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Benjamin P. Horton
University of Pennsylvania, bphorton@sas.upenn.edu

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FULL NAME: Benjamin Peter Horton

AFFILIATION: University of Pennsylvania, Philadelphia, PA 19104, USA

ADDRESS: Sea Level Research Laboratory, Department of Earth and Environmental Science, University of Pennsylvania, Philadelphia, PA 19104, USA

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Synopsis

High quality relative sea-level (RSL) data from mid-latitude regions reveal spatial and temporal variations among eustatic, isostatic (glacio and hydro) and local factors since the Last Glacial Maximum. In regions of the Atlantic seaboard of North America and Europe that were once covered by the major ice sheets RSL fell by over 100m because of isostatic rebound. In contrast, the regions at the periphery and beyond of the ice sheets observations showed continually rising sea levels, at variable rates, due to the interplay between post-glacial isostatic recovery, marginal forebulge collapse and hydro-isostatic loading. The RSL observations from the Southern Hemisphere illustrated a mid-Holocene highstand of various magnitudes and timing.

1. Introduction

Since the Last Glacial Maximum (LGM) approximately 50 million cubic kilometers of ice melted from the land-based ice sheets (MS 141), raising global relative sea level (RSL) in regions distant from the major glaciation centers (far-field sites; MS 149) by c. 120 m (Figure 1). In contrast, RSLs have dropped by many hundreds of meters in regions once covered by the major ice sheets (near and intermediate field sites; MS 147) as a consequence of the isostatic rebound of the solid Earth. Such rapid changes in RSL are part of a complex pattern of interactions among eustatic, isostatic (glacio and hydro) and local factors, all of which have different response timescales. The eustatic contribution to RSL change during deglaciation averaged 10 mm per year; however peak rates potentially exceeded 50 mm per year during "meltwater pulses" at 19 and 14.5 cal kyr BP (MS 141). Empirical and glacial isostatic modeling studies suggested a significant reduction in the eustatic contributions to RSL change at c. 7 cal kyr BP and the earth entered into a period of RSL stability during which ocean volume, on average, changed only by a few meters. Clarke et al. (1978) identified six types of sea-level curve (I – VI), which reflect a range of RSL histories recorded in coasts which have emerged, submerged, or are in transitional areas and record a combination of both uplift and subsidence (MS 147, 149). Although these curves provide the general impression of the rate and direction of RSL change, they do not reflect the true uncertainty associated with estimates of the altitude and age of former sea levels (Figure 2). This chapter examines the processes and patterns of Late Quaternary sea-level changes along the passive coastal margins of the mid-latitudes, with reference to selected studies. The chapter includes all types of sea-level curve except Zone I (Clarke et al., 1978).

2. Late Quaternary sea-levels

2.1 Atlantic seaboard of North America

Atlantic Canada and the Gulf of Maine have had a complex, regionally and temporally varying sea-level since the LGM and represent Transitional Zones I-II and Zone II (Clark et al., 1978). Shaw et al. (2002) presented the paleogeography of Atlantic Canada from 13 ^{14}C kyr BP to present based upon the collection and compilation of sea-level index points from numerous studies. RSL curves from **Newfoundland** show either continuous falling RSL with a marine limit at 120 m (e.g. Pinwar; Figure 3a) or RSL dropping below the modern level before rising once more (e.g. Port au Port). Submerged Holocene deltas record the spatially and temporally varying postglacial RSL lowstand along the coast of Newfoundland. For example, RSL at La Poile Bay fell to a -30 m lowstand c. 10 ^{14}C kyr BP. The RSL curve for **Nova Scotia** falls to a lowstand of -65 m at 11.3–11.7 ^{14}C kyr BP, before rising at a decreasing rate through the Holocene.

Since the LGM, isostatic rebound has dominated the RSL history of the northwestern Gulf of **Maine**. The retreat of the Laurentide ice sheet exposed large areas of isostatically depressed land, which were rapidly submerged by the sea (e.g. Barnhardt et al., 1995). The maximum inland extent of the marine invasion was 70 to 129 m above present sea level at 14 ^{14}C kyr BP (Figure 3b). After ice retreat, the land rebounded isostatically, resulting in a RSL fall to a lowstand of -60 to -65 m on the inner shelf 10.5 ^{14}C kyr BP. Lowstand shorelines and deltas record this phase. Subsequent slowing of the rate of rebound and overtaking by the rise of eustatic contributions resulted in local RSL rise at a generally decreasing rate to present. Sea-level rise over the past 5 cal kyr BP is known in considerable detail from high-marsh peats (MS 145 and 146). For example, Gehrels et al. (2004) showed a northeast to southwest gradient of crustal motion, reflecting the former distribution of Laurentide ice, from late Holocene RSL data from the Canadian provinces of New Brunswick and Nova Scotia, and the Gulf of Maine. The highest rates of late Holocene RSL rise occurred in Nova Scotia (c. 2.5 mm per year). The RSL history for the southern New Brunswick showed a late Holocene RSL rise at of c. 1 mm per year.

The Atlantic coast of the United States from New Hampshire to Florida, has a wide continental shelf and great interplay between post-glacial isostatic recovery, forebulge collapse and hydro-isostatic loading. Clark et al. (1978) suggest that the sea-level observations should be continually rising through the Holocene (Zone II), although records from Florida are supposed to show former sea-levels above present (Zone III). Along the **New Hampshire** coast saltmarsh deposits and drowned forests revealed that RSL has risen since 7 ^{14}C kyr BP, though at a rate decreasing gradually since c. 4 ^{14}C kyr BP (Pirazzoli, 1991).

At c. 13.5 cal kyr BP, RSL for **Massachusetts** was -65 m below present (Uchupi et al., 2006). RSL rose rapidly to 4.5 cal kyr BP, with a more gradual incline to near its present level c. 1 cal kyr BP. In the Boston area of Massachusetts, there was a very limited rate of rise (0.6 m) for the last 3 ^{14}C kyr BP, with a more rapid rise (3 mm per year) during the mid-Holocene (e.g. Pirazzoli, 1991). Donnelly (in press) studied basal high-marsh sediments from Romney Marsh, Revere, Massachusetts. He indicated a rise in RSL of c. 2.6 m in the last 3.3 cal kyr. The data suggested a possible decrease in the rate of rise from 0.8 mm per year between 3.3 and 1 cal kyr BP to 0.5 mm per year between 1 cal kyr BP and the last 150 to 500 years. In Southeastern Massachusetts radiocarbon dates from shells and freshwater peat suggested that RSL rose from c -70 m at 12 ^{14}C kyr BP to c. -35 m at 10 ^{14}C kyr BP at a rapid rate of 17 mm per year. Between 10 ^{14}C kyr BP and 6 ^{14}C kyr BP the rate of RSL rise dropped to c. 3 mm per year and remained at that rate until c. 2 ^{14}C kyr BP. During the last 2 ^{14}C kyr BP, the general rate of RSL rise has been c. 1 mm per year (Pirazzoli, 1991).

RSL changes in **Connecticut** have been inferred from New Haven Harbor and Hammock River marshes. The former site revealed a RSL rise of 10.5–12 m during the last 5.9 ^{14}C kyr BP, whereas the latter did not show any pauses or reverses in the rise of RSL for the last 7 ^{14}C kyr BP. Van de Plassche et al. (1998) created a new RSL curve from the Hammock River marsh for the last 1.5 cal kyr using AMS radiocarbon dates from salt marsh deposits. The resulting record, expressed as deviations from a long-term (isostatic) trend of 1 mm per year, suggested that sea level has oscillated centimeters to decimeters on timescales of centuries, being 0.25 m higher during the Medieval Warm Period than the Little Ice Age and rising at 1 mm per year over the last 300 cal yr. Donnelly et al. (2004) constructed a high-resolution RSL record for the past 700 years by dating basal salt-marsh peat samples above a glacial erratic from an eastern Connecticut salt marsh. The data revealed a RSL rise of 1 mm per year from 1300 to 1850 A.D. with a nearly three-fold increase in the regional rate of sea-level rise to modern levels likely occurred in the later half of the 19th century.

For the **New York** region, RSL rise since the LGM was amplified by the proposed catastrophic drainage of late Wisconsinan glacial lakes 12–14 cal kyr BP (e.g. Theiler et al., in press). The shoreline was located at c. 60 m isobath and the large glacial lakes north of the New York Bight are thought to have breached the moraine front at the Verrazano Narrows and other locations in New Jersey and New York. Gornitz and Seeber (1990) suggested a 2 mm per year RSL rise during the last 7 ^{14}C kyr BP. Sea-level rise in the last 150 years appears to have exceeded historic rates. Recent sea-level studies of the **New Jersey** coast suggested a rise of 2 mm per year from 6 cal kyr BP (e.g. Miller et al., 2005). The **Delaware** RSL curve suggests rising RSL rates of 3 mm per year before 5 cal kyr BP, 2.1 mm per year from 5 to 2 cal kyr BP and 0.9 mm per year from 1.3 cal kyr BP to present (Nikitina et al., 2000; Figure 3c). **Chesapeake Bay**, the largest estuary in the US, is a geologic product of rising sea level. By 10 cal kyr BP the main channel of the ancient Susquehanna River valley was flooded and became a narrow estuary (e.g. Larsen, 1998). Between 6 and 7 cal kyr BP, RSL was c. 9m below present and Chesapeake Bay took on its characteristic "drowned river valley" shoreline pattern. The rate of RSL rise from 6 to 1 cal kyr BP was 1.4 mm per year. The rate further decreased to 0.6 mm per year in the last 1000 years (Kearney, 1996).

There is a shortage of RSL data along the Atlantic Coast from the Carolinas to Florida at the boundary between Zones II and III (Clark et al., 1978). In **South Carolina** an oscillating RSL history during the Holocene has been proposed (e.g. Scott et al., 1995). RSL rose from -3 m at 4.6–5.2 cal kyr BP to +1 m by c. 4.3 cal kyr BP. Sea level subsequently fell to -3 m by c. 3.6 cal kyr BP. Since 3.6 cal kyr BP, sea level has risen steadily at a rate of 1 mm per year. A few notable papers from the **Florida** Keys showed continual rise of RSL during the Holocene with no indication of an emergence in Florida during the Holocene. (e.g. Toscano and Lundberg, 1998). Using U-Th dating of pristine *Acropora palmata* and head corals cored, Toscano and Lundberg (1998) suggested RSL rose from -13.5 to -7 m between 8.9 to 5 ka. Toscano and Lundberg (1998) identified a catastrophic RSL rise event of >45 mm per year, between 7.6 and 7.2 ka, which they attributed to West Antarctic Ice Sheet instability and changes in marine ice extent between 8 and 7 ka. Sea-level reconstructions based on soilstones and mangrove peat showed a rise of 1.2 mm per year from -7 m at 7 ^{14}C kyr BP to -0.8 m at 2 ^{14}C kyr BP, followed by a rise of 0.3 mm per year from 2 cal kyr BP to the present.

2.2 Europe

RSL observations and geophysical isostatic models clearly define the area of post-glacial rebound in Fennoscandia (MS 142). This is surrounded by a subsiding zone that has the greatest post-glacial subsidence (the so-called glacial forebulge or peripheral bulge), which is situated in the North Sea between Norway and Great Britain, and extends through the northwestern Netherlands and northern Germany. Clark et al. (1978) suggest European RSL observations should represent Transitional Zone I-II, Zone II and Zone III.

Late Quaternary RSL change has led to the evolution of coastlines along the southern **Baltic Sea**. The Baltic Ice Lake (the first stage in the history of the Baltic Sea) formed 12 ^{14}C kyr BP after the re-advance of the ice margin in north **Estonia** (Raukas, 2000). The retreat of the continental ice cover in Central **Sweden** at 10.6 ^{14}C kyr BP caused the lowering of the Baltic Ice Lake level by 25–30 m. Sea level rapidly rose to 42–45 m above present at 9.2–9 ^{14}C kyr BP on the Island of Hiiumaa in Estonia (Raukas, 2000; Figure 3d). Sea level subsequently fell 30–35 m between 9 and 8 yr ^{14}C kyr BP. Eustatic contributions to sea level exceeded the rate of glacioisostatic land uplift in the eastern part of the Gulf of Finland in period 8.4 to 6.8 cal kyr BP. In southeastern Sweden several minor fluctuations of RSL were identified between 8.5 and 5 cal kyr BP (Berglund et al., 2005). They correlated a distinct regression phase around 8.1 cal kyr BP with the Greenland ice-core cold event dated to 8.2 ice-core kyr BP. There was a rapid RSL fall from the LGM in southern Sweden until approximately 9.2 ^{14}C kyr BP followed by RSL rise with a series of observations until 7.2 ^{14}C kyr BP and then a fall in RSL to present. The uplift rate has been estimated at 2.5 mm per year during the last 7000 years. In Baltic **Germany**, RSL rose rapidly (20 mm per year) from 8 to 5.7 cal kyr BP, after which RSL gradually increased to present (e.g. Meyer and Harff, 2005). **Danish** coastlines show evidence of emergence in the north and submergence to the south because it is located at the margin of the former Scandinavian Ice Sheet. For example, Clemmenson et al. (2001) produced a Holocene RSL curve for Skagen at the northern tip of Denmark. Sea level fell c. 11 m between 5.6 and 1.4 cal kyr BP, but was characterized by periods of stability (c. 5.7–5.5 cal kyr BP, 5.2–4.7 cal kyr BP, 4.1–2.6 cal kyr BP and 1.7-1.5 cal kyr BP) separated by periods of rapid fall.

Shennan and Horton (2002) provided a synthesis of several local and regional RSL analyses and proposed simplified Late Quaternary summary RSL curves for regions of the **United Kingdom**. Isolation basins, raised tidal marshes, coastal wetlands and dune systems from northwest Scotland have produced a 16 cal kyr BP record of RSL change from the time of local deglaciation following the LGM to the present (Figure 3e). Sea-level records from Scotland reflected the spatially-variable effect of glacio-isostatic adjustment, which produced a mid Holocene highstand that diminishes from maximum altitudes at the sites beneath thickest ice at LGM to the peripheral sites under thin ice cover, with the Shetland Isles showing no Holocene RSL above present. The transition at the north appeared to be between Orkney and Wick, which shows a small highstand. On both the east and west coasts of the UK there is a clear north to south trend. For example, there is a regional difference between Northumberland and Norfolk, east coast of England, of 20 m at 8 cal kyr BP and by 4 cal kyr BP RSL in Northumberland was above present, whereas in areas to the south RSL has been below present throughout the Holocene. Estimates for late Holocene RSL change range from 0.7 mm per year in the Norfolk to -0.7 mm per year in Northumberland (Shennan and Horton, 2002).

During the LGM, the **Southern North Sea** was 110–130 m below present sea level so most parts of the North Sea basin were dry land (e.g. Streif, 2004). Marine mollusks found at a depth of 72 m below present-day sea level yielded a radiocarbon age of 10.3 ^{14}C kyr BP. A phase of the transgression lasted from 10.3 to 7.1 ^{14}C kyr BP when RSL rose from 72 to 25 m below present (Streif, 2004). The average rate of RSL rise is c. 15 mm per year, but reached c. 21 mm per year between 8.6 and 7.1 ^{14}C kyr BP. The final phase of the transgression began at c. 7.5 ^{14}C kyr BP and has continued until today. However, Behre (2004) suggested that RSL in the late Holocene was not continuous with a short phase of lowering in the 13th and 14th centuries.

Denys and Baeteman's (1995) Holocene sea-level data for the **Belgian** coastal plain suggested an initial RSL rise of c. 7 mm per year before c. 7.5 cal kyr BP. This resulted in a very rapid shift of the facies belts across the continental shelf towards a position close to the present-day boundary of the coastal plain. At c. 7.5–7 cal kyr BP the RSL curve shows a distinct rate-of-rise decrease to an average of 2.5 mm per year, and consequently, the rapid landward shift of the various sedimentary environments ceased. The rate of RSL rise continued to decrease, and after c. 5.5–5 cal kyr BP, it fell to an average of 0.7 mm per year. Van de Plassche (1982), who used predominantly basal peat data, concluded that during the past 6 cal kyr BP the northern and western **Netherlands** showed continuous RSL rise with an increase of over 1 m during the last 2.5 cal kyr BP that included a few small fluctuations.

Sea-level studies from Atlantic **France** showed a rapid rise in the early Holocene with no evidence of RSL being above present (Louwye and Declercq, 1998). In the Gironde Estuary, Mellalieu et al. (2000) identified a widespread deposit of fresh and brackish-water peat that began forming across much of the area from c. 6.4 cal kyr BP. This peat reached thicknesses of 1 to 3 m and was inundated by marine conditions once more at c. 2.8 cal kyr BP.

Portuguese RSL data is characteristic of Zone III (Clark et al., 1978). RSL was c. 100m below present at 16 cal kyr BP. Since 13 cal kyr BP a very rapid RSL occurred with RSL reaching -40 m between 12 and 11 cal kyr BP followed by an equally rapid decent to -60 m in response to the Younger Dryas (Dias et al., 2000). Sea-level rose rapidly again at c 10 cal kyr BP. Boski et al. (2002) indicated RSL rising rapidly at a rate of 8.5 mm per year to approximately 6.5 cal kyr BP (Figure 3g). Since then, lagoonal sediments in the vicinity of the estuary have been enclosed behind sand spits and predominantly sandy sedimentation was initiated within the estuary. After a second phase of slower rise at the rate of 3 mm per year, which lasted until c. 5 cal kyr BP, the sea approached the present level. There is no indication of an emergence during the Holocene.

2.3 Southern Hemisphere

The available mid-latitude RSL observations from the Southern Hemisphere fall within Zone V and therefore, should illustrate a mid-Holocene highstand (Clark et al., 1978). **Australia** is relatively seismically stable with little evidence of tectonic deformation since the Mesozoic. It is situated at the centre of the Australian-Indian plate and has passive continental margins. This makes Australia an important far-field location for RSL study, ranging from the first widely proposed eustatic sea-level curve (MS 141), to some of the earliest debates on hydro-isostasy (MS 142).

In **New South Wales** RSL rose rapidly from c. -120 m at the LGM to +1 m by 6.5 ^{14}C kyr BP (Sloss et al., 2005). In **South Australia** and **Tasmania** RSL had risen sufficiently by 17.5 ^{14}C kyr BP to enter the Bass Basin from the west and form an estuarine environment (Lambeck and Chappell, 2001). At 14 ^{14}C kyr BP, when the RSL rise reached the barrier in the east and Tasmania became isolated from the Australian mainland. Detailed geological investigations in South Australia reveal rapid rates of sea-level rise of 9 mm per year between 10−8 ^{14}C kyr BP (Harvey 2003; Figure 3h), and a more rapid rate of 24 mm per year between 8−6.7 ^{14}C kyr BP. The peak of the postglacial marine transgression was +4.5 m at c. 7 ^{14}C kyr BP. Sites on the south coast of **Western Australia** displayed a RSL of +1m by c. 7.5 cal kyr BP. There appears to have been a substantial stepped fall of RSL on the Western Australian coast somewhere between 3.8 cal kyr BP and after 3.6 cal kyr BP. This is not what would be expected from a dominant hydro-isostatic signal, and is more suggestive of eustatic contributions (Lessa and Masselink, 2006).

The most complete and currently accepted Holocene RSL curve for **New Zealand** is largely based on data from tectonically “quiet” areas near Dunedin and Auckland (e.g. Hayward et al., 2002). Sea level rose from c. 25 m below present at c. 9 cal kyr BP to reach its present height at c. 7 cal kyr BP. Since then, RSL has been no more than 1 m above and no more than 0.5 m below the present height.

Being remote from Quaternary ice sheets, the **South African** coasts have experienced only minor isostatic movements. Ramsay (1995) produced a 9000 year record showing early

Holocene RSL rise to a mid Holocene highstand of +3.5 m at 4.7 ^{14}C kyr BP with RSL subsequently falling below present levels, but also showed a secondary highstand at 1.6 ^{14}C kyr BP (+1.5 m) before current RSL is attained at 0.9 ^{14}C kyr BP (Ramsay, 1995). A second investigation in South Africa has concentrated on a saltmarsh lagoon on the southwest coast (Compton, 2001). This lagoon reflects more Atlantic rather than Indian Ocean processes. The RSL record, derived from calibrated radiocarbon dated saltmarsh peats agreed with Ramsay's two mid-late Holocene highstands theory (Figure 3i).

Milne et al., (2005) compiled Holocene RSL data from the Atlantic coast of **South America** to understand the cause of the observed spatial trend and estimate a eustatic signal for the Holocene. Milne et al. (2005) concluded that the quality of the RSL data from mid Atlantic locations was poor, with large age and altitude uncertainties and added complications provided by the possible effects of tectonic and isostatic factors associated, respectively, with Andean uplift and the loading effects of the Patagonian and Antarctic ice complexes. Within the Beagle Channel, Milne et al. (2005) demonstrated a pronounced high-stand of +6 m at 6 cal. kyr BP, followed by a fall to present by 3 cal. kyr BP (Figure 3j).

3. Conclusion

High quality RSL data from the mid-latitudes reveal spatial and temporal variations among eustatic, isostatic (glacio and hydro) and local factors since the LGM. Such data are used for many applications, ranging from calibrating models of earth rheology and ice sheet reconstructions to the development of coastal lowlands and human occupation. However, there are still many open questions related to reconstructing former RSL (MS 145 and 146). Figure 3 and Table 1 show the variety of methods of interpreting RSL changes. These RSL analyses attempt to determine how sea level has varied by plotting index points on a scatter plot with RSL as the dependent variable. However, sea-level index points should be shown with an error box or envelope that demonstrates the full assessment of RSL and age errors. Errors that are often ignored in sea-level analyses included: (1) the uncertainty in the relationship between a given indicator and the local to regional paleoenvironment in which it is formed (known as the indicative meaning) (2) sediment compaction and tidal range variations; and (3) calibration of radiocarbon dates, and if appropriate the application of the Marine Reservoir Effect.

Word Count: 3966 (excluding figure and table captions)

Region	Relative sea-level description	Reference
Newfoundland	From 13 ^{14}C kyr BP to present RSL curves show either continuous falling RSL with a marine limit at 120 m (Figure 3a) or RSL dropping below the modern level before rising once more.	Shaw et al., 2002
Maine	RSL fall from 70-129 m above present sea level at 14 ^{14}C kyr BP to a lowstand of -60-65 m at 10.5 ^{14}C kyr BP. RSL rise at a generally decreasing rate to present.	Barnhardt et al., 1995
Delaware	Continuous rising RSL from 12 cal kyr BP with rates of 3 mm per year before 5 cal kyr BP, 2.1 mm per year from 5 to 2 cal kyr BP and 0.9 mm per year from 1.3 cal kyr BP to present. There is no indication of an emergence during the Holocene.	Nikitina et al., 2000
Estonia	RSL fall from 12 ^{14}C kyr BP to present with a rapid rise to 42–45 m above present at 9.2–9 ^{14}C kyr BP. Sea level subsequently fell 30–35 m between 9 and 8 yr ^{14}C kyr BP.	Raukas, 2000
Northwest Scotland	RSL fall from a marine limit between 35 and 40 m at c.16 kyr cal BP through to an early-Holocene minimum. Sea-level index points define the culmination of the mid-Holocene RSL highstand of 7m above present at 7.6–7.4 cal kyr BP. The RSL highstand persisted for more than 1000 years before the onset of any significant RSL fall.	Shennan and Horton, 2002
Belgium	Continuously rising RSL from 9.3 cal kyr BP to present with rates of 7 mm per year before 7.5 cal kyr BP. At 7.5–7 cal kyr BP the RSL curve shows a distinct rate-of-rise decrease to an average of 2.5 mm per year. After 5.5–5 cal kyr BP, RSL rise fell to an average of 0.7 mm per year. There is no indication of an emergence during the Holocene.	Denys and Baetman, 1995
Portugal	Continually rising RSL from 9.8 cal kyr BP with no indication of an emergence during the Holocene. Sea-level rose at a rate of 8.5 mm per year to 6.5 cal kyr BP. Subsequently RSL rose at a slower rate of 3 mm per year, which lasted until 5 cal kyr BP.	Boski et al., 2002
South Australia	RSL rise from 10 ^{14}C kyr to a mid Holocene highstand of +4.5 m at c. 7 ^{14}C kyr, and a subsequent fall to present. RSL rose at 9 mm per year between 10−8 ^{14}C kyr BP, with a more rapid rate of 24 mm per year between 8−6.7 ^{14}C kyr BP.	Harvey 2003
South Africa	RSL rise from –30 m between 10 and 9 cal kyr BP to 0–3 m above present by 6.8 cal kyr BP. Sea level was near present between 4.9 and 2.5 ka followed by a drop in sea level of 1–2 m between 2.5 and 1.8 ka. A brief sea-level highstand of approximately 0.5 to 1.0 m at 1.3 cal kyr BP, followed by a lowstand of around –0.5 to –1.0 m at c. 0.7 cal kyr BP.	Compton, 2001
Beagle	RSL data demonstrate a pronounced high-stand of +6m at	Milne et

Channel	c.6 cal. kyr BP, followed by a fall to present sea level by c. 3 cal. kyr BP.	al., 2005

Table 1. Summary of relative sea-level change from selection mid-latitude regions

Figure Captions

FIGURE 1. The relative sea-level curve for the last glacial cycle for Huon Peninsula supplemented with observations from Bonaparte Gulf, Australia. Error bars define the upper and lower limits (modified from Lambeck et al., 2002).

FIGURE 2. Sea-level zones and typical relative sea-level curves deduced for each zone by Clark et al. (1978) under the assumption that no eustatic change has occurred since 5 ka BP.

FIGURE 3. Selected relative sea-level observations for the mid-latitude: (a) Newfoundland (Shaw et al., 2002); (b) Maine (Barnhardt et al., 1995); (c) Delaware (Nikitina et al., 2000), which includes wide error envelope; (d) Estonia (Raukas, 2000); (e) Northwest Scotland (Shennan and Horton, 2002), which includes index points and limiting points (data points that are above RSL); (f) Belgium (Denys and Baetman, 1995) including index points and a RSL error band; (g) Portugal (Boski et al., 2002); (h) South Australia (Harvey 2003); (j) South Africa (Compton, 2001); and (i) Beagle Channel (Milne et al., 2005). Clarke et al.'s (1978) six types of 'sea-level curve' (I – VI) are shown.