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TEDEN SREDOZEMSKE OBALE IN MAKROREGIONALNIH STRATEGIJ
Izola, Slovenija
16. – 20. september 2024

MEDITERRANEAN COAST AND MACRO-REGIONAL STRATEGIES WEEK
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Consultation within TSG 3:
Construction Activities in the Sea and on the Seashore and Achieving good environmental status of the Sea

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

GEOLOGY OF THE SLOVENIAN COAST

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Izola, 19. 9. 2024

Geology overview

- Cretaceous and Palaeocene-Eocene limestones (oldest)
- Eocene flysch
- Pliocene-Quaternary marine sediments (youngest)

Structural geology of the area

- Mesozoic: Adriatic-Dinaric carbonate platform
- Palaeogene: the platform disintegrated, the area deepened and a deep foreland basin was formed - flysch formation
- Miocene-today: Istria-Friuli underthrust zone
  - Segmentation of the Adria microplate → Padan and Adriatic part
  - Underthrusting of the Padanian part beneath the External Dinarides

Source: Placer et al., 2010

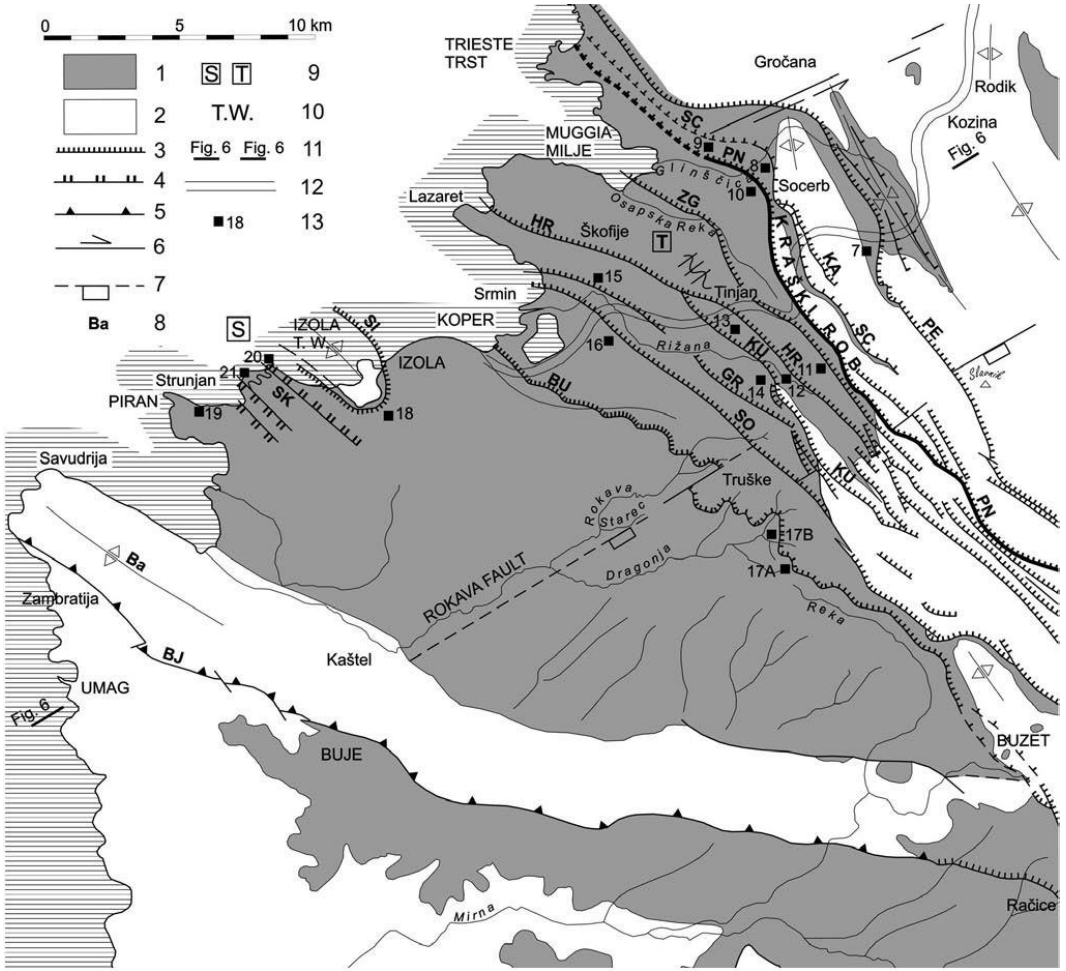


Fig. 5. **Istria-Friuli Underthrust Zone**. 1. Upper ductile horizon: flysch; 2. Platform carbonates; 3. Thrust faults: PE – Petrinje Thrust Fault, KA – Kastelec Thrust Fault, SC – Socerb Thrust Fault, PN – Palmanova Thrust Fault (local Črni Kal Thrust Fault), ZG – Zanigrad Thrust Fault, HR – Hrastovlje Thrust Fault, KU – Kubed Thrust Fault, GR – Gračišče Thrust Fault, SO – Sočerga Thrust Fault, BU – Buzet Thrust Fault, SI – Simon Thrust Fault; 4. Secondary thrust faults of the Strunjan Structure: SK – Sv. Križ Thrust Fault; 5. Thrust Front of External Dinarides: BJ – Buje Fault; 6. Strike-slipe fault; 7. Normal fault; 8. Ba – Buje Anticline; 9. S – Strunjan Structure, T – Tinjan Structure; 10. Izola Tectonic Window; 11. Fig. 6 - Fig. 6 – Synthetic profile Umag – Kozina on Fig. 6; 12. Motorway.

Structural geology

Several thrust structures:

- Palmanova Thrust Fault
  - central structural element
- Strunjan Structure
  - Reverse thrust faults
  - Folds in Strunjan
  - Sv. Križ / Izola Thrust Fault
  - Simon (interlayered) Thrusts
  - Izola Anticline

Structures continue under the sea.

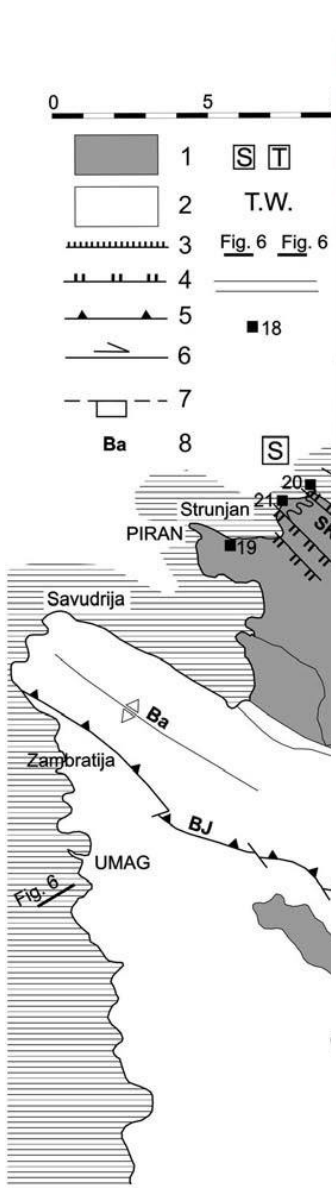
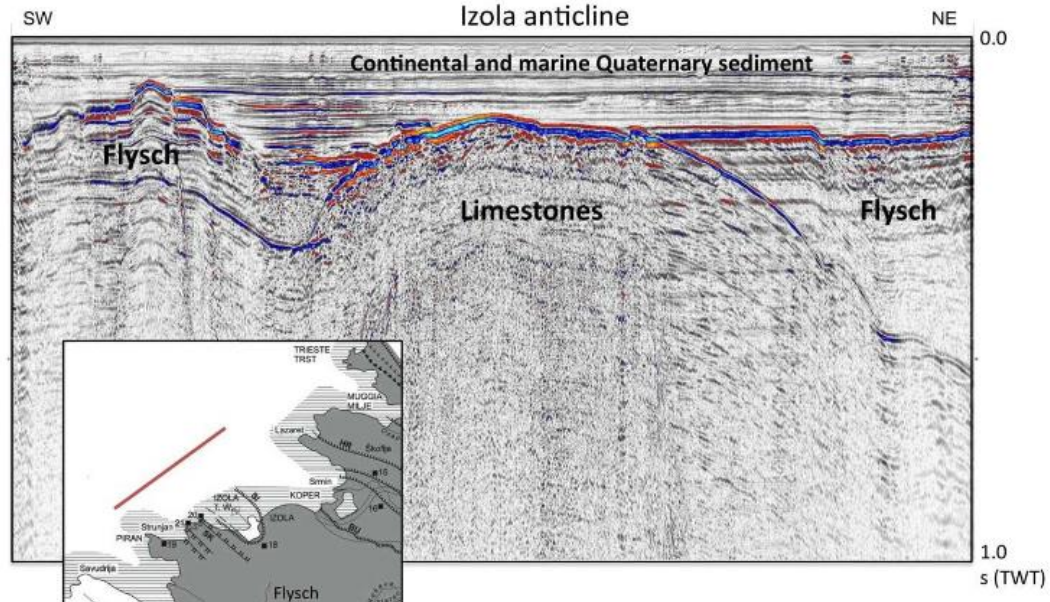
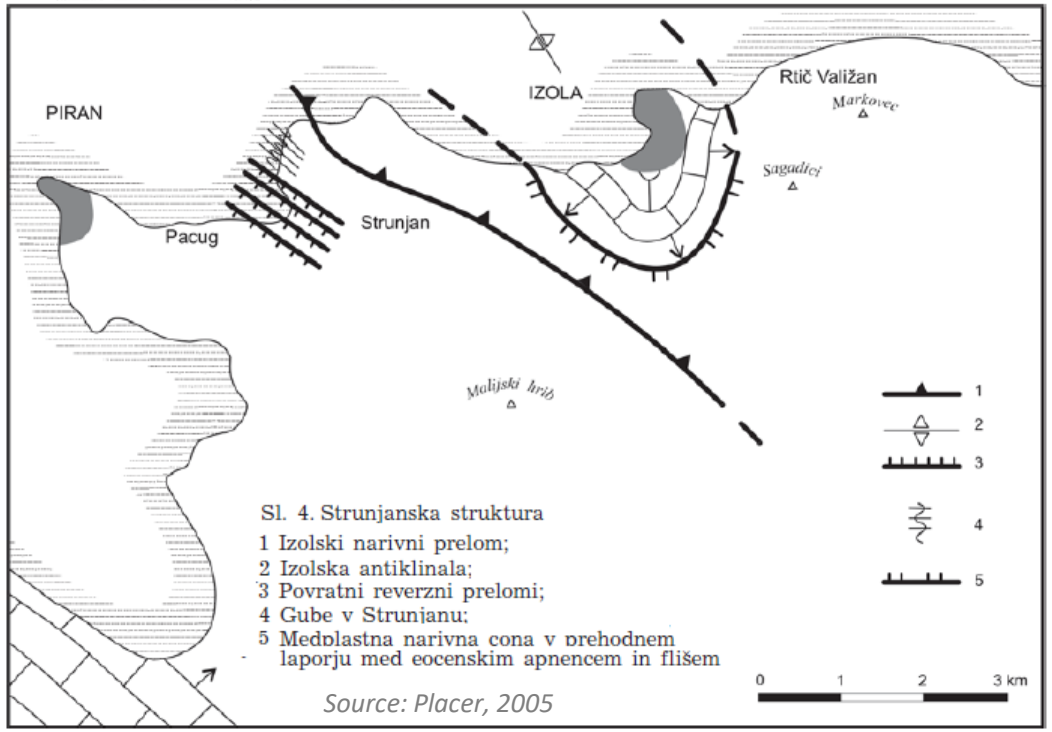


Fig. 5. **Istria-Friuli Underthru**
Thrust Fault, KA – Kastelec Th
ZG – Zanigrad Thrust Fault, H
Thrust Fault, BU – Buzet Thrus
Thrust Fault; 5. Thrust Front o
9. S – Strunjan Structure, T –
on Fig. 6; 12. Motorway.

Source: Placer et al., 2010



Source: Vrabec et al., 2014



Sl. 4. Strunjanska struktura
1 Izolski narivni prelom;
2 Izolska antiklinala;
3 Povratni reverzni prelomi;
4 Gube v Strunjanu;
5 Medplastna narivna cona v prehodnem laporju med eocenskim apnencem in flišem

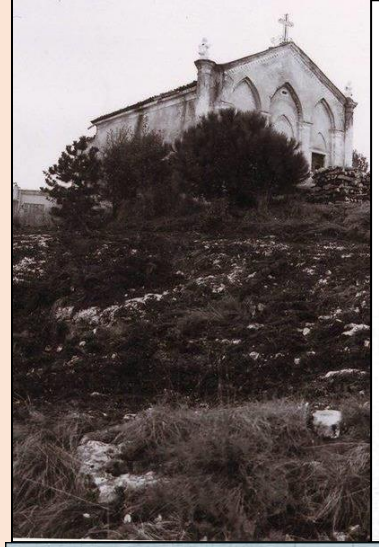
Source: Placer, 2005

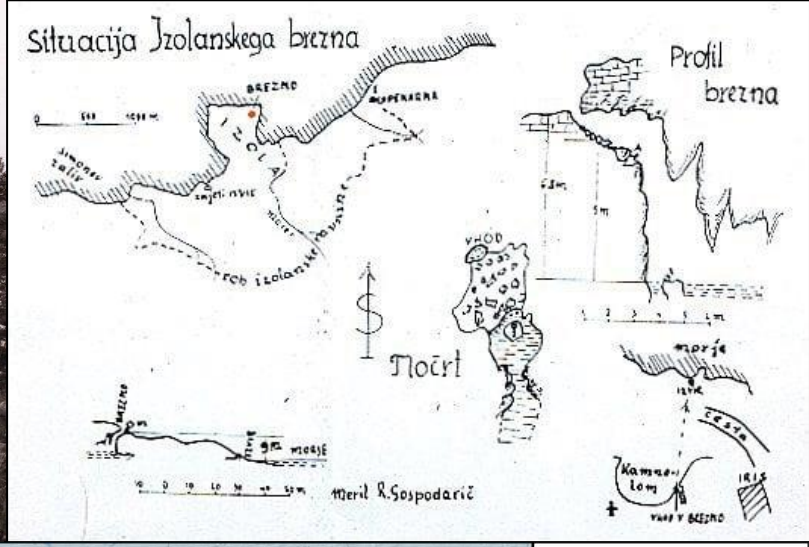
Alveolinic-numulitic limestone

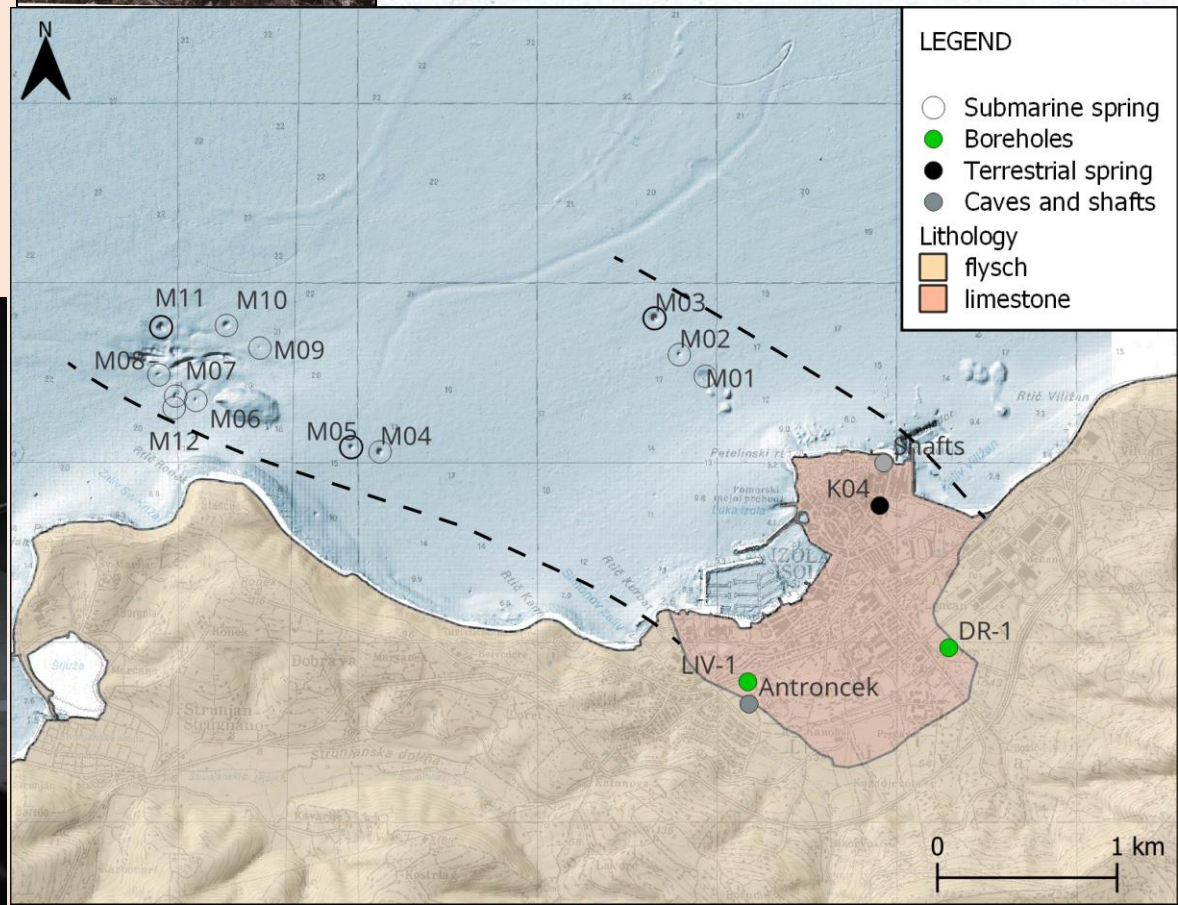
- Outcroping in the Izola Anticline
- Foraminiferal limestone (single-celled organisms)
- Formed in the shallow sea (Adriatic-Dinaric carbonate platform)
- Paleocene-Eocene

Alveolinic-numulitic limestone

- Karst features
  - Antronček cave
  - Sv. Peter shaft and Izola shaft
  - Submarine springs



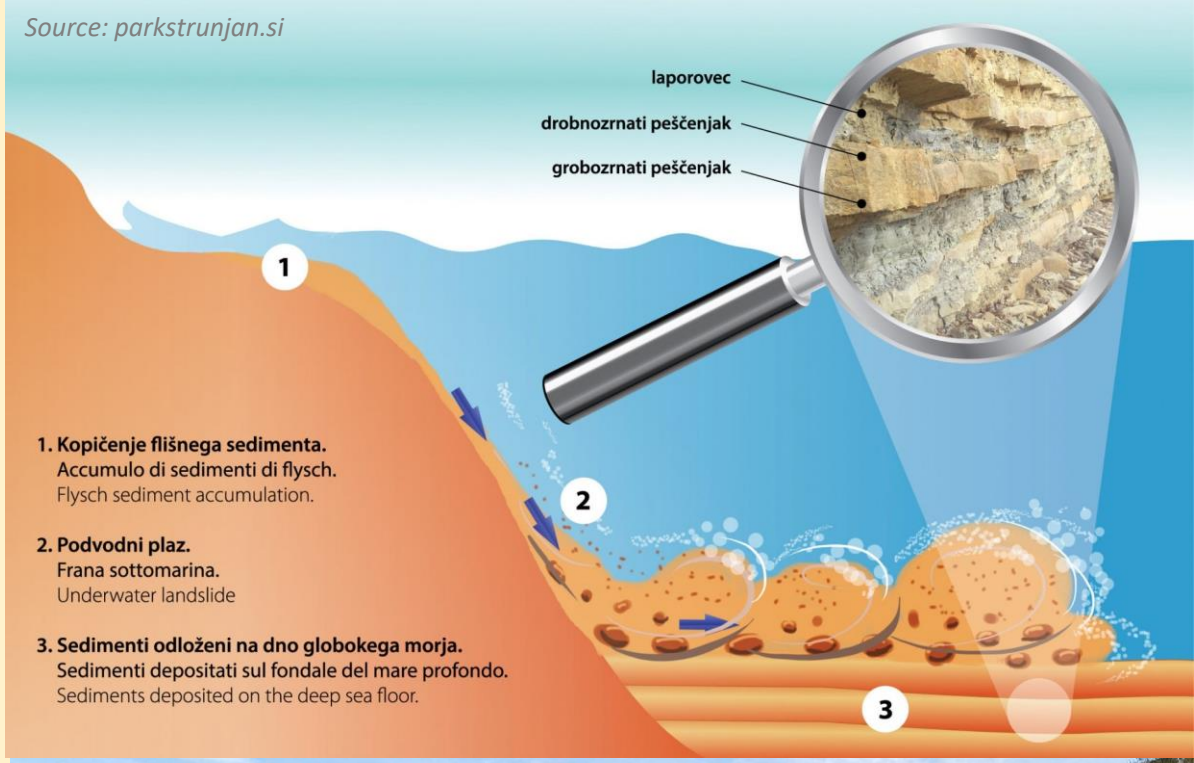




Eocene flysch

- Alternating layers of marlstones and sandstones
- Sequences up to 500 m
- Formation:
  - Orogenesis and formation of a foreland basin → deep-sea environment
  - Sediment accumulation on continental shelfs
  - Gravitational mass flows
  - Gravitational gradation of the sediment

Source: parkstrunjan.si



Eocene flysch

- Flysch cliffs
- Strunjan cliff
  - 80 m high
  - Highest cliff in the Adriatic Sea
- Hazard - rockfall!
  - After heavy rainfall
  - Strong winds
  - Erosion by the sea
  - Temperature fluctuations → shrinking and stretching of rocks → rock breakdown
- *Don‘t sunbathe under the Strunjan Cliff!* 😉

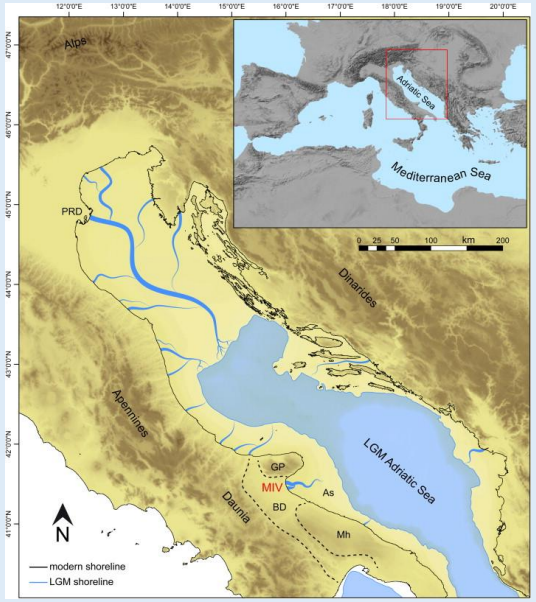
Seabed sediments

Pliocene-Pleistocene

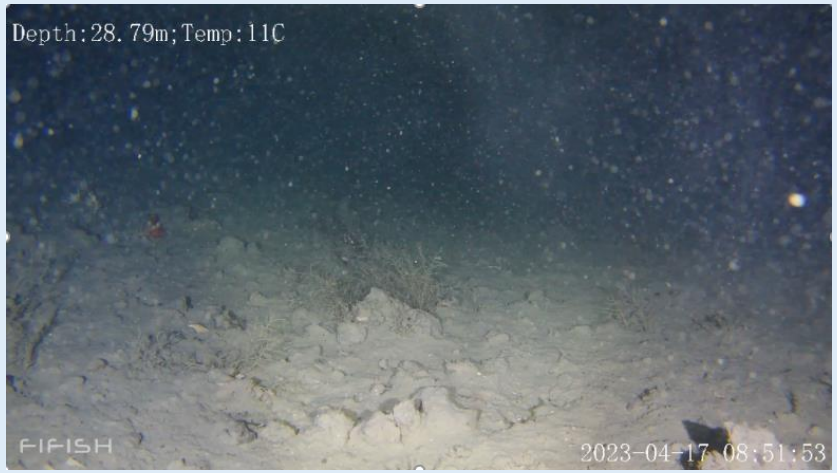
- Several 100 m thick
- Continental and marine sediments
- Regression and transgression of the sea
- Earliest post-LGM transgressive deposits in the Gulf of Trieste dated to 11,211–11,316 cal yr BP

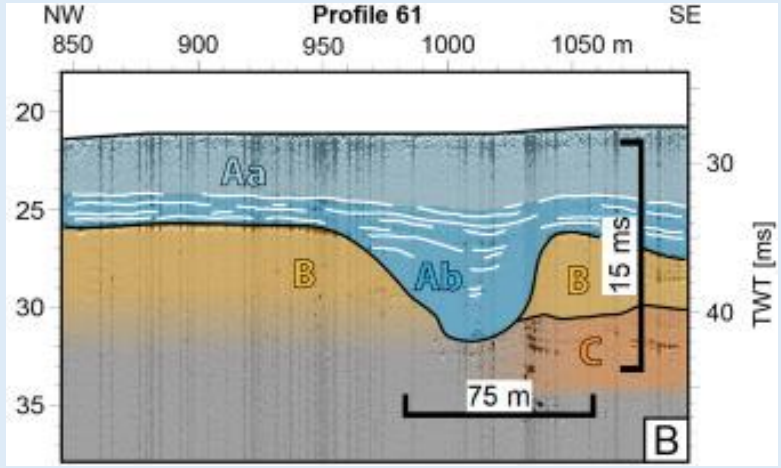
Holocene

- 0-24 m thick (3,2 m on average)
- Marine sediments with a lot of terrigene component



Source: Maselli et al., 2014



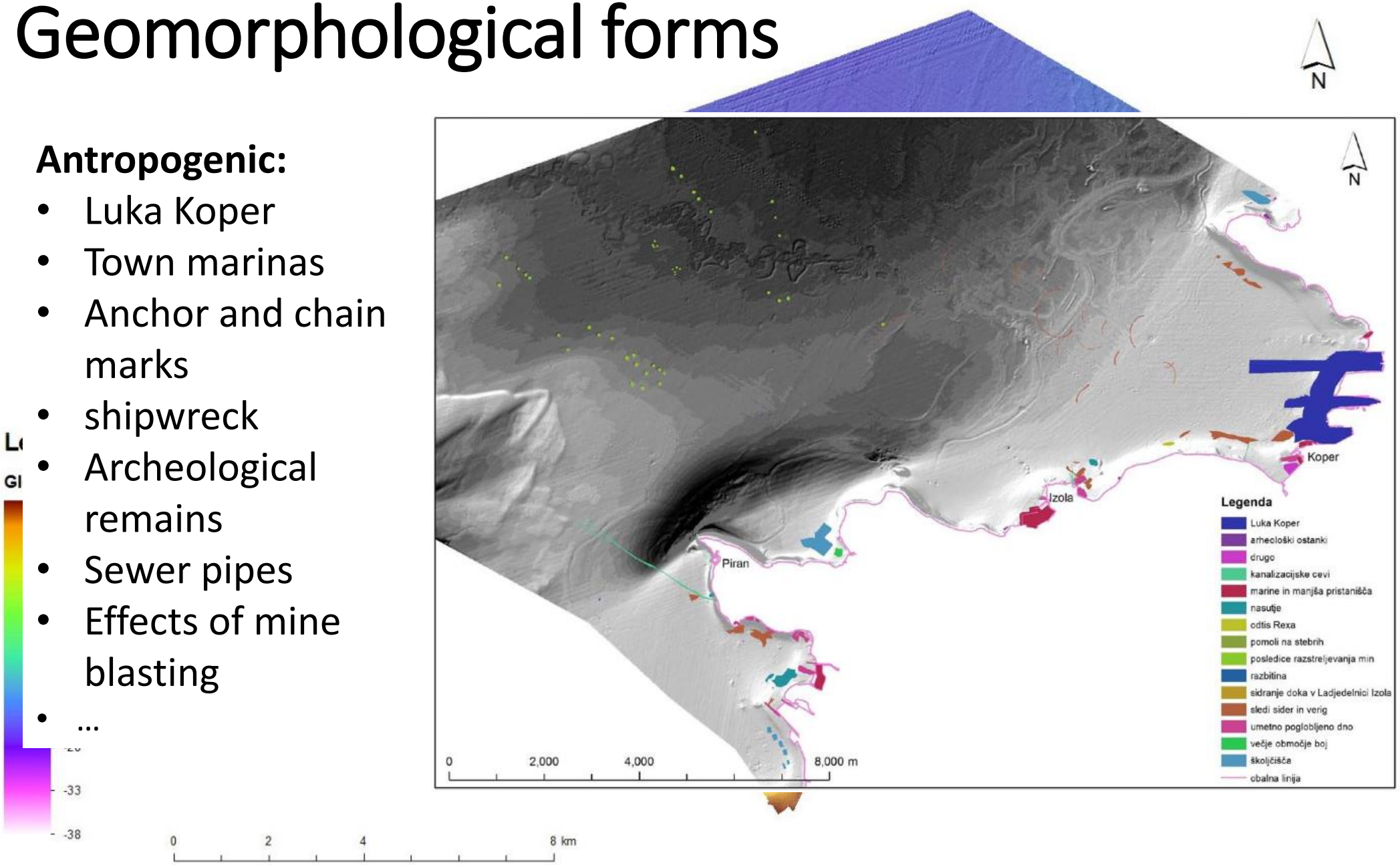


Source: Novak et al., 2020

Geomorphological forms

Antropogenic:

- Luka Koper
- Town marinas
- Anchor and chain marks
- shipwreck
- Archeological remains
- Sewer pipes
- Effects of mine blasting
- …

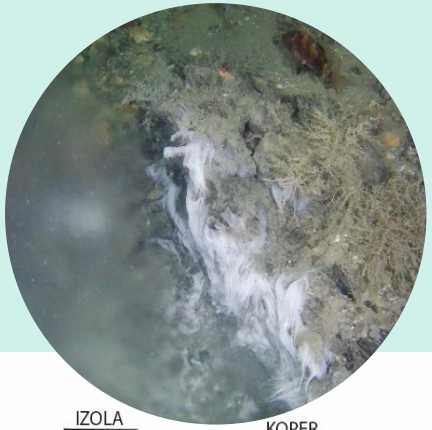


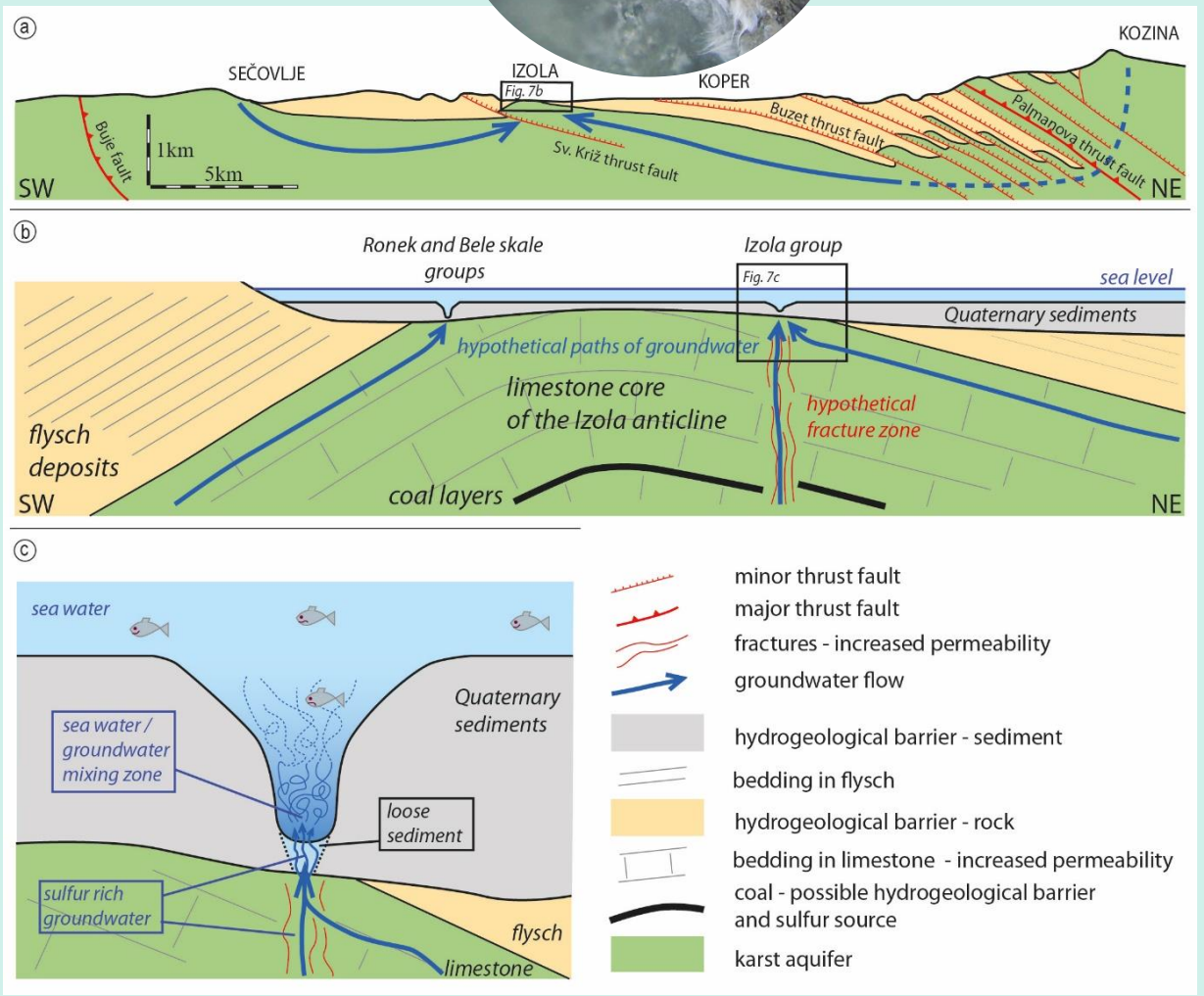
Slika 14: DMR morskega dna.

Source: Slavec, 2012

Submarine sulphurous springs

- 12 pockmarks - funnel-shaped depressions in the seabed sediment
- Formed by brakish fluid (not as salty as seawater but saltier than freshwater)
- Springs with warm (up to 31.2 °C) and higly sulphidic water (up to 42 mg/L)
- Recharge from
  - Karst plateau on the E or
  - limestones on the S (Croatian side, Buje Anticline)
- Sulphate reduction due to coal layers in the Liburnian formation
- Ecosystems at the outflows





Source: Šušmelj et al., 2024

Take home message

Slovenian coast hides many interesting geological features.

Consider the:

- hazard under the flysch cliffs
- possible karst cavities in the limestone
- (sulphorous) groundwater
- ecosystems on the seafloor.

Take into account the opinion of geologists when carrying out construction activities!

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HVALA! THANK YOU!

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Izola, 19. 9. 2024