



### THE 70 AND 45 METRE O.D. STRANDLINES IN THE VALE of PICKERING

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#### Introduction

While Carvill Lewis (1894) is accredited with the earliest recognition of a glacial or extra-morainic lake in the Vale of Pickering by Kendall in 1902, the first mention of two temporally defined stands of a Glacial Lake Pickering was provided by Straw (1979). Straw (1979) considered that the two phases of the glacial lake included a high-level phase at 70 m O.D. and a low-level phase at 45 m O.D. Evans *et al.* (2017) likewise also recognized two levels of Glacial Lake Pickering. Based on luminescence dating, from East Heslerton, Evans *et al.* (2017) concluded that the 45 m level of Glacial Lake Pickering dates to c. 17.6 ka with the 70 m lake level being much earlier and relates to ice-

damming the Coxwold-Gilling Gap and the Derwent Valley near Kirkham Priory, south of Malton (Evans *et al.*, 2017; see also Bateman *et al.* 2015). It was also considered by Evans *et al.* (2017) that the 70 m lake may have drained through a spillway at Hunmanby.

Confirmation of the generation of two glacial lakes in the Vale of Pickering resulted from landform mapping by Fairburn (2019), who identified two distinct sets of alluvial fans on both the northern and southern flanks of the Vale of Pickering: the implication of this mapping was that drainage from the Vale has been blocked on two occasions. The erosional and/or depositional boundaries of the major landforms in the Vale, such as the Hutton Buscel Terrace and Wykeham



**Figure 1.** Landform and geological map of the Vale of Pickering between East and West Heslerton showing the 45 m and 70 m O.D. strandlines and the location of Figure 4). From Fairburn and Bateman 2021, (with permission).

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**Figure 2.** Digital elevation model of part of the southern margin of the Vale of Pickering showing the hummocky chalk-gravel alluvial in between the 45 m and 70 m O.D. strandline and the location of Figure 4. From Fairburn 2019, (with permission).

Moraine at c. 45 m O.D. and c. 70 m O.D., attest to the model. Consequently, the field mapping, supported by mapping from digital elevation models (Fairburn, 2019), provide robust evidence for the validity of the glacial lakes and their imprinted strandlines. Claims by Eddey *et al.* (2022) that the geomorphic evidence for a Glacial Lake Pickering is 'weak and contested' does not appear credible.

The objective of this article, while redefining the origin and extent of the 70 m O.D. strandline on the present landscape, is mainly designed to provide additional field evidence for the validity of the more obscure 45 m O.D. strandline.

# The 70 m O.D. Strandline

A suggestion by Eddey *et al.* (2022) that there is no unequivocal evidence for a well-defined 70 m shoreline in the Vale of Pickering is not supported by the observations of Evans *et al.* (2017) or by field mapping, as the 70 m shoreline forms a distinct boundary between chalk gravel fans and the Chalk Group of the Yorkshire Wolds on the southern side of the Vale (Figures 1 and 2; Fairburn and Bateman, 2021) and between fluvial sediments and Jurassic limestones on the northern side of the Vale (Fairburn, 2019, Fairburn and Bateman, 2021). In places the boundary is enhanced by a riser above the 70 m O.D. strandline (Fairburn and Bateman, 2021). An alternative suggestion for the origin of the 70 m O.D. strandline was proposed by Fairburn (2022), who concluded that c. 70 m O.D. lake never existed and that the 70 m O.D. strandline is a rebound surface resulting from post-MIS 6 glacioisostatic uplift of terracing from a c. 40 m O.D. mid-Pleistocene lake. This rebound surface is therefore part of the surface of the so-called 52 metre Strandline, defined by Penny (1974), that rises from c. 40 m O.D. near Elloughton to 70 m O.D. near Crambe (Fairburn, 2022). That such significant post-glacial rebound can occur is based on the current realization that an MIS 6 terrestrial glaciation could have been a widespread Saalian advance in the UK (Powell et al., 2016; Gibbard et al., 2018; Evans et al., 2019, Gibson et al., 2022) likely extending from north of the Vale of Pickering to North Norfolk. A significant part of this 52 metre Strandline, between Goodmanham (55 m) and North Cliff (65 m) is shown in Figure 3. The strandline must have a maximum age of  $156 \pm 12$  ka – an IRSL date of fluvial sediments below the strandline in Yedman Dale (Fairburn and Bateman, 2021).

# The 45 m O.D. Strandline

Based on 'new geographic mapping' and 'paleographical reconstructions' Eddey *et al.* (2022) suggested that Paleolake Pickering was feasible up to 45 m O.D. It should be noted that a 45 m O.D. strandline, extending through East and West Heslerton has been mapped in the field by Fairburn and Bateman (2021). The 45 m O.D. strandline also provides a marked cutoff at the

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base of the Hutton Buscel Terrace (Fairburn 2019) and outlines the base of the Wykeham Moraine (Fairburn, 2022). It is also clearly depicted on LiDAR imagery below the Chalk Group escarpment (Figure 2). Recent newly acquired photography from near East Heslerton provides a further presentation of the 45 m O.D. strandline where it is backed by an approximate 1.0 m riser below the chalk gravel alluvial fans (Figure 4). Contrary to the mapping of Fairburn and Bateman (2021), Eddey *et al.* (2022) have interpreted the 45 m O.D. strandline as the northern boundary of the Yorkshire Wolds escarpment.

### Conclusions

Based on geological mapping and LiDAR imagery,

supported by IRSL dating (Fairburn, 2019; Fairburn and Bateman, 2021), two temporally distinct lakes (during MIS 2 and MIS 6) have been firmly identified in the Vale of Pickering. This contrasts with the opinions of Eddey *et al.* (2022) that 'geomorphic evidence' for the existence of a glacial lake in the Vale of Pickering is 'weak and contested.'

Failure to accept geological mapping in the Vale of Pickering has led to incorrect location recognition of the Wolds Escarpment.

The 70 m O.D. strandline has probably resulted from post-MIS 6 isostatic rebound.



**Figure 3.** Plot of the 52 Metre Strandline and the Jurassic/Cretaceous unconformity along the western face of the Wolds between Goodmanham and North Cliff (from Fairburn, 2022, fig. 14). The inclusion of the British Geological Survey mapping is acknowledged: Permit Number CP21/022 British Geological Survey © UKRI 2021. All rights reserved.



**Figure 4.** Photographs of the 45 m O.D. strandline taken approximately 500m west of East Heslerton. The riser above the strandline is about 1.0m. The strandline is most clearly defined on the photo top left. The Yorkshire Wolds escarpment is visible in the background of all four photographs at c. 70 m O.D.

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