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# **EURASIAN SCIENTIFIC DISCUSSIONS**

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# GEOLOGICAL AND MINERALOGICAL SCIENCES

UDC 551.4.072

## CROSS-SECTIONAL MORPHOMETRY AND GEORADAR SIGNATURE OF SMALL NON-TIDAL INLET (PRORVA) CHANNELS, BLACK SEA, UKRAINE

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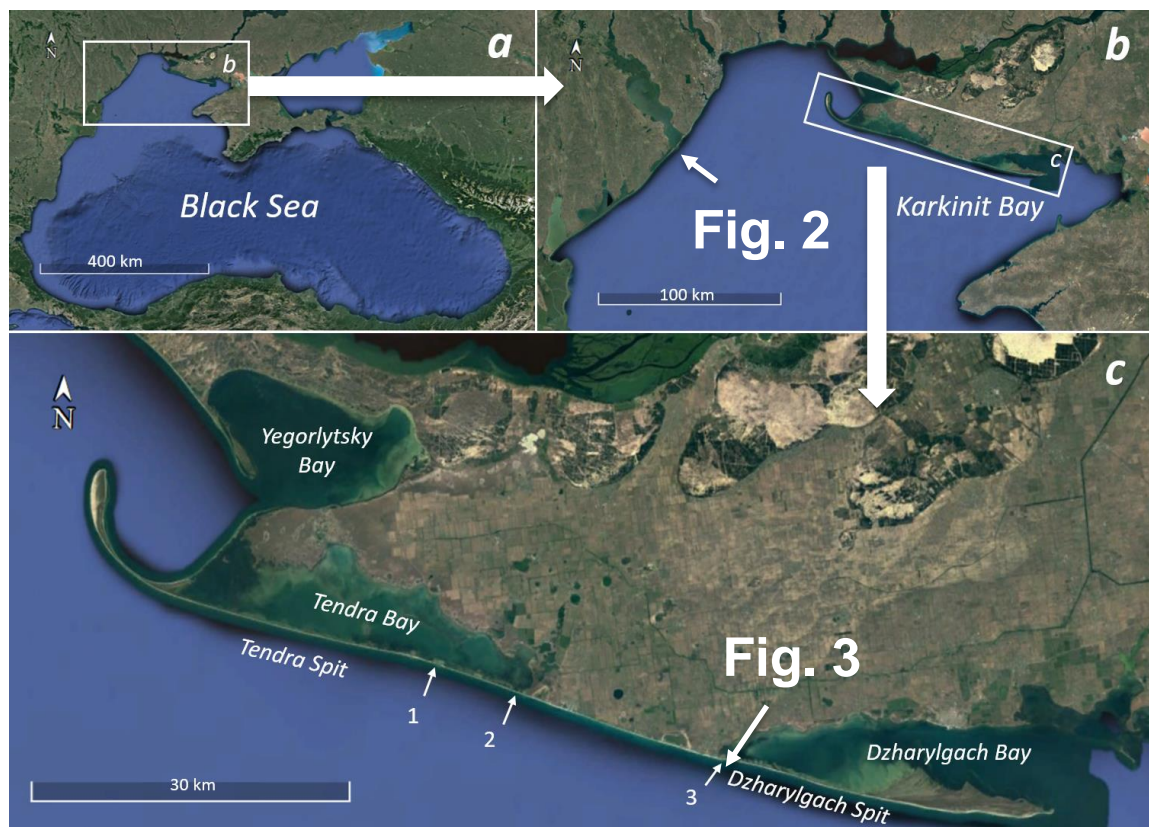
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**Abstract:** This study is the first comparison of a buried channel structure imaged with georadar and an active inlet (prorva) along the non-tidal Black Sea coast of Ukraine. A paleo-channel along the liman coast exhibits easterly dipping bounding surfaces (clinoforms) interpreted as a spit platform and culminates in a cut-and-fill structure (width ~5 m; depth ~1 m). An active channel with similar cross-sectional morphometry and dimensions is represented by Lazurnenska prorva along Kinburn peninsula. This comparative effort has implications to finding other buried channels along the barrier coasts and demonstrates the potential geological legacy of modern channels.

**Keywords:** morphology, relict inlet, cut-and-fill, clinoform, GPR



**Introduction:** Channels through coastal barriers in non-tidal settings have been relatively understudied [1], especially once inactive. Traditionally, historic or relict inlets and associated facies have been studied through geomorphic analysis or historical documents, which has a number of challenges [2-4]. With an ongoing refinement of new subsurface imaging technology, such as ground-penetrating radar (GPR), high-resolution continuous visualization of subsurface barrier architecture overcomes most of these challenges [2-6]. This paper presents the first comparison of a small modern inlet called “prorva” along the Black Sea coast of Ukraine (Fig. 1) with a buried channel structure of similar dimensions.

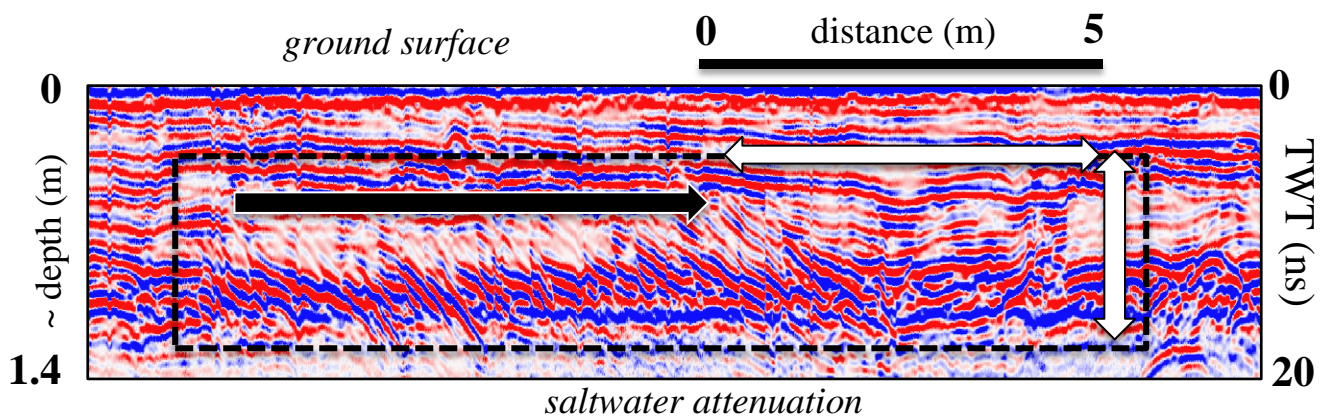


**Figure 1. Location map of the study sites: Zatoka paleo-channel (see Fig 2) and Lazurnenska channel (see Fig. 2). Image source: GoogleEarth™**

**Methodology:** The internal stratification of a buried channel in Zatoka was investigated using high-resolution, continuous imaging by MALA 800 MHz ground-penetrating radar (GPR) system, with signal velocities of 14 and 6 cm/ns for unsaturated and saturated sections, respectively (Fig. 2). Geomorphic analysis of

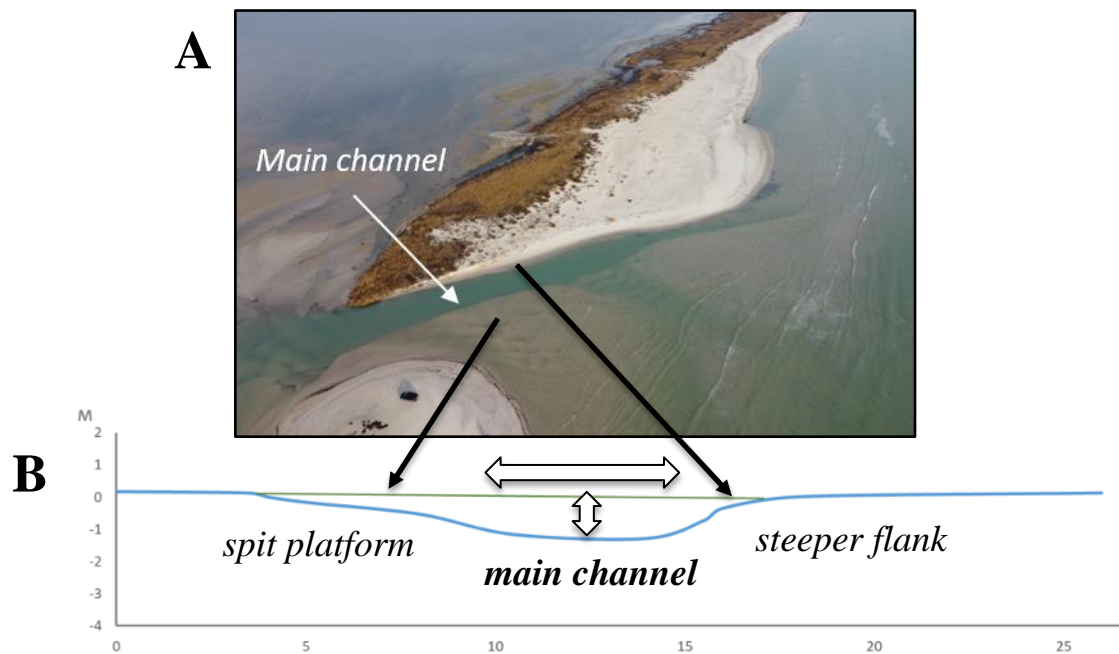
Lazurnenska channel was conducted using GoogleEarth™ satellite images (Fig. 1), historical coastal charts, and oblique aerial photographs (Fig. 3A). Channel bathymetry was measured in the field (Fig. 3B).

**Results and Summary:** In the summer of 2012, a small channel complex was imaged along the Zatoka section near Dniester Liman (Fig. 1). The image shows a series of easterly dipping clinofolds (spit platform) culminating in a channel structure with a conformable fill [3], which is ~ 5 m wide and ~1 m deep (Fig. 2). It likely represents an ephemeral prorva filled via longshore transport and aggradation.



**Figure 2. Shore-parallel GPR image of a buried channel complex (dashed box) within Zatoka barrier, which is preserved as a concave-up structure at the end of the lateral migration clinofolds (black arrow). The final channel width and depth are shown by white arrows. Note relatively horizontal bedding around the box. GPR signal velocity of 14 cm/ns is used for unsaturated channel-fill segment; TWT – two-way travel time). Compare with an active prorva morphology in Fig. 3.**

Comparisons to modern and historic breaches and inlets along the northern Black Sea coast [1], shows that Lazurnenska inlet channel along the root segment of the Dzharylgach recurved spit (Kinburn peninsula; Fig. 1) has similar morphometry (Fig. 3). The channel exhibits a gently dipping spit platform with an easterly shifted channel that has overall dimensions similar to Zatoka paleo-channel (Figs. 2 and 3B).



**Figure 3. Lazurnenska Prorva: A) Aerial photograph of an active channel with sedimentation (spit platform) to the northwest (bottom of photograph), indicating easterly sediment transport and channel migration. B) Bathymetric cross-section indicates a relatively small active channel (see Fig. 1 for location). White arrows are the same dimensions as paleo-channel in Fig. 2.**

Our study shows a preservation potential for non-tidal channels within barrier lithosomes. Identifying and mapping other historic and relict inlets, once field safety is secured following military operations, will help with paleogeographic reconstructions used in archaeological and geological research [7-11].

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