Raised Beaches and Submerged Forests – Curious Anomalies?

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Summary: *The following analysis of Holocene sea-level changes is intended as an overview for the general reader. Use of specialist terminology has therefore been held to a minimum and is defined where its use is unavoidable. The purpose is to question some of the assumptions that underlie modern theories about the causes of Holocene sea-level change.*

Under gradualist geology there is no mechanism that properly explains the formation of raised beach terraces. For the sea to cut cliffs and form beaches at the shoreline requires a stable sea level to prevail for hundreds of years and then to *rapidly fall* to cut a terrace at a lower level, without leaving transitional features. If sea level were gradually changing over time, as the glaciologists tell us, then no intermediate beach terraces would be able to form.

Also around modern coastlines are sometimes found the 'submerged forests'; a term that applies to any form of land-based vegetation found below beach sand. Usually however, it is the presence of mature tree roots, still in their position of growth that draws attention to such features. Young trees cannot grow in salt water, so again it implies a *rapid rise* of the sea to submerge the mature woodland and bury the roots with sand. Gradual flooding would have allowed them to be eroded away by the tides.

The standard theory of climate and sea-level change, as it has evolved, need only be summarised. It represents primarily 'western' science, from surveys by American, European and Australian fieldworkers which are then extrapolated to give a world view. On this theory, over the past million years, there have been some twelve glaciations; the most recent cold period, often simply referred-to as 'The Ice Age', reached its peak around 18,000 years ago before rapid warming to the interglacial *Holocene* epoch around 11,700 years ago. The text-book consensus is that at the peak of this most recent glaciation, the North American 'Laurentide' icesheet expanded to a depth of some 3,500 metres as it spread across Canada and Greenland, and the northern icecap further extended across northern Britain, Scandinavia and on into the Arctic Ocean.

In the 1960s when the Milankovitch astronomical theory of ice ages gained general acceptance then it took control of all theories of past climate and sea-level. It offered a process acceptable to the gradualist consensus. For regions such as the Canadian arctic, Scandinavia and Northern Britain, where the scouring of former icesheets and the apparent rebound of the land is visible in the landscape, this leads to the simple equivalence of where did all this meltwater go? Plainly it went into raising the sea-level worldwide, perhaps by as much as 120 metres; often we find this referred-to as the 'post-glacial sea-level rise' and its drowning of the coasts as the 'Holocene Transgression'. At the last glacial maximum (LGM) around 18000 BP sea levels were at their lowest and since then have risen as the icecaps melted. These broad outlines and their astronomical causes are not challenged here; the question is whether there were also other forces at work.

Among many consequences, the post-glacial sea-level rise explains the drowning of the North-European continental shelf, separating Britain and Ireland from the rest of the continent. The shallow North Sea basin must have been dry land when so much of the world's water was locked up as ice. This was further confirmed when trawlers began to drag-up animal bones and flint arrowheads. Conventional dating for the submergence of this former tundra region follows the glacio-eustatic theory, suggesting that it was drowned around 8500 BP when the land-bridge between Britain and the continent was finally severed. The shallowest part of the North Sea: the Dogger Bank, may have lingered on until the soft sediments were eroded away like so much of the

modern east coast of England. The constraints of glacio-eustatic theory therefore dictate that similar low-lying land around Britain and Ireland must similarly have been drowned around the same time. The drowned forests found below Welsh and Irish beaches suggest that the submergence stabilized around 5,000 years ago. A prime example is that at Borth, mid-Wales.[1] For a pictorial view of this ancient forest see the Daily Mirror website report following Storm Hannah in 2019.

The submerged forest at Borth was dated to c.5300-5100 BP with other examples similarly but less securely dated around the British coasts.[2] Raised beach terraces of Holocene age are not found around North Atlantic coasts.

Across arctic Canada and Scandinavia the creation of a sequence of raised-beach terraces can be convincingly explained by the rebound of the land since the removal of the ice burden; a process termed 'glacial isostasy' together with 'glacial eustasy' for its effect on the sea level. The specialists assert that the Milankovitch orbital factors, together with glacial eustasy and isostasy, can explain all of the variations. There is also a tendency, in any field of academic excellence, for researchers to go out into the field and discover what they are expected to find. So much of modern theory is based on theoretical 'modelling'. To avoid textbook bias, it is necessary to strip-out such preconceptions. Of value is solely the 'pure' dating evidence from samples collected by fieldworkers and their height relative to sea-level. It is often difficult to isolate the pure unbiased data in the specialist studies. As an example of the difficulties, see the paper by Kaplin-et-al (1993) which sought to reconcile various sea-level data across the vast area of Russia and Siberia. [3]

However, the key assumption that a vast ice sheet existed in the High Arctic of Siberia and Beringia throughout the LGM and then melted-away has been called into question by recent research in the Chukchi Sea.[4] The primary focus was to investigate transgressions dating from earlier epochs, the most recent being the Krasny-Flagian Transgression (named after the "red-flag" valley on Wrangel Island where it is extant) and dated 64,000-73,000 years ago. The reasonable conclusion is that no more-recent ice sheet could have existed in this area or it should have destroyed these older features. The Chukchi Shelf was ice-free throughout the LGM and also into the Holocene, as is evident from the survival of dwarf mammoths on Wrangel until c.2500 BC.[5] Such creatures must have been isolated there for thousands of years for the dwarf species to evolve.

More recent studies would put the eastward limit of any glacio-isostatic rebound at the longitude of Novaya Zemlya and Franz Josef Land and therefore the supposed northern icesheet was confined to the Barents Sea and westwards.[6] The northern icecap was decidedly lop-sided and centred upon northern Greenland. How Siberia – today the northern-hemisphere's coldest region – could remain ice-free, is an enigma. As a digression, it has been suggested that Kerguelen Island, at the antipodes of Greenland, may have been completely covered by an ice sheet throughout the LGM;[7] another enigma that is unexplained by conventional theories.

Other indicators also come from the far-east. The conclusion of Kaplin-et-al was that the 'Holocene transgression' created beach terraces above present day in Chukotka (far-east Siberia) and Primorye (Amur coast) but apparently not in Kamchatka, suggesting "different tectonic regimes".[8] The data itself is highly confusing. For example, a beach terrace 5-7 m above sea level in Krest Bay, Chukotka was only loosely dated "from 8-5 ka BP";[9] these are contemporary with the so-called Jomon terraces of Japan.

Shell middens of the indigenous Jomon culture may be found on raised beach sites around modern Japanese coasts. The Jomon were hunter-gatherers and their middens – heaps of discarded shells – indicate where they lived. This is quite perverse compared to the situation in Europe and America, where the coasts of equivalent age have been drowned beneath the 'post-glacial sea-level rise' and

we find instead the submerged forests; but for Europe one is only permitted to whisper about the possibility of Neolithic and Mesolithic human settlements submerged offshore.

Japanese archaeologists classify the Jomon culture into various eras. The first people arrived around 12,000 years ago when the islands were joined to the Asian mainland; they may have been related to the Ainu of modern Hokkaido. The Initial Jomon is dated 8000–5000 BC. By this period, the rising sea had separated the southern islands of Shikoku and Kyushu from the main island of Honshu. The Early Jomon (ca. 5000–2500 BC) is defined by shell-middens of a coastal fishing culture and pottery similar to neighbouring Korea. The later Jomon phases up to 300 BC show a transition to Neolithic, before rice-farmers from mainland Asia displaced the native people.

At the LGM around 18000 BP, when world sea-levels were at their lowest, it follows that all the islands of Japan were linked together. Thereafter the sea-level rose in parallel with other parts of the world, reaching a maximum around 6000 BP (c.4000 BC) after which it apparently reversed. Specialists term this the 'Jomon Transgression' and the apparent decline of sea-level as the 'Jomon Regression'. To explain this regression is a puzzle for geomorphologists; they have to resort to local tectonic forces raising the land; or redistribution of loads on the seabed and mantle. Once such concepts find their way into published scientific papers it is assumed that some earlier researcher has 'proven' the theory and others are expected to cite it, whereas in fact, nothing is proven.

Precise dating of raised beaches is as difficult as explaining their cause. One can only say that the re-emergence must be older than the most recent datable artefacts found on them and younger than the marine organisms found within them. The Jomon shell-middens also give an indication of the proximity of the sea, based on whether they are marine or fresh-water species. A dateable example of this is the Futatsumori Shell Midden.[10] This settlement features an extensive midden from the Early through to the Middle Jomon period (approx. 3500 – 2000 BC). The plateau lies at an altitude around 30m and covers an area of about 35 ha on the west bank of Lake Ogawara near the Pacific coast.

Another example lies at the entrance of Ogushi Bay in the Goto Islands off Kyushu. The researcher Esaka in 1967 discovered Early Jomon pottery and used this to estimate the age of the beach terrace.[11] More recent researchers used 14C dating of the shells cemented in the beach-rock to date the terrace to 5650±150 BP.[12] The researchers conclude that the sea has been comparatively stable and the terrace has been continuously above the sea during the past five thousand years.

However, such anomalous high sea-level are not restricted to Japan. For Korea, Song-et-al conclude that the Yellow Sea stood 1-2m higher than present between 7800 and 5000 BP before falling to modern levels; but again their analysis is heavily influenced by glacio-eustatic modelling.[13]

Equivalent sequences of Holocene raised beaches are extant further south. In China, we find that the entire plain of the Huang-Ho River was first occupied by farmers only since about 5000 BP. Wang and Zhao cite "hundreds" of 14C dates from along the Chinese coast, from the Bohai Sea down to Hainan, to show that the maximum of Holocene transgression occurred between 6000-5000 BP followed by a subsequent regression, as in Japan.[14] At the mouth of the Yangze River, He-et-al identify two regressions and interruption of the coastal Hemdu culture between 6700-6300 BP and again 5600-5000 BP.[15] They conclude that the East China coastal plain was a shallow sea earlier in the Holocene. Rollet-et-al also find that a shallow estuary filled the Fuzhou basin (opposite Taiwan) during the mid-Holocene highstand;[16] and small islands existed that were occupied from 5500 BP onwards. It is from this era that seafaring to Taiwan and beyond first began (proto-Polynesians).

Two of these 'islands' of settlement in the Fuzhou Basin between 5500 and 5000 BP were situated 80 km inland of the modern Chinese coast, after which the regression of the sea allowed rapid human settlement and rice farming on the newly emerged coastal plain.[17] This is the same era at which we find the submerged forests around British and Irish coasts. If the sea can regress by this distance (by whatever process) then it could also transgress the coast by a similar amount in other places; but no specialist researcher would dare suggest that we should look 80 km offshore around Atlantic coasts to locate submerged Neolithic settlements! Such is the limitation in thinking that constrains academic research. To find such free discussions then you have to consult older coastal studies that predate the glacio-eustatic theories of the 1960s.

South of the equator, Australia is considered to be a relatively stable sea-level zone, free of tectonic and glacial influences. Studies of the Great Barrier Reef in the 1970s established that sea level had reached close to present shorelines around 6000 bp (uncorrected), confirmed by more recent discovery of older drowned reefs.[18] The extensive review by Lewis-et-al of all the dating evidence confirms this but with regional differences.[19] Australian researchers will dispute whether there was a mid-Holocene highstand as in China (it seems to depend on whether they believe tubeworms are a good indicator of sea-level) while others think there were 'oscillations'.

Further south for Tasmania there seems to be general agreement that there was no mid-Holocene highstand and that the separation from the mainland occurred quite early in the Holocene, well before the level reached current shores;[20] yet evidence of Aborigine settlement suggests they were still able to reach it by canoe until c.6000 BC, which is suggestive of lowered shorelines.[21] It should be noted that Tasmania is at latitude (c.40^{o}S) comparable with Spain and Japan; there is no continental land at higher southern latitudes to compare with northern hemisphere coasts, or with South America.

South America lies almost exactly at the antipodes of the East Asia coast and exhibits a similar pattern of raised beach terraces along an emergent coastal plain. Coastlines along the Pacific are difficult to assess due to the severe tectonic forces uplifting the Andes, but on the Patagonian side there have been a number of recent studies and attempts to explain the raised beaches.

Along the Patagonian coast, seven terraces of various ages are identified at heights between 8m and 186m, with naturalists since the nineteenth century noting the presence of marine fossils and shells on the coastal plain. At all the locations studied the highest Holocene terrace is considered the oldest, with the lower terraces being younger regressive features. For example, the sites at Camarones and Bahia Bustamente (central Patagonia) gave dates between 5380±70 BP and 6708±40 BP for terraces 6-7m above modern sea level.[22]

A similar pattern of terraces and raised lagoons continues north as far as the Brazilian coastal plain around Rio de Janeiro, where transgression peaked between 4590 and 5100 BP.[23] However here, the terraces are evident at lower levels than in Argentina, around +2.5m. It is generally recognised that the South American beach terraces are tilted, being at their highest in the south of Patagonia.

An interesting study of the Rio de la Plata estuary is that of Prieto-et-al.[24] The estuary has taken its present form only since the regression of the sea; in earlier times the estuary extended further inland along the Paraná River (Argentina) into which the Uruguay River then flowed. The researchers consider that the River Paraná then met the sea near the modern city of Rosario, which is some 250 km upstream of the present-day tidal estuary; they cite the dating to 6296 cal BP, of a baleen whale carcass found near Baradero. The modern Paraná Delta was certainly in place by 2243 BP when there is evidence of human occupation. The researchers suggest a "rapid fall" of the sea from a maximum at 5800-5200 cal BP. Perhaps a more precise dating indicator from the same study may be

found at Aroyo Solis Grande (east of Montevideo) where they suggest that salt-marsh vegetation shows the highstand at 6300-5100 BP followed by a transition to brackish freshwater marsh between 5100 BP and 2900 BP.

Comparisons with China and Japan are significant here; we see, on opposite sides of the world at the same era, a comparable regression of the sea by many kilometres in shallow estuaries. In both regions we see the creation of new coastal plains. This correspondence must be contrasted with the formation of the submerged forests and peats around European coasts.

Take a step-back for a moment and consider what this means. There can only be one worldwide (eustatic) sea-level at any given epoch. The evidence is therefore demanding a geological process that can raise the vast area of land from Siberia down to China out of the sea by several metres and the same again for all of South America; and all this within only a matter of decades; while simultaneously land in the North Atlantic and perhaps also around Australia is sinking. In most of the sea-level studies cited (and others) one will see little reference to the fact that our planet is a dynamic rotating system; with the sea-level at any location determined by a balance of gravity versus the centrifugal rotation tending to throw it outward. The *geoid* or ellipsoid of the Earth varies by 13 miles (22 km) between the polar and equatorial radius. A variation of only minutes of arc in the polar locations would be all that is required to cause sea-level variations of the order that are observed.

There are other contemporary indicators away from the coasts that could be included. These mid-Holocene coastal events are coincident with climate changes. Pollen evidence defines the Atlantic-Sub-Boreal (warm to cooler) transition in Europe around 5,000 years ago. A fluctuation of glaciers in the Alps and the Andes also occurred at this time; the desertification of the Sahara region also began at this era. One could continue this list of mid-Holocene anomalies. The problem goes much wider than just fluctuating sea-levels.

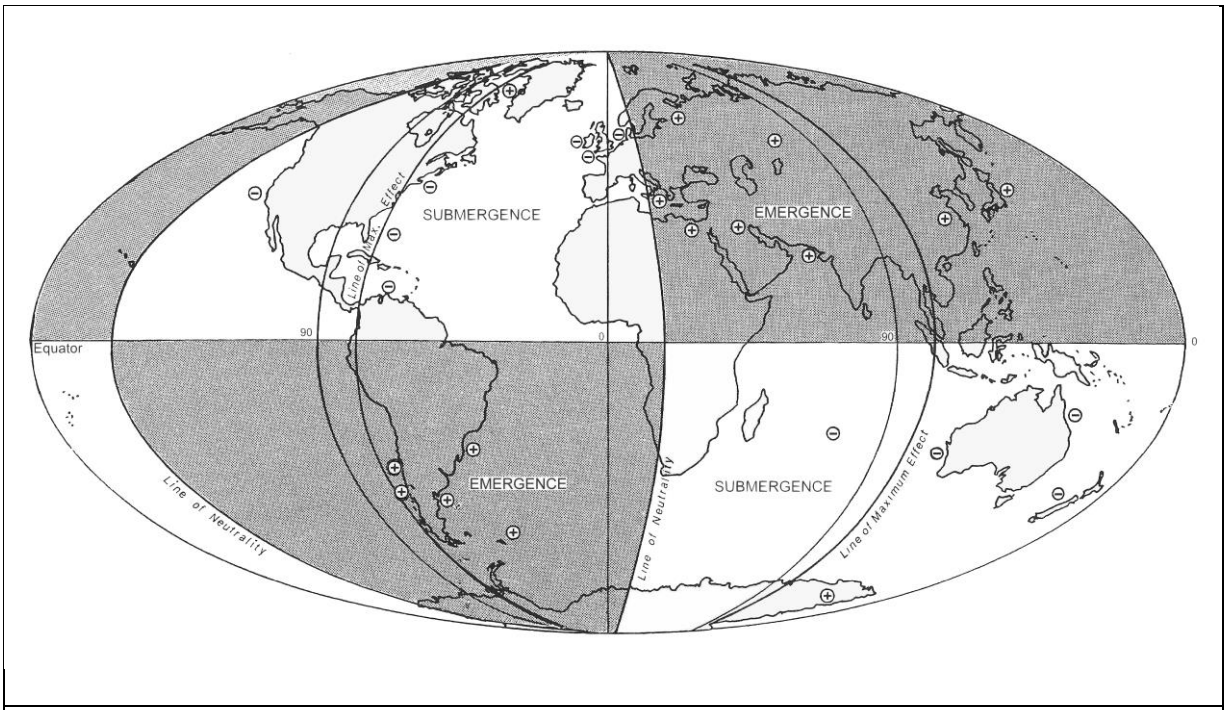
In recent decades some new terminology has come to the fore within sea-level studies. The sites of former icecaps are termed ‘near-field’, whereas those regions further away, where secondary uplift effects are perceived, are termed ‘intermediate field’ and ‘far-field’. The proposal is that the rises and falls of the coastlines in the mid-Holocene, due to the perceived eustatic and isostatic factors, could be explained by a ‘forebulge’ in the mantle below the sea-bed further away from the seats of glaciation.[25] In summary, this bulge first raised the sea-bed but as the ice melted so the mantle returned to “former load centres”; this forebulge-collapse mechanism is offered to explain submergence followed by emergence; with the weight of ocean water fighting against the rebound with different results according to local conditions. While this may have some merit for South America, it is difficult to see how such a forebulge-collapse in East Asia could be explained by rebound from a non-existent ice sheet in Siberia; or indeed why raised-beach terraces of similar age are not found around Europe and America, where instead we find submergence. It cannot explain *why* the northern icecap was apparently centred on Greenland rather than the North Pole; still less could this mechanism explain the rapid climate swings ongoing at the same era. It seems that attempts to explain how coastlines could be simultaneously high in one region while being low in another are becoming ever-more elaborate and shrouded in jargon.

The weakness in all of the various glacio-eustatic ‘models’ is that estimates of loading on the sea-bed are based upon assumptions about how much ice has melted since the Pleistocene ice age; and the thickness of the ice-sheets are themselves calculated based on estimates of how much the sea-level has risen since they melted. It may be seen that the whole process goes around in a circle of assumptions.

A wide-ranging critique of the confusion and anomalies at the heart of modern sea-level research may be found at the notrickszone website. The website's authors argue, based on 80 published sources, that rising sea-levels today are not the result of increased carbon dioxide in the atmosphere (no comment). However, they do have a point that former warm-climate and high sea level regimes cannot be cited to make a case for it while the specialists remain so divided over the interpretation of ancient coastlines.

If one may attempt to summarise by focusing only on the 'pure' dating evidence of raised beaches and submerged forests (and set-aside the text-book models that may bias how the specialists present their results) then we may discern a pattern of sea-level change in alternate quarter-spheres *since c.6000 BP*. The precise date of such change is only as good as the samples chosen for dating by the various fieldworkers and published in their papers. To pin down a *precise* date for the transition would require specialist researchers to seek unambiguous dating evidence together with a more open-minded attitude from academic referees, to allow such work to be published for others to cite. Unfortunately, this is not how the academic process works. Usually, as we saw with the advent of radiocarbon and tree-ring dating, the eminent authorities will defend an established theory until some unexpected discovery renders it completely untenable.

Tags: sea level change, Holocene sea level, pole shift, ice ages, raised beaches, submerged forests, Holocene climate, pollen zones



The pattern of sea-level change since c.6000 BP plotted on an equal-area projection, as published by the author in 1995; each 'plus' or 'minus' sign marks a site with a published or an accepted date as to how the sea level (or the land height) has changed since that era. Inland sites where the snow or tree line has changed (itself simply a height above sea-level) can be just as useful in establishing such a pattern. Such a quarter-sphere pattern would be indicative of *a small pole-shift* since this date, in addition to the glacio-eustatic influences. Any evidence of earlier pole-shifts during the ice-ages would now be drowned beneath the post-glacial sea-level rise. Further discussion and cross-disciplinary correspondences with sea-level evidence may be found in my books Atlantis of the West and Towers of Atlantis.

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