# Origin of the black sandstone at One Tree Point, Whangarei Harbour. Geocene 20: 13-14.

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# ORIGIN OF THE BLACK SANDSTONE AT ONE TREE POINT, WHANGAREI HARBOUR

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## Introduction

Twenty-six members of Auckland Geology Club visited One Tree Point on the south shore of Whangarei Harbour (Fig. 1) in May 2019. We were primarily looking at the subtidal through intertidal to subaerial dune sand sequence and evidence for higher sea levels during the Last Interglacial (Nicol, 2002; Hayward, 2016). The sedimentary features and trace fossils within the uncemented intertidal sandstone are highlighted by the presence of laminae of black, titanomagnetite sand within the more abundant white quartz sand (Figs 1, 2; Gregory and Campbell, 2005). These cliffs expose an erosional face through a series of Last Interglacial sand dune ridges with thin lenses of peat on top of them. There is another belt of sand dune ridges of Holocene age 1–3 km seaward of these older dunes. During the Holocene, an extensive peat swamp existed between the two sand dune belts. This peat swamp is now drained, but thick peat underlies a swathe of flat, low-lying land south and inland of One Tree Point (Edbrooke and Brook, 2009).


Fig. 1. Google map of northern half of Bream Bay's prograded foreland barrier showing location of the One Tree Point cliff section immediately west of the boat ramp where the unusual black-stained sandstone occurs. Note the linear beach ridge lines.

## Observations

The low cliffs, extending for about 100 m west from the boat ramp, are composed of more cemented and weathered or case-hardened sands (often tinged orange by iron oxide weathering; Fig. 3) than those forming the higher and fresher bluffs a further 100 m to the west. Initially we were perplexed by the dark, in places black, colour of the seemingly quartz-rich sands below high tide level in the more cemented cliffs near the boat ramp (Fig. 4). It was tempting to think that black colour was also from titanomagnetite grains, but the sands here were non-magnetic and the sand grains appeared to be quartzose.


Fig. 2. Laminae of white quartz and black titano-magnetite in the upper part of the Last Interglacial high-tidal beach facies, highlight the sedimentary features and trace fossils.

Upon closer examination it was clear that the black colouration was not a primary sediment feature, as the colouration cut across sediment packages. The upper limit of pervasive blackness approximated extreme high tide level through all these cliffs. Close observation suggested that the blackness was derived from fine black organic matter deposited between the sand grains. In one small point of more-cemented sand there were numerous irregular (in places branching) black veinlets of organic mud (up to 1 cm thick) intruding these black-stained sands (Fig. 5).

Fig. 3. The low cliffs 0–100 m west of the One Tree Point boat ramp are made of dark-coloured (lowest part), and orange iron-stained, weakly cemented sandstone. The higher black horizons are rich in magnetic titano-magnetite grains.

Fig. 4. Cliffs 50 m west of the One Tree Point boat ramp showing the lower black-coloured sandstone the nature of which caused considerable initial debate.

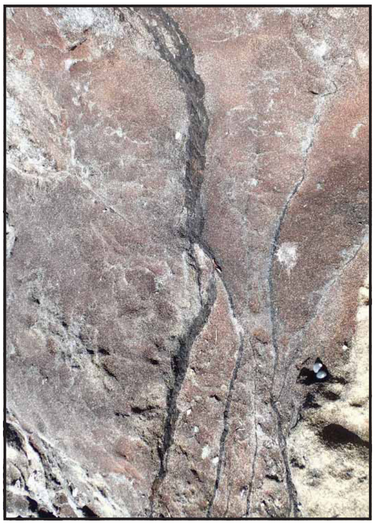

Fig. 5. Veinlets of black organic silt intruding weakly-cemented sandstone at about high tide level, about 100 m west of One Tree Point boat ramp.
Width of photo 50 cm.

## Hypothesis

We infer that:

1. The fine organic matter that has infiltrated and stains the sand in the intertidal part of the cliff (Fig. 6) and fills the unusual black veinlets (Fig. 5) is derived from the thick Holocene peat inland to the south.
2. The organic matter has been transported up to 2 km through the highly permeable Last Interglacial sands by flowing groundwater. The elevation of the top of the groundwater would have been controlled near the coast by the tides, with the freshwater flowing through and out of the cliff sands in the intertidal zone (up to extreme tide level) when the tide was out.
3. Some of the organic matter has been trapped in the Last Interglacial sands or bound in with the oxidized iron oxide, resulting in the dark or black colouration of the originally white, dominantly quartz sand.
4. The movement of this organic-rich groundwater could have occurred only during the mid-late Holocene

Fig. 6. The nature and origin of the black-coloured quartz sand at and below high-water mark (lower one third of the photo) west of the boat ramp at One Tree Point caused considerable discussion amongst the visiting Geoclubbers.

(about the last 5000 years) after the peat had started accumulating and after sea level had returned to near its present level after the end of the Last Ice Age.
5. Migration of, and cementation by, organic derived material has been documented elsewhere in Northland – Molloy (1988) notes that areas of old coastal sands have often developed podzol profiles under former kauri forest. In these places, organic-rich topsoils pass into leached E horizons. Below this white podzolised layer, sand grains have become cemented together by the migrating humic and aluminium compounds.

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