

# Bulletin of the Geological Society of Norfolk

No. 73 (2023)

Published January 2023

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ISSN0143-9286

## A REVISED MUD BUDGET FOR THE NORTH NORFOLK COAST

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### ABSTRACT

*We present an updated mud budget for North Norfolk coast (NNC) cliff erosion and mud demand for mudflat and saltmarsh accretion. Since the last such budget in the 1980s the rate of regional sea level rise has doubled, which means that the accommodation space created in low lying coastal environments (mudflats and saltmarsh), and therefore the demand for mud to infill this space, has also doubled. We calculate a total sediment yield for the North Norfolk cliffs (Weybourne to Happisburgh) of  $1078 \text{ kT a}^{-1}$  and a total mud eroded figure of  $412 \text{ kT a}^{-1}$ , in line with previous estimates. Our new mud demand estimate, using revised NNC saltmarsh/mudflat area (Weybourne to Holme) and a revised bulk density term, is  $102 \text{ kT a}^{-1}$ . Mud supplied by cliff erosion is thus about three to four times the amount currently demanded by NNC mudflat and saltmarsh accretion. However, decadal scale variability in East Anglian cliff retreat rate, linked to variability in storminess, could result in significantly more or less erosion than the long term mean. The lower figure implies that during some future decades mud supply from erosion of these cliffs could reduce by 75% to around  $112 \text{ kT a}^{-1}$ , only slightly more than the mud demand figure for continued NNC saltmarsh and mudflat accretion. This raises the possibility of at least temporary low coast drowning which could change the overall geomorphic response of the NNC mudflat/saltmarsh continuum.*

Bull. geol Soc. Norfolk (2023), **73**, 3-20.



## ORGANIC CARBON AND METALS IN STIFFKEY SALTMARSH, NORTH NORFOLK COAST

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### ABSTRACT

*We present organic carbon and selected metals data for Stiffkey saltmarsh on the North Norfolk Coast in an effort to quantify modern fluxes and to use this framework to better understand Holocene storage. Stiffkey salt marsh is well suited to such analysis as its Holocene sedimentology, its chronology and sediment accretion rates are well constrained. Organic carbon stored in the upper 70 cm of the upper salt marsh is largely terrestrial saltmarsh refractory organic matter (plant roots and stems); it has escaped strong diagenetic alteration once buried below the modern near-surface root mat and represents a reliable record of the long-term stored component. The high saltmarsh carbon flux values in the upper 18 cm are mostly between 70-80 g m<sup>-2</sup> a<sup>-1</sup>, while the lower saltmarsh carbon flux values in the upper 22 cm have a mean value of 255 g m<sup>-2</sup> a<sup>-1</sup>; these carbon flux values are strongly positively linked to sediment accretion rate. By measuring depositional areas we calculate spatial carbon storage values on a variety of timescales; e.g. the subsurface sediments at Stiffkey are estimated to have stored ~0.64 million tonnes of organic carbon over the last 5700 years. The metals data show these saltmarsh sediments had a predominantly natural source of Cu and Zn; however, Pb contents decrease markedly in the upper 10 cm (ca. mid-1970s) probably recording decreasing atmospheric Pb deposition following the phase out of tetraethyllead in automobile petrol fuel in the late 1970s-1980s.*

Bull. geol Soc. Norfolk (2023), **73**, 21-47.

**TWO LATE PLEISTOCENE *HIPPOPOTAMUS* BONES FROM THE WAVENEY VALLEY, WITH A REVIEW OF PLEISTOCENE VERTEBRATE SITES AROUND HARLESTON, SOUTH NORFOLK**

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**ABSTRACT**

*A recent find of bones of Hippopotamus amphibius Linnaeus, 1758 from the vicinity of Harleston, Norfolk, is the first record of this species in the Waveney valley for over a century. An account of the specimens is given and their likely context and find-spots are discussed. Local quarries are reviewed, some of which have yielded Pleistocene vertebrate remains, and the significance of quarries at Homersfield and Flixton for post-Anglian biostratigraphy is discussed. Three plausible source localities for the bones are identified. 1) Shotford Heath – the lowermost quarry ('Ocean Pit') developed in Floodplain Terrace (No. 1) at about +14 m OD. 2) Wortwell Quarry - developed in Floodplain Terrace (No. 1) at about +12 m OD. 3) Earsham Quarry – developed in Floodplain Terrace (No. 1) at about +5 m OD.*



## **THREE VIEWS: COMPLEX POST-EXHUMATION HISTORY OF A CHALK COBBLE, NORTH NORFOLK**

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### **ABSTRACT**

*A complex chalk cobble collected from the north coast of Norfolk between Cromer and Overstrand contains a mixed suite of palaeontological and neoichnological features preserved in close association. These features allow the history of the clast to be determined in some detail. The clast has been rolled on the seafloor; it retains a large Cretaceous invertebrate macrofossil, Eupatagus ex. gr. scutata (Leske), that has, in part, been modified by modern borers. Half of the clast has been bored by modern sponges and bivalves, modifying the surface of the clast. These borings provided protection for invertebrate shelled nestlers and encrusters (spirorbids and serpulids).*

## **BOOK REVIEW**

### **THE SEA: NATURE AND CULTURE**

**Richard Hamblyn, Reaktion Books, London 2021. 239 pp. £16.95**

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The Sea is one of the fine ‘Earth series’ published by Reaktion Books. I have a number of these volumes on my shelves, such as Volcano, South Pole and Cave, all of which are informative and well-thumbed. All are readable and printed on high-quality glossy paper. Illustrations are well-reproduced and commonly in colour. The Sea is a worthy addition.

The Sea includes an introduction, five chapters and an afterword; a timeline, references and websites, acknowledgements and index. It is a book that examines man and the sea from several directions, all logical and worthwhile. Why the sea? Hamblyn makes an unarguable case; “... physically it covers more than 70 per cent of the Earth’s surface, while conceptually it overwhelms the human imagination” (p. 8).

Speaking as a geological beachcomber, it is the interaction between the land and the sea that defines my research direction and my own sense of awe. In ‘Shorelines’ (chapter 1) Hamblyn is walking in my manor. His main interest here is the shoreline as the edge of the sea, the zone of interaction between man and the sea, a contact that can start when we are very young. The tides and waves are most apparent on the shore, so we are first made aware of the motions of the sea on the coast. But the shore can embrace a multitude of sins, from saltmarshes through to the sand flats of Southport at low tides, through dunes to epic cliffed coasts such as the Cliffs of Mohr and the Atlantic east coast of Barbados.

Bull. geol Soc. Norfolk (2023), **73**, 95-97