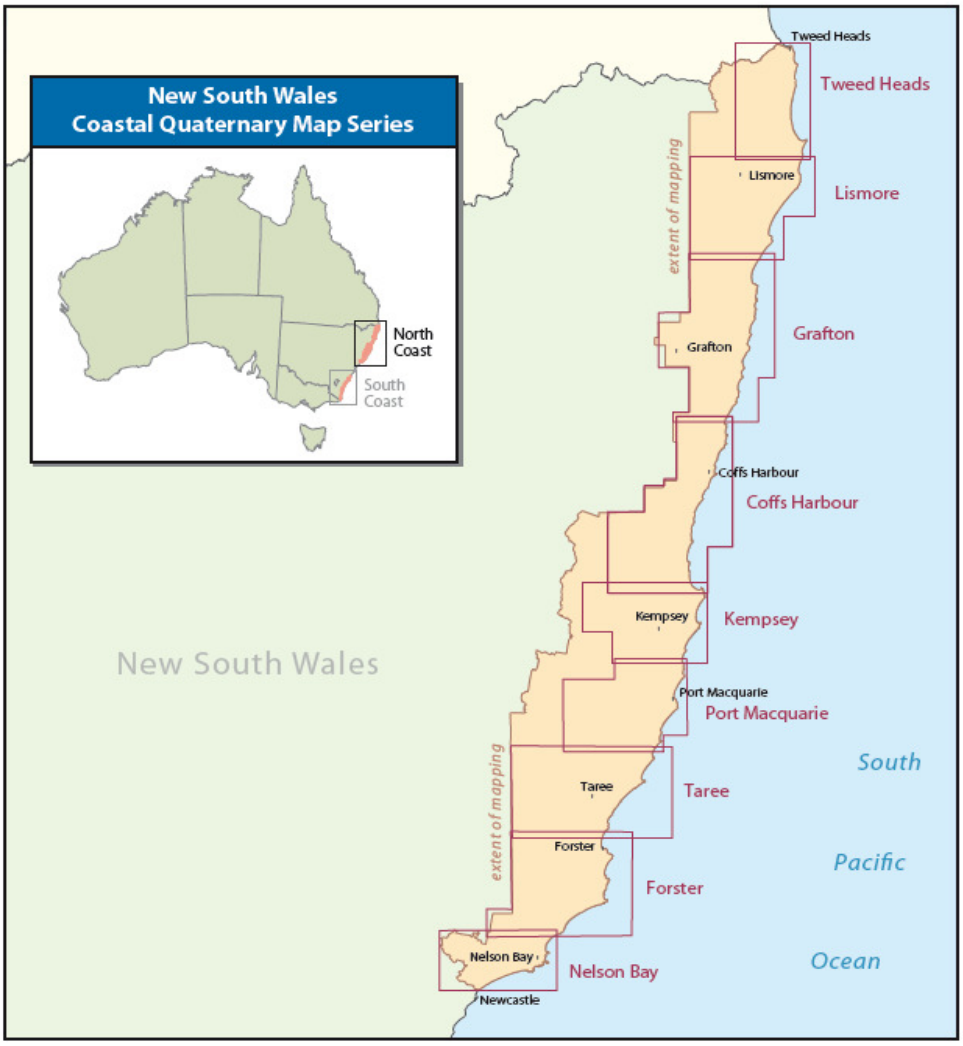

Figure 2. Index map for the recently published Coastal Quaternary Geology Map Series covering the northern CCA area.

Acknowledgements

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Troedson A.L. & Hashimoto T.R. 2008. Coastal Quaternary geology – north and south coast of NSW. Geological Survey of New South Wales, Bulletin 34.