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Short communication

Testing the reliability of paper seismic record to SEGY conversion on the surface and shallow sub-surface geology of the Barra Fan (NE Atlantic Ocean)

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ABSTRACT

Marine seismic reflection data have been collected for decades and since the mid-to late- 1980s much of this data is positioned relatively accurately. This older data provides a valuable archive, however, it is mainly stored on paper records that do not allow easy integration with other datasets. A method for converting these records to digital SEGY format has been reported previously, although the accuracy and reliability has not been documented. Using 3.5 kHz pinger, bathymetric and side scan sonar data we test the accuracy and data resolution of converted paper seismic records on the surface and shallow-subsurface of the Barra Fan, NE Atlantic Ocean. Frequencies of navigational updates and printed fix marks are vital in determining positional accuracy as interpolation between fixes, which may be 30 minutes apart, is a significant source of potential error. Vertical data resolution of the converted records is primarily governed by the dimensions of the printed record, with order of magnitude differences noted between the scanned BGS and NOC pinger records. Positional accuracy of pinger data is observed to be within the resolution of the bathymetric grid. BGS 1985 pinger data is located within 40 m of bathymetric constrained locations at 635 m below mean sea level and NOC 1998 pinger data within 25 m of bathymetric locations at 1180 m below mean sea level. This paper-to-digital conversion is not a replacement for modern data acquisition, but it does provide a valuable complement to such data. Where appropriate archival paper data is available for conversion it could be used to assist efficiency of forthcoming surveys and may be used to provide time series evidence of seabed processes.

1. Introduction

Acquisition of marine geophysical data is a costly process with vessel day rates routinely passing tens of thousands euros per day. Additionally, survey sites are often remote and may cause large transit time overheads. Sub-bottom reflection data has been collected for decades but much of the older data is stored on paper records and not so easily integrated with modern bathymetric data. Miles et al. (2007) discuss methodologies for converting paper seismic records into SEGY format. However, they did not test the use and reliability of this technique in the field. To this end, this paper presents work developed from Owen (2013), where archival paper seismic records were obtained from the BGS (British Geological Survey) and NOC (National Oceanography Centre) before being scanned, converted to SEGY format digital seismic files and compared to multibeam bathymetry data. Thereby making it possible to assess the positional accuracy of the conversion process on the surface and shallow sub-surface geology of the Barra Fan, NE Atlantic.

Seismic reflection surveys have been used to map the sub-surface since 1921 (Dragoset, 2005) with marine reflection surveys coming to prominence in the 1950s when they were used to map bathymetry and surface sediment types (see for example Tolstoy, 1951; Dietz et al., 1954; Damuth, 1980 and references cited therein for discussion of methodological development). Hydrocarbon industry development of airguns and digital processing in the 1960s allowed further advances in seismic stratigraphy (e.g. Vail et al., 1977) and numerous surveys have been performed since.

During that time, the technique of offshore navigation has changed significantly. The hyperbolic radio navigation system, Decca, was developed in the United Kingdom after World War II

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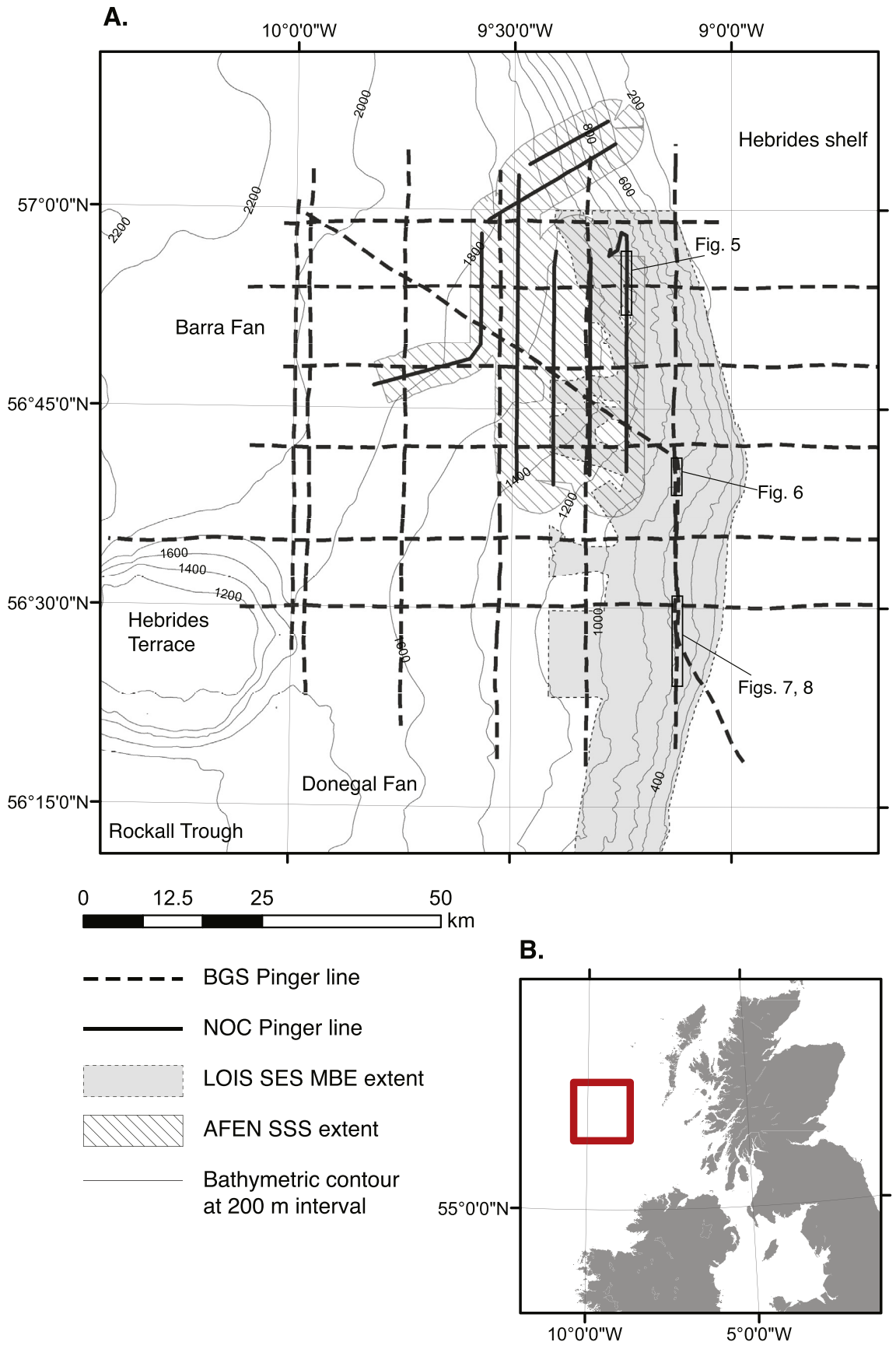

Figure 1. Location map of Barra Fan and interpreted seismic lines. A. Barra Fan study site with data used. B. Location of study site in relation to Britain and Ireland.