No evidence for a 10-m historical tectonic uplift at Mangalia, (Romanian Black Sea coast): Comment on Drăgușin et al. (2025)

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Abstract

Drăgușin et al. (2025) interpreted deposits at Mangalia (Romania) as evidence of a two-phase tectonic event (~14 m subsidence and uplift) during the 18th–19th centuries. Based on multi-proxy data from the same site, we show that this scenario is inconsistent with regional tectonics, stratigraphy, and archaeology. The deposits instead record the gradual infill of a coastal depression episodically affected by extreme marine incursions.

1. Introduction

Drăgușin et al. (2025) interpret deposits now ~3–8 m above sea level (asl) at Mangalia (ancient Callatis) as evidence for an abrupt, two-phase tectonic episode in the 18th–19th centuries: ~4 m subsidence permitting marine sedimentation followed by ~10 m uplift. An earlier EGUsphere version of this study (Drăgușin et al., 2024) was rejected after peer review; the published paper does not address the reviewers' main criticism. We argue this scenario conflicts with regional tectonics, stratigraphy, sedimentology, chronology, and the archaeological record, and that the deposits reflect episodic marine incursions infilling a pre-existing coastal depression (likely a sinkhole).

2. Regional and site-scale evidence do not support recent large tectonic motions

Southern Dobrogea is a stable platform province at least since the Miocene (e.g., Dinu et al., 2005; Konerding et al., 2010). At Mangalia, neither field observations nor the geophysical profiles in Drăgușin et al. show offsets, fault planes, or folds indicative of recent deformation, despite the amplitude their model requires.

Analogies invoked elsewhere are inappropriate: the New Madrid sequence produced vertical steps of order ~2 m (Mueller et al., 2004), and the 1819 Kutch event created a regional scarp up to ~4.3 m over ~90 km (Rajendran & Rajendran, 2011). Extrapolating such cases to a localized ~10 m uplift in an intraplate, structurally quiescent area is not tenable.
Archaeological and historical evidence also weigh against the hypothesized 18th–19th century bi-directional movement. Roman and Late Roman walls at Callatis, including several square towers, preserve consistent elevations with no warping or displacement (Alexandru 2024; Mărgineanu-Cârstoiu 2024). Ottoman-era remains and documentary records lack any mention of sudden vertical shifts (Radu and Radu-Iorguș 2022). Even the well-documented 1901 earthquake (M 7.2) left no comparable imprint.

3. Implied rates and timescales are geodynamically implausible

Accepting the proposed chronology would require ~10 m uplift in <200 yr, on the order of 10 cm yr^{-1} or several multi-metre steps, neither credible here. Even in active orogens, sustained rock-uplift of this magnitude is exceptional; coseismic vertical displacements typically fall near 1–2 m per event (Burbank and Anderson, 2011).
Our OSL ages for the upper sand body (their "Unit 2") of ~120–100 yr indicate recent emplacement; the tectonic model would thus demand extremely rapid post-depositional uplift without structural signature or historical testimony.

4. Stratigraphy and facies argue against continuous lagoonal submergence

At Mangalia, the contact between Sarmatian limestone and overlying loess/red-clay cover lies typically between −2 and +1 m asl (Constantinescu, 2012); a ~10 m historical uplift would more likely expose a limestone cliff rather than an active shoreline incised in unconsolidated loess. The internal organization of the sequence and our analyses of the meiofauna also contradict a prolonged lagoon:
(i) Silts (Unit 3) are dominantly non-marine. Meiofauna are largely absent or represented by reworked marine tests; freshwater ostracods (Candona) dominate, consistent with a continental wetland influenced by sulphidic springs.
(ii) Sands (Unit 2) are brackish-to-marine. Abundant foraminifera (*Ammonia beccarii, Elphidium, Quinqueloculina*) and marine ostracods (*Loxoconcha, Amnicythere, Cyprideis torosa, Cytheroma variabilis*) mark high-energy incursions, not quiet lagoon fill.
(iii) Laterally continuous silty laminae within Unit 2 contain freshwater taxa centrally and landward but are absent seaward, a geometry and composition inconsistent with continuous marine submergence but with episodic flooding alternating with marine overwash.

5. The charcoal-rich "Black Layer" (Unit 3b) records slope-wash, not lagoonal settling

Unit 3b thickens toward the southern margin of the depression, at the foot of the slopes that once hosted ancient settlements. It contains abundant sand-sized charcoal, roof-tile debris, pottery, and faunal fragments, with higher sand and lower clay than the enclosing grey silts. This composition is diagnostic of high-energy slope-wash into a depression and incompatible with buoyant charcoal accumulating from prolonged suspension in a calm lagoon.

6. Coarse facies in the seaward sector were overlooked

Cores from the eastern (seaward) sector include poorly sorted sands with rolled gravels, broken shell debris, and mud aggregates, whereas these facies are absent landward, indicating a clear landward decrease in energy. These facies, overlooked by Drăgușin et al, are typical of marine overwash during extreme events, not of a calm loess-bounded lagoon.

7. Reported elevations of "marine deposits" are overestimated

Drăgușin et al. cite 9–10 m asl for the top of natural marine sands but do not specify how these elevations were obtained. High-precision DGPS along the exposed trench and stratigraphy in our cores place the top of the natural sands (Unit 2) at ≤ +8 m asl. The tectonic argument thus partly rests on an elevation datum that fails measurement control.

8. A plausible process sequence

A plausible reading of the evidence is:
(i) a pre-existing coastal depression, likely a sinkhole, trapped silts from runoff and springs;
(ii) marine incursions during exceptional events (i.e. storms/tsunamis) transported sands into the basin, interbedded with slope-derived silts, producing a landward decreasing energy gradient;
(iii) recent anthropogenic filling partially capped the sequence.
This model explains: the non-marine silts, marine assemblages in sands, lateral facies organization, the presence of coarse clasts seaward, and the measured elevations, without invoking undocumented neotectonics in the 18th–19th centuries. Hydrometeorological data from Dobrudja (sub-hourly extremes up to 21 mm/5 min; ~225 mm/24 h recorded in late August 2024 at Mangalia; Irașoc et al., 2024) demonstrate the capacity for high-energy flooding to mobilize such facies.

9. Conclusions

The hypothesized ~14 m bi-directional vertical motion at Mangalia in the last two centuries is incompatible with regional tectonic context, the absence of structural indicators, realistic uplift rates, stratigraphic architecture, microfossil evidence, measured elevations of marine deposits, and the archaeological record. A sinkhole-centered, event-driven infill model - episodically influenced by extreme marine incursions - accounts for the observations without extraordinary tectonics. We therefore advise caution against over-interpreting local stratigraphy as evidence of rare intraplate megadisplacements and recommend additional multi-proxy work to refine chronology and hydrodynamic drivers.

References

Alexandru N (2024) Callatis, oraș grecesc în ținutul geților, Cluj-Napoca.

Burbank DW, Anderson RS (2011) Tectonic Geomorphology (2nd ed.). Wiley-Blackwell.

Constantinescu Ș (2012) Analiza geomorfologică a țărmului cu faleză între Capul Midia și Vama Veche, Edit. Universitară, 182 p.

Dinu C, Wong HK, Tambrea D, Matenco L (2005) Stratigraphic and structural characteristics of the Romanian Black Sea shelf. Tectonophysics 410(1–4):417–435. https:// doi. org/ 10. 1016/j. tecto. 2005. 04. 012.

Drăguşin V, Alexandru N, Caminschi M, Chitea F, Ersek V, Floroiu A, Giosan L, Grigore GA, Hanganu D, Ilie M, Ioane D, Mocuţa M, Pantia AI, Popa I, Sava G, Sava T, Stochici R, Ungureanu C (2024). A 10-m vertical displacement on the Romanian Black Sea coast during modern history. *EGUsphere [preprint*], https://doi.org/10.5194/egusphere-2024-2385.

Drăguşin V, Alexandru N, Caminschi M, Chitea F, Ersek V, Floroiu A, Giosan L, Grigore GA, Hanganu D, Ilie M, Ioane D, Mănăilescu C, Mocuţa M, Pantia AI, Petre AR, Popa I, Sava G, Sava T, Stochici R, Ungureanu C (2025). A 10-m vertical displacement on the Romanian Black Sea coast during modern history. *Geoscience Letters* (2025) 12:29.

Irașoc, A., Ionac, N., Dumitrescu, A., & Beteringhe, A. (2024). Extreme rainfall intensities at sub-hourly temporal scale in Dobrudja (Romania). Geographia Technica, 19(1), 103–120. https://doi.org/10.21163/GT_2024.191.08

Konerding C, Dinu C, Wong HK (2010) Seismic sequence stratigraphy, structure and subsidence history of the Romanian Black Sea shelf. In: Sosson M, Kaymakci N, Stephenson RA, Bergerat F, Starostenko V (eds) Sedimentary basin tectonics from the Black Sea and Caucasus to the Arabian platform, vol 340. Geological Society Special Publications, London, pp 159–180

Mărgineanu-Cârstoiu M (2024) Sur l'architecture de Callatis et Tomis (IIIe-IIe siècles av. J.-C.-IIe-IIIe siècles ap. J.-C.) București

Mueller K, Hough S, Bilham R (2004) Analysing the 1811–1812 New Madrid earthquakes with recent instrumentally recorded aftershocks. Nature 429:284–288. https:// doi. org/ 10. 1038/ nature02557

Radu L, Radu-Iorguș C, (2022) Ottoman Mangalia - Some Notes. Peuce S.N. XX: 277–288

Rajendran CP, Rajendran K (2011) Characteristics of deformation and past seismicity associated with the 1819 Kutch earthquake, northwestern India. Bull Seismol Soc Am 91(3):407–426. https://doi. org/ 10. 1785/ 01199 90162

Declarations

Availability of data and materials

All data discussed in this Comment are available from the corresponding author upon reasonable request.

Competing interests

The authors declare having no competing interests.

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Authors' contributions

All authors contributed to fieldwork, data analysis, and interpretation. The manuscript was jointly written and approved by all co-authors.

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