

HOLOCENE ANALYSIS

Method Indicator		
Bottom-Up	Hybrid	Top-Down
		YES

Summary of key issues

Issue	Description
Description	Analysis of the transgression and progression of an estuary over long time scales; reflecting the rate of sea level change; uplift, subsidence or consolidation of the landmass; and the available sediment supply.
Temporal Applicability	Geological timescales: many centuries to millennia.
Spatial Applicability	Whole estuary
Links with Other Tools	<ul style="list-style-type: none"> ▪ Accommodation space / geological analysis; ▪ Expert Geomorphological Analysis; ▪ Historical analysis.
Data Sources	<ul style="list-style-type: none"> ▪ Borehole records and cores; ▪ Seismic reflection surveys; ▪ Particle size, heavy mineral and geochemical analysis (Ridgway et al., 2000); ▪ Radiocarbon dating of the sediments (Godwin & Willis, 1961; Stuiver & Reimer, 1993); ▪ Pollen analysis (Godwin, 1940; Moore et al., 1991); ▪ Foraminifera analysis (MacFadyen, 1933; Scott & Medioli, 1980); ▪ Geoarchaeological investigations (Mellalieu et al., 2000).
Necessary Software Tools / Skills	Dependent on the techniques and data sources applied.
Typical Analyses	To establish a relative sea level rise curve for an estuary, through the reconstruction of geological and stratigraphic sequences, and assigning dates to particular horizons.
Limitations	Data availability
Example Applications	Humber Holocene Chronology

For most estuaries the change in sea level since the last ice age has had a major influence on their evolution. As sea levels rise, former river valleys are progressively drowned to become estuaries. This basal surface defines the space within which the estuary is formed. The subsequent development of the estuary then reflects the rate of sea level change, any uplift, subsidence or consolidation of the landmass, and the available sediment supply. Because of the way these various parameters interact it is common for an estuary to exhibit periods of transgression, when the estuary moves landward, and progression, when it moves seaward, over the time scale of centuries to millennia. Trying to identify these changes provides a context for the present form of an estuary and can often indicate the bounds within which future evolution is most likely to take place.

Such an investigation will usually make use of a range of field and analysis techniques, such as:

- Borehole records and cores;
- Seismic reflection surveys;
- Particle size, heavy mineral and geochemical analysis (Ridgway et al., 2000);
- Radiocarbon dating of the sediments (Godwin & Willis, 1961; Stuiver & Reimer, 1993);
- Pollen analysis (Godwin, 1940; Moore et al., 1991);
- Foraminifera analysis (MacFadyen, 1933; Scott & Medioli, 1980); and
- Geoarchaeological investigations (Mellalieu et al., 2000).

In order to carry out analysis of estuaries, it is necessary to define the basal topography of the estuarine sediments, as well as the high water surface and long-term sea level within the estuary. The approach therefore draws heavily on the techniques already outlined in the Accommodation Space section. In particular, borehole data over the entire estuary domain (including the full extent of the floodplain) is needed to establish the base of the Holocene sediments and provide some indication of maximum water levels over time. Inevitably this limits the application of this method to those estuaries with sufficient data, although an indicative assessment may be possible in situations with only limited data, using modern topographic maps and some knowledge of the solid geology, which may have implications of future management options (ABPmer, 2004a).

The results for these various techniques are then used to (i) reconstruct the geological and stratigraphic sequences, (ii) to assign dates to particular horizons and (iii) establish a relative sea level curve for the area. Some good examples of this type of analysis are to be found in (Shennan, 1986a; Shennan, 1986b; Long et al., 1998). Ultimately, this may be presented as a simple chronology of change ([Humber Holocene chronology](#)), or in the context of a behavioural model, such as the transgressive/progressive model (Long et al., 2000), or the highstand model (Roy, 1984; Woodroffe et al., 1993).

References

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