

# **Deepwater Play Types of the Black Sea: A Brief Overview\***

**G. Tari<sup>1</sup>, C. Menlikli<sup>2</sup>, and S. Derman<sup>3</sup>**

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<sup>1</sup>Gabor Tari, OMV, Vienna, Austria ([gabor.tari@omv.com](mailto:gabor.tari@omv.com))

<sup>2</sup>TPAO, Ankara, Turkey

<sup>3</sup>Consultant, Ankara, Turkey

## **Abstract**

The numerous, mostly untested deepwater Black Sea play types can be subdivided into syn-rift and post-rift plays. The largest targets are syn-rift fault blocks, such as the Andrusov and Tetyaev highs in Turkey and Ukraine, respectively. Although their internal stratigraphy is poorly constrained (i.e. proportion of pre-rift and syn-rift versus basement) translating to not only reservoir risk but also to reservoir quality risk, the trap sizes are very large. Also, the assumed lateral charge from the Miocene-Oligocene Maikop Formation and perhaps even from Eocene sources makes these structures extremely attractive. The overall structure of the Shatsky Ridge is not as clear as it has elements of an extremely large carbonate platform on top. The Polshkov High is unique in the sense that it represents a large rotated syn-rift fault block along the lower plate edge of the Western Black Sea in Bulgaria. On the conjugate upper plate margin, very large inverted syn-rift structures, such as the Kozlu Anticline, are recognized in the Turkish sector.

On top of most of the syn-rift highs described above, various typical carbonate geometries can be interpreted on seismic data such as backreef pinnacles, lowstand buildups, raised rims, backstepping, aggradation and prograding clinoforms. These syn-rift to post-rift carbonate platforms tend to grow on footwall blocks of syn-rift faults and can reach more than 800 meters in thickness. The age of these carbonate features is poorly constrained at present as to the exact opening age of the Black Sea basins, i.e. anywhere between Jurassic to Eocene.

Several intra-Tertiary reservoirs could be targeted in the compactional anticlines above the large syn-rift highs. Another play associated with Tertiary sands is that of the deepwater extension of the Subbotina discovery in Ukraine. The Subbotina structure is a compressional anticline situated in a dominantly Miocene, south-vergent folded belt offshore Kerch Peninsula. Similar folded belts are also known in the Russian, Georgian, Turkish and Bulgarian sectors of the Black Sea. Also, pure stratigraphic traps may exist in a widely recognized Eocene low-stand

wedge along the basin margins. However, reservoir quality is a definite risk for the Tertiary reservoir intervals in certain segments of the Black Sea as the function of the provenance area(s).

### **References**

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Meisner, A., O. Krylov, and M. Nemcok, 2009, Development and structural architecture of the eastern Black Sea: *Leading Edge*, v. 28/9, p. 1046-1055.

Menlikli, C., A. Demirer, O. Sipahioglu, L. Korpe, and V. Aydemir, 2009, Exploration plays in the Turkish Black Sea: *Leading Edge*, v. 28/9, p. 1066-1075.

Robinson, A.G., E.R. Griffith, and J. Sargeant, 1996, Old fields and new plays in the Rioni foreland basin, Republic of Georgia: *AAPG Annual Meeting Expanded Abstracts*, v. 5, p. 120-121.

Tari, G., J. Davies, R. Dellmour, E. Larratt, B. Novotny, and E. Kozhuharov, 2009, Play types and hydrocarbon potential of the deepwater Black Sea, NE Bulgaria: *Leading Edge*, v. 28/9, p. 1076/1081.

# Deepwater play types of the Black Sea: a brief overview

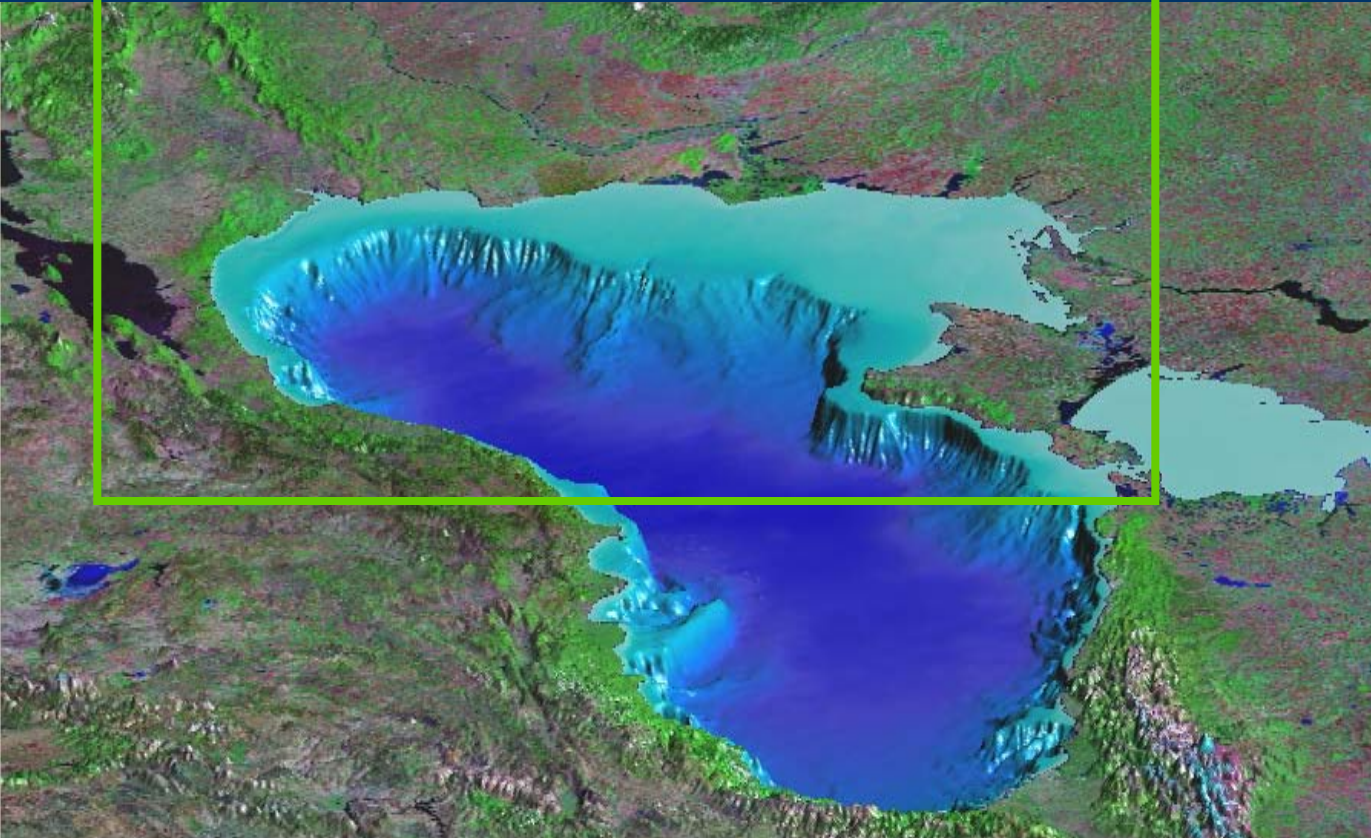
Gabor Tari<sup>1</sup>, Cem Menlikli<sup>2</sup> and Sami Derman<sup>3</sup>

<sup>1</sup> OMV, Vienna, Austria

<sup>2</sup> TPAO, Ankara, Turkey

<sup>3</sup> Consultant, Ankara, Turkey

AAPG Conference, Kiev, October 18, 2010





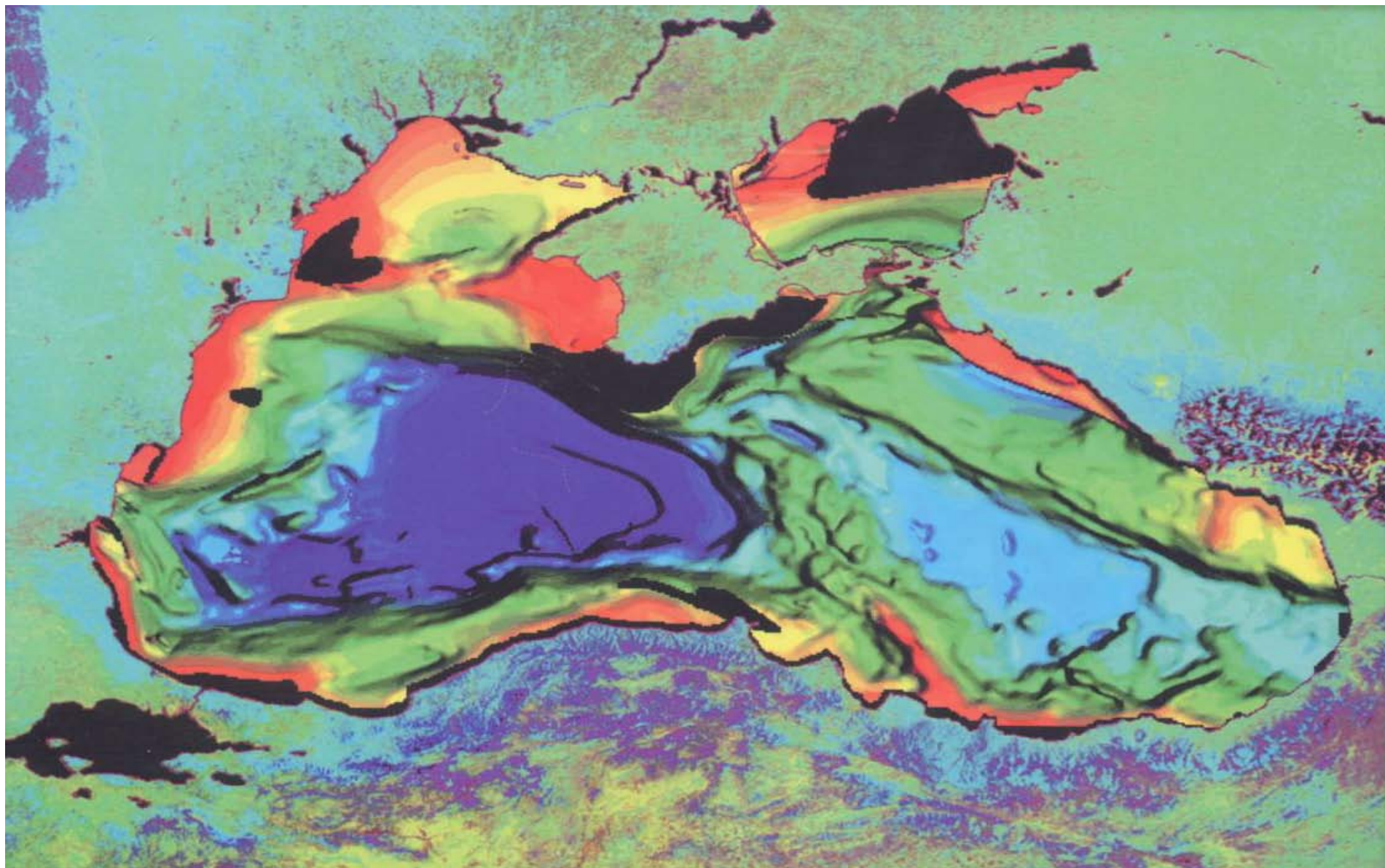
# Exploration blocks, Black Sea, October 2010





# Black Sea Basin, depth to break-up unconformity

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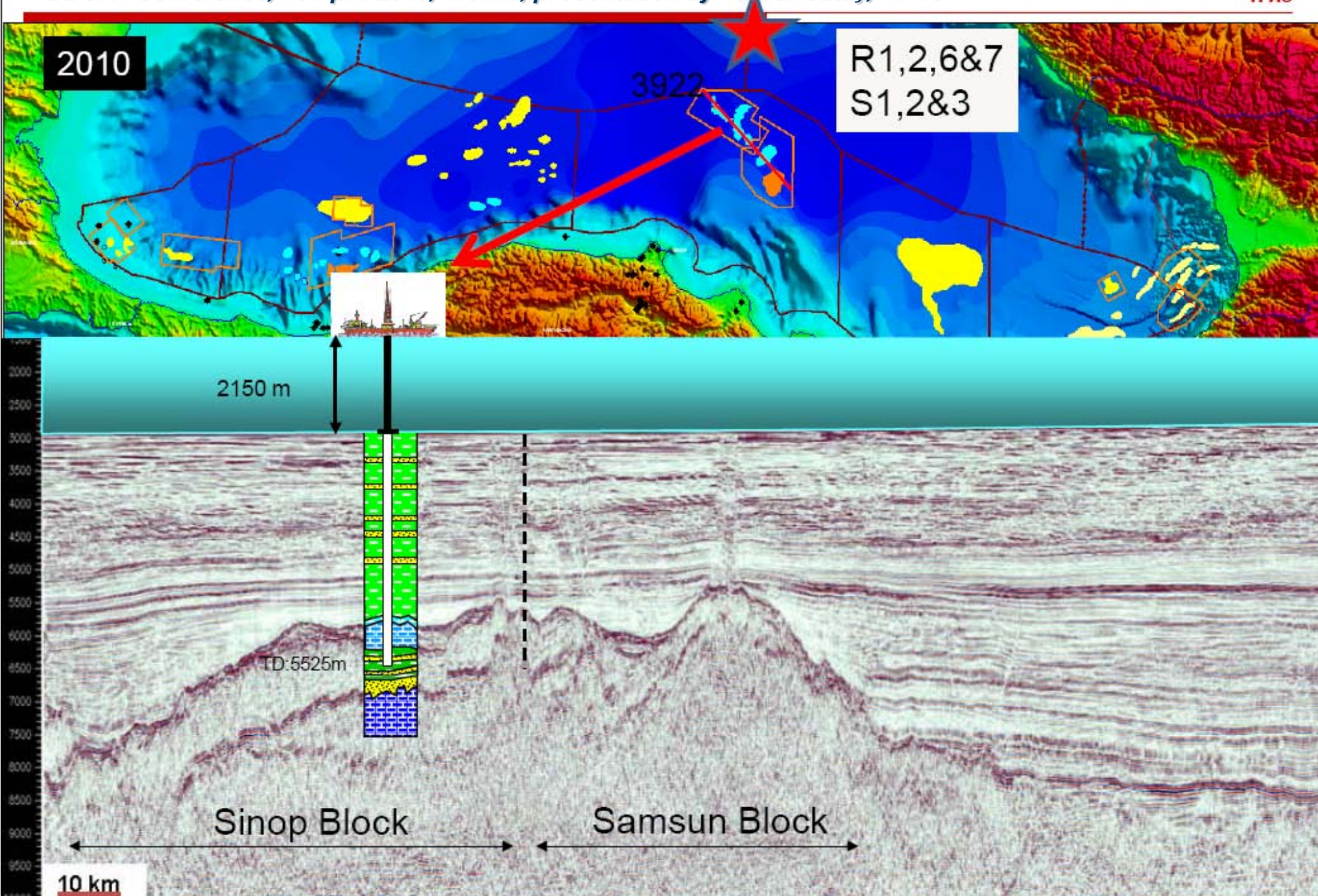


Robinson et al. (1996)



# Sinop-1 (Petrobras – TPAO – ExxonMobil)

BBSPA Conference, 15 April 2010, Vienna, presentation by Yurdal Öztaş, TPAO



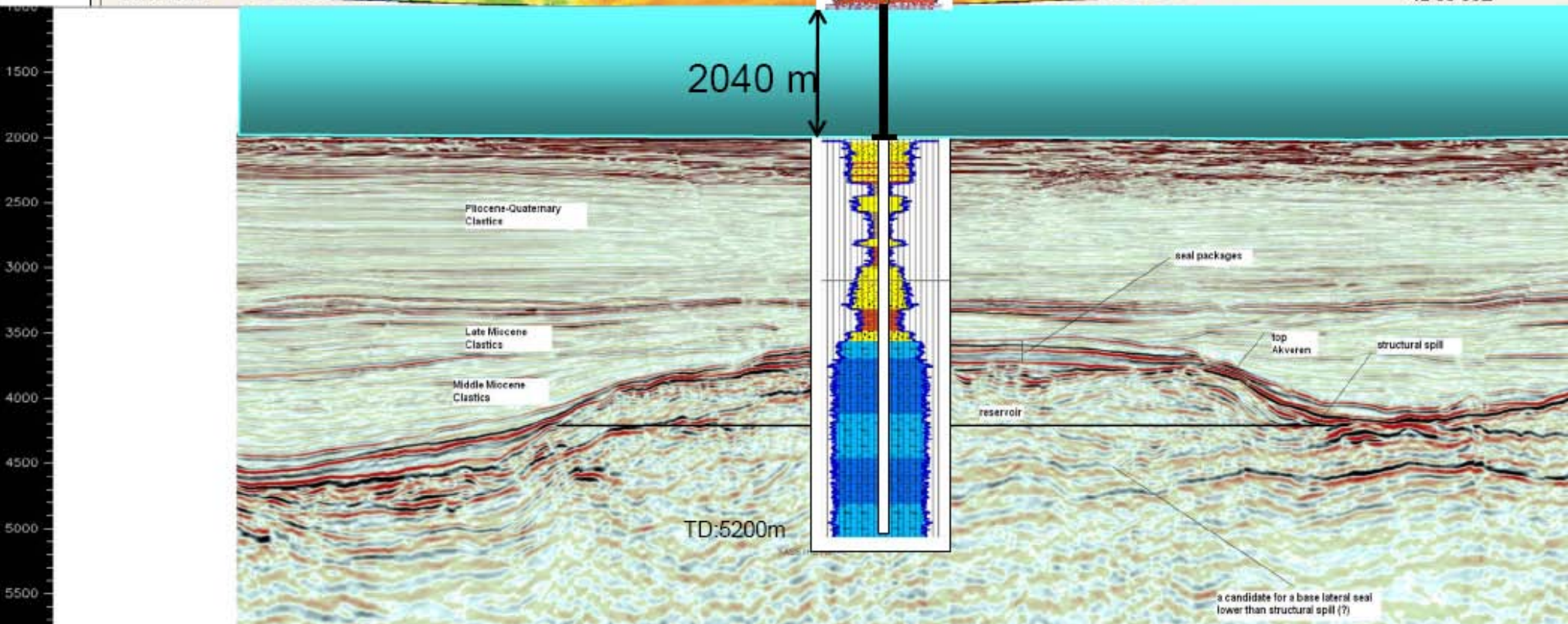
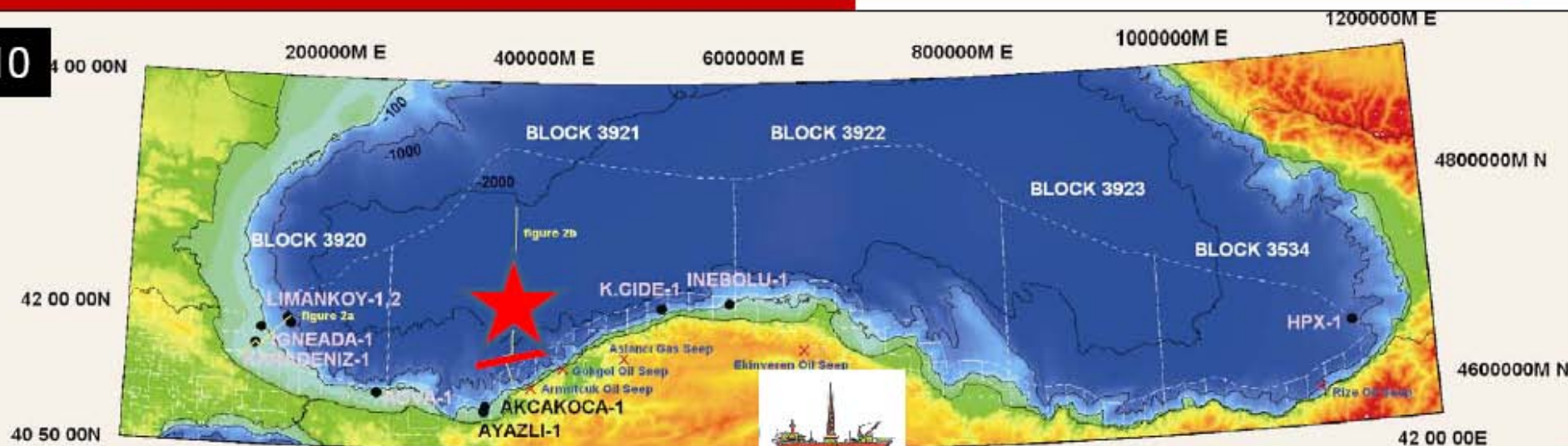


# Yassihoyuk-1 (TPAO)

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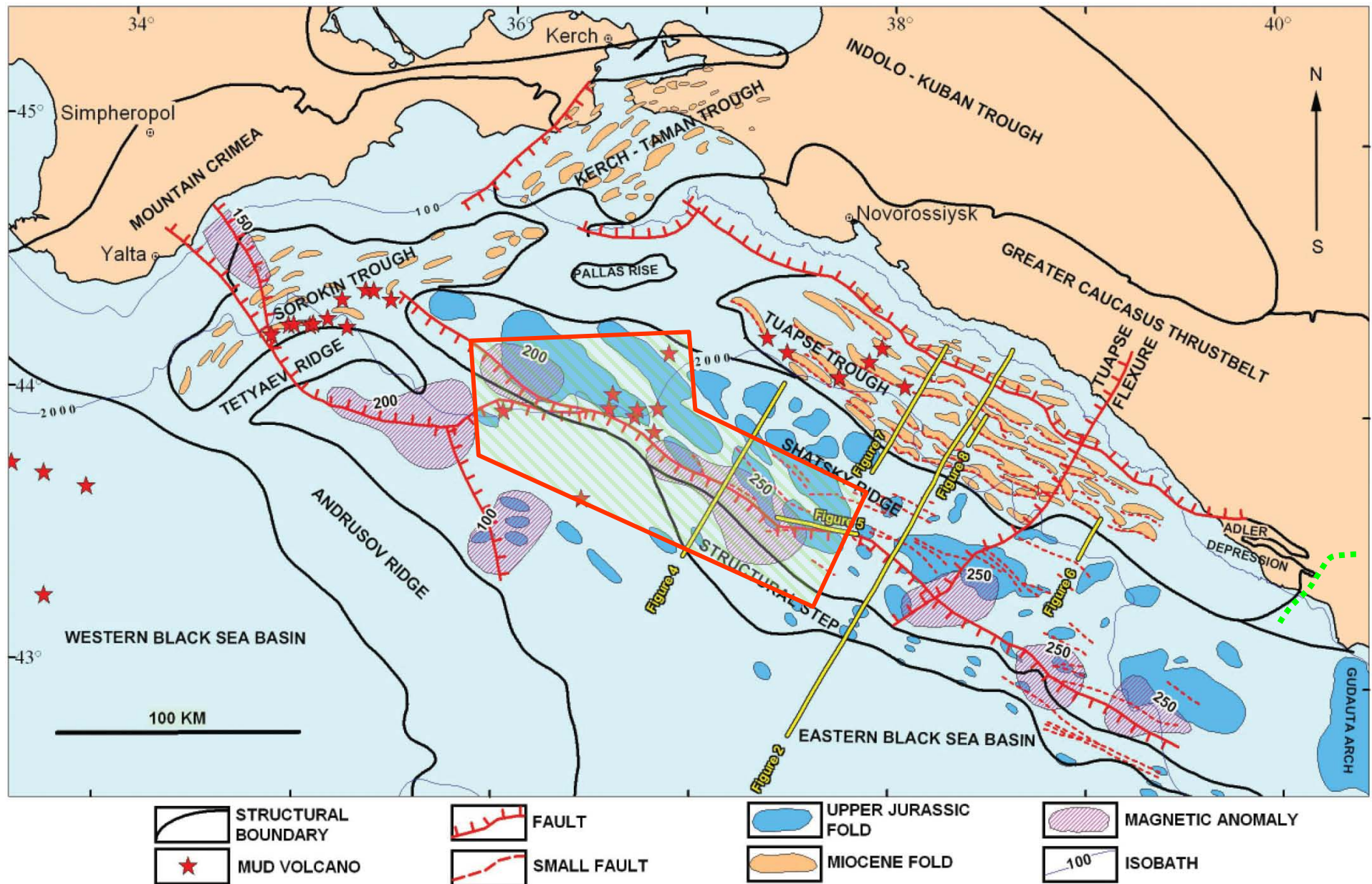


2010





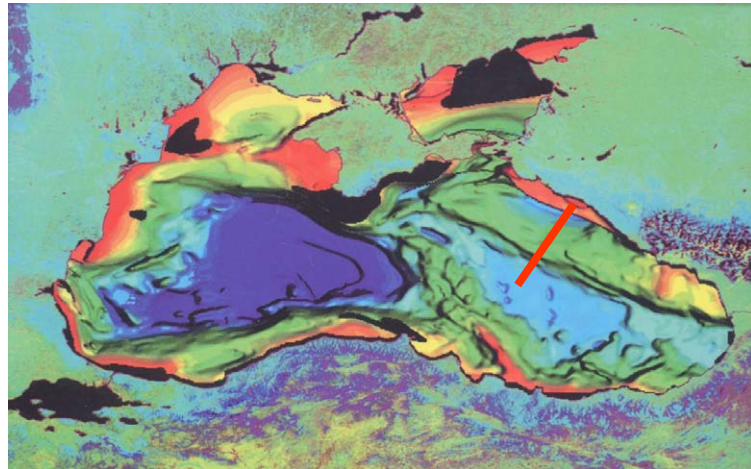
# Russia, structures and Chevron/Rosneft block



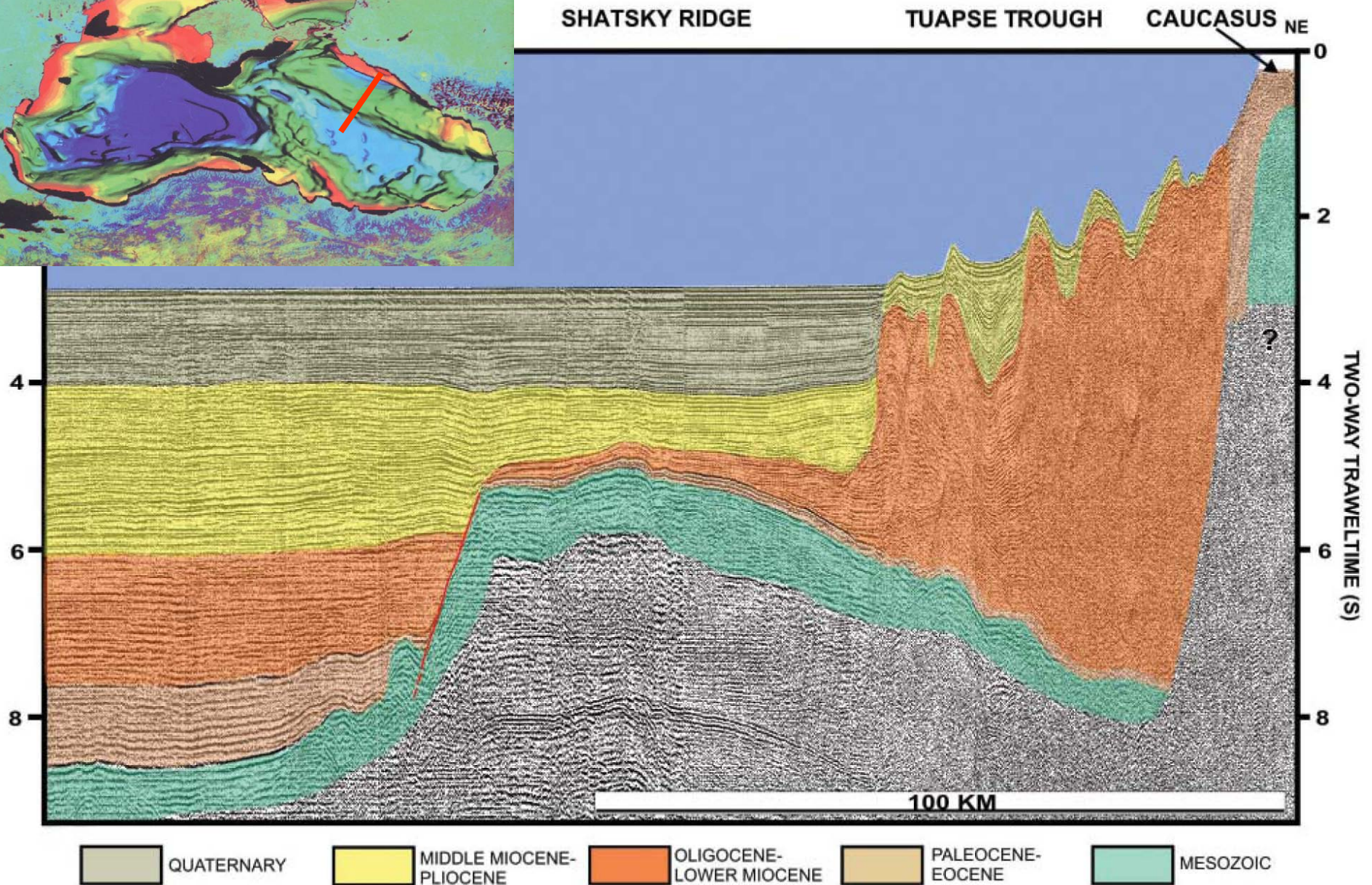
Meisner and others (2009)



# Shatsky High and Tuapse Trough, Russia

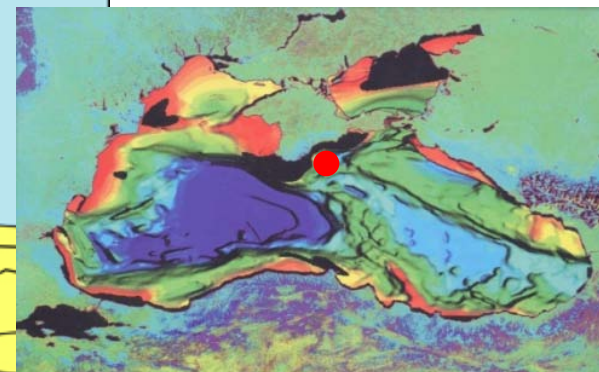
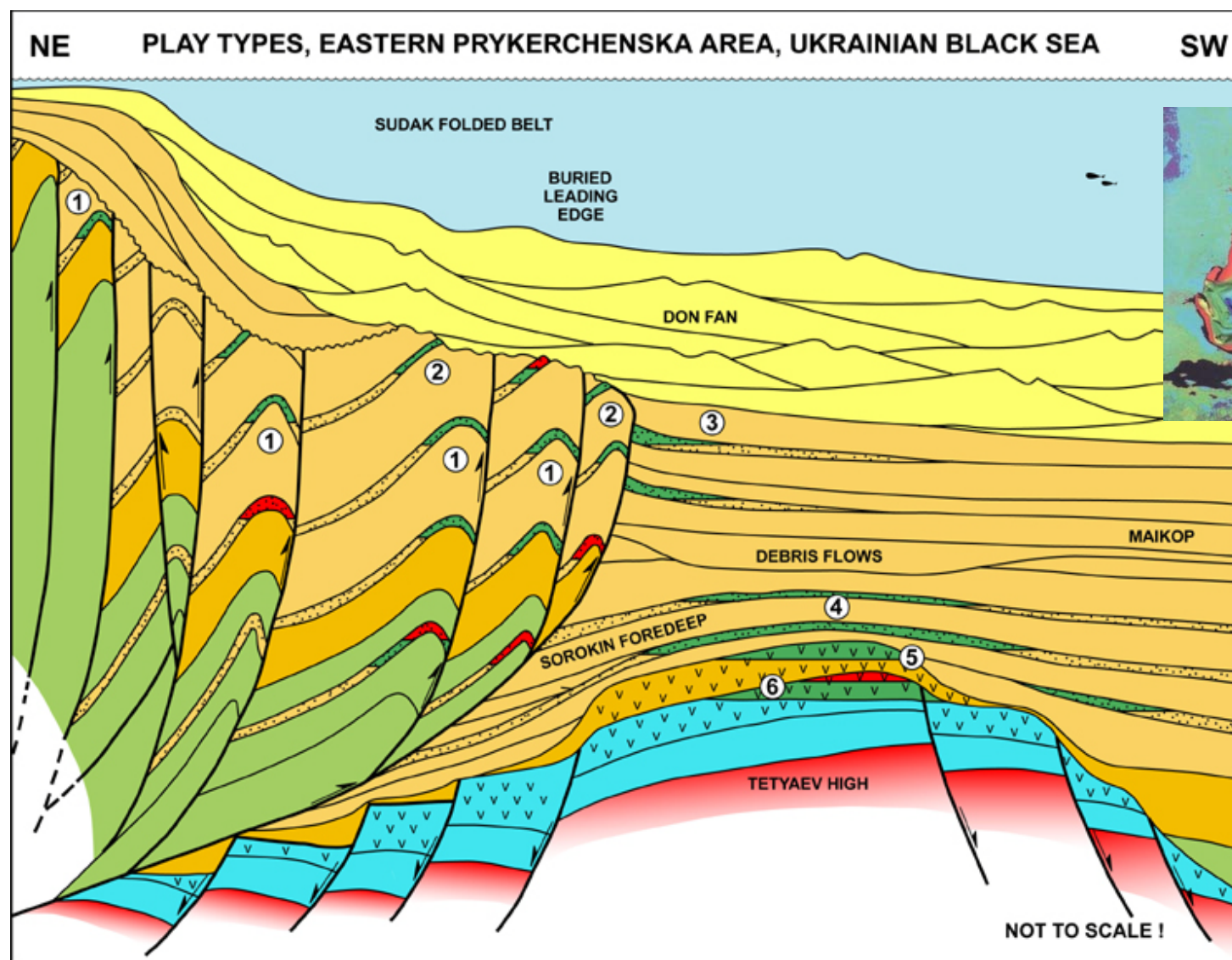


Meisner and others (2009)



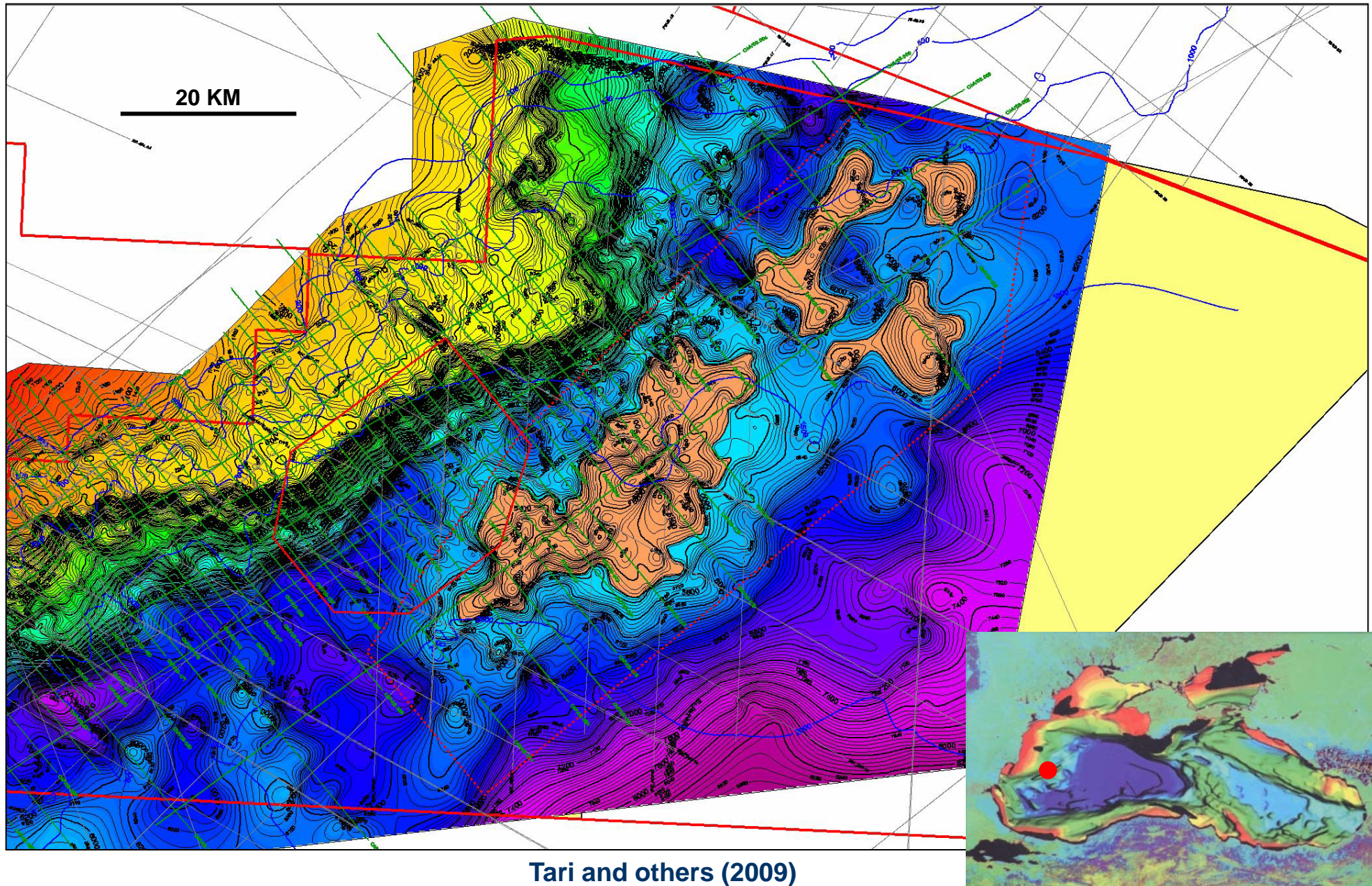


# Tetyaev High, syn- and post-rift plays, Ukraine



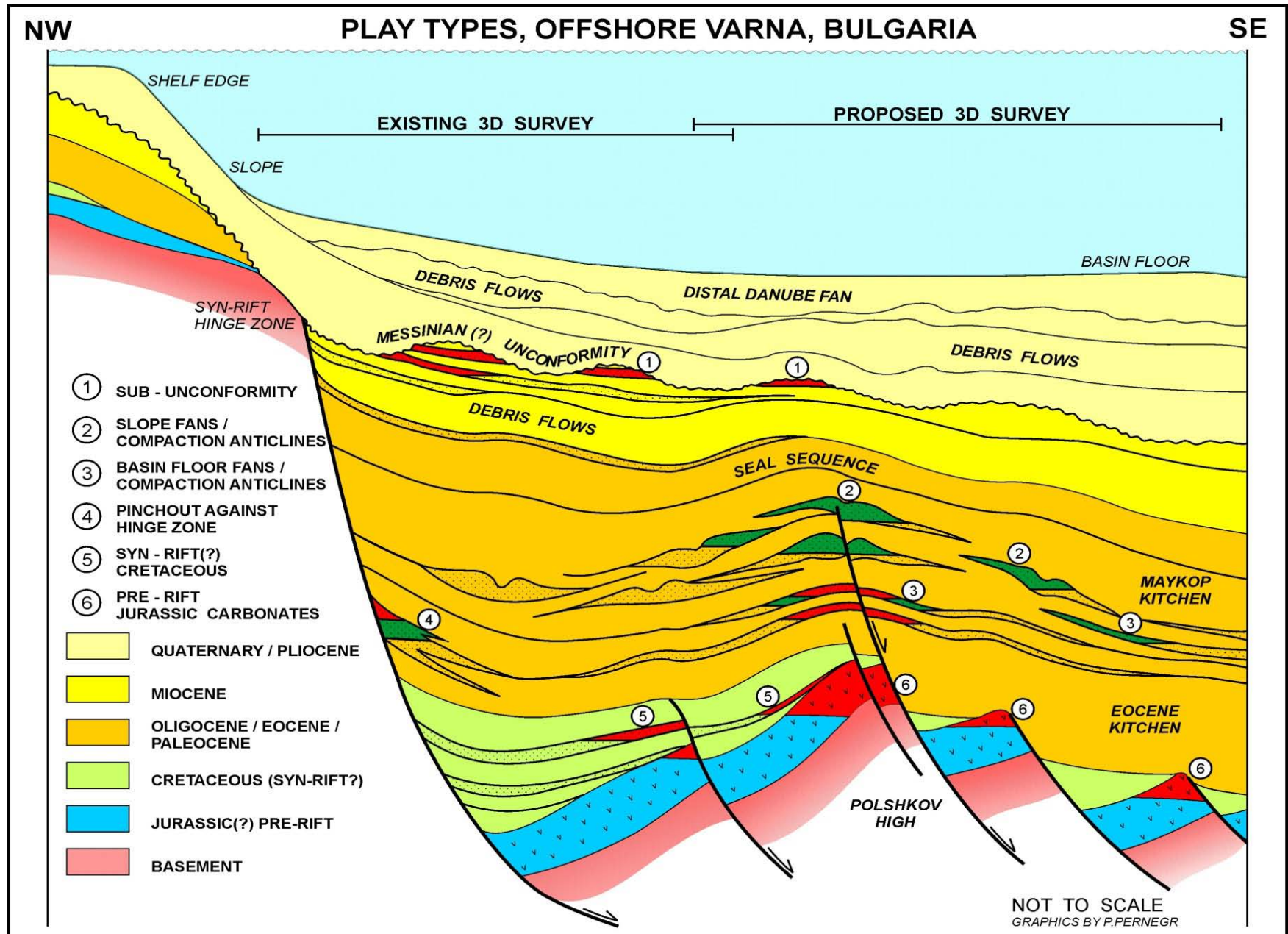


# Polshkov High, Bulgaria, top pre-rift depth structure





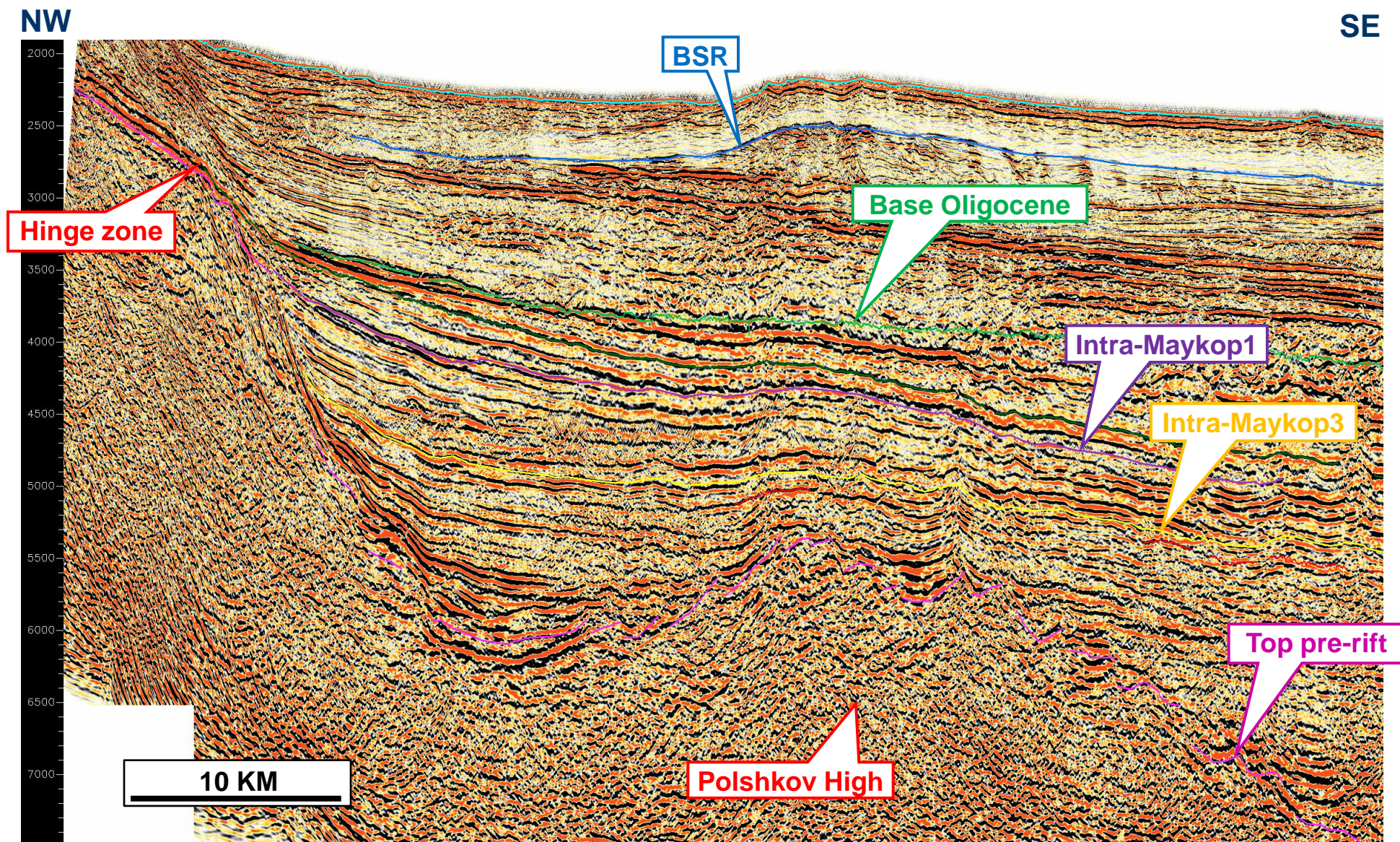
# Deepwater play types, NE Bulgaria



Tari and others (2009)



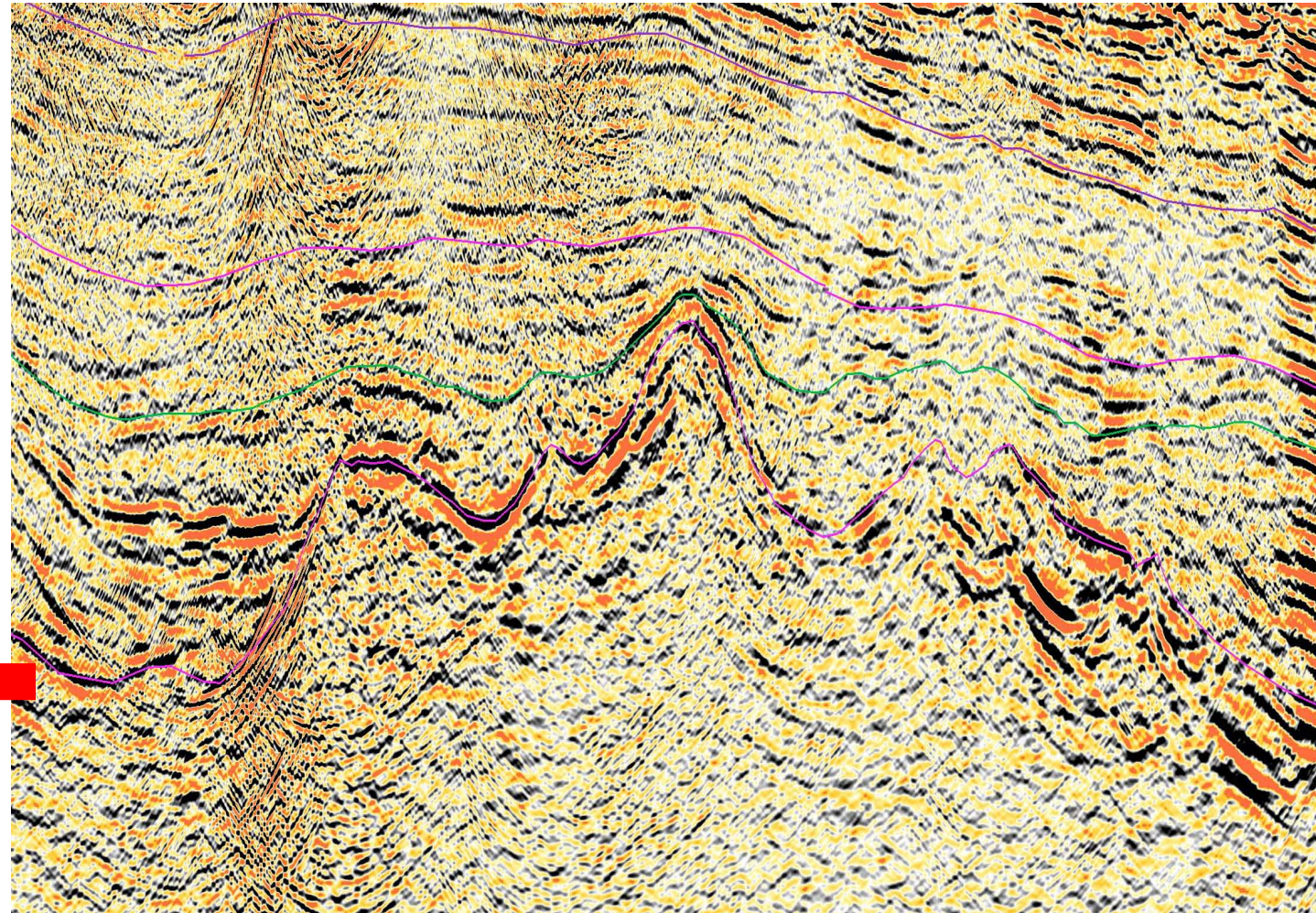
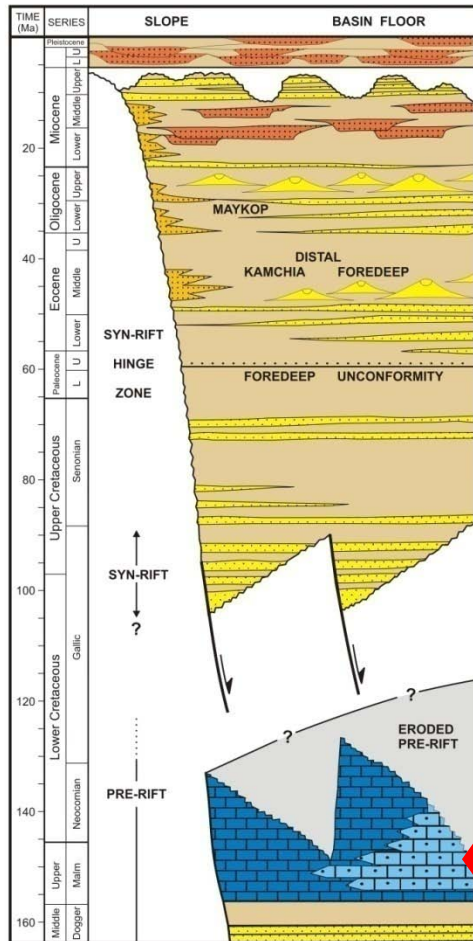
# Typical vintage seismic line, Polshkov High



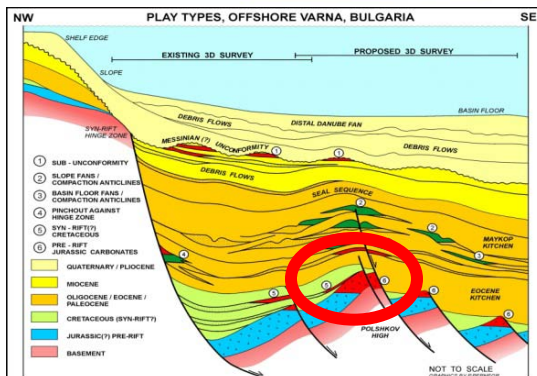
Line BS92-11



# Jurassic-Lower Cretaceous reefs(?), Polskhov High

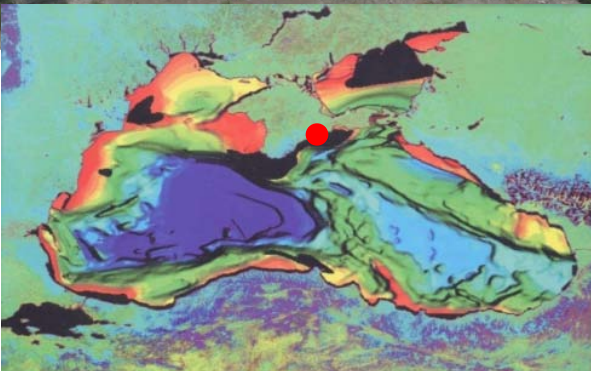
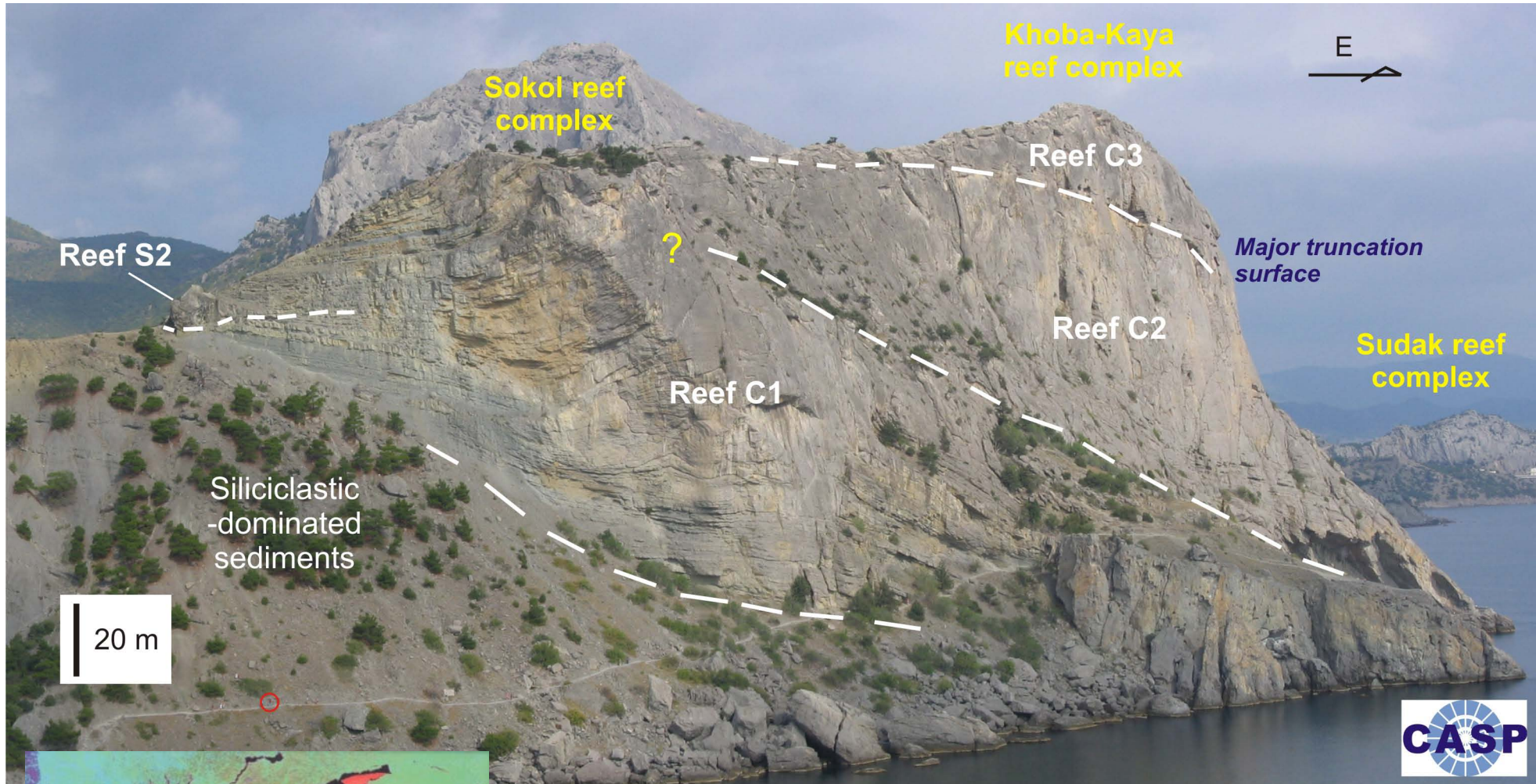


Tari and others (2009)





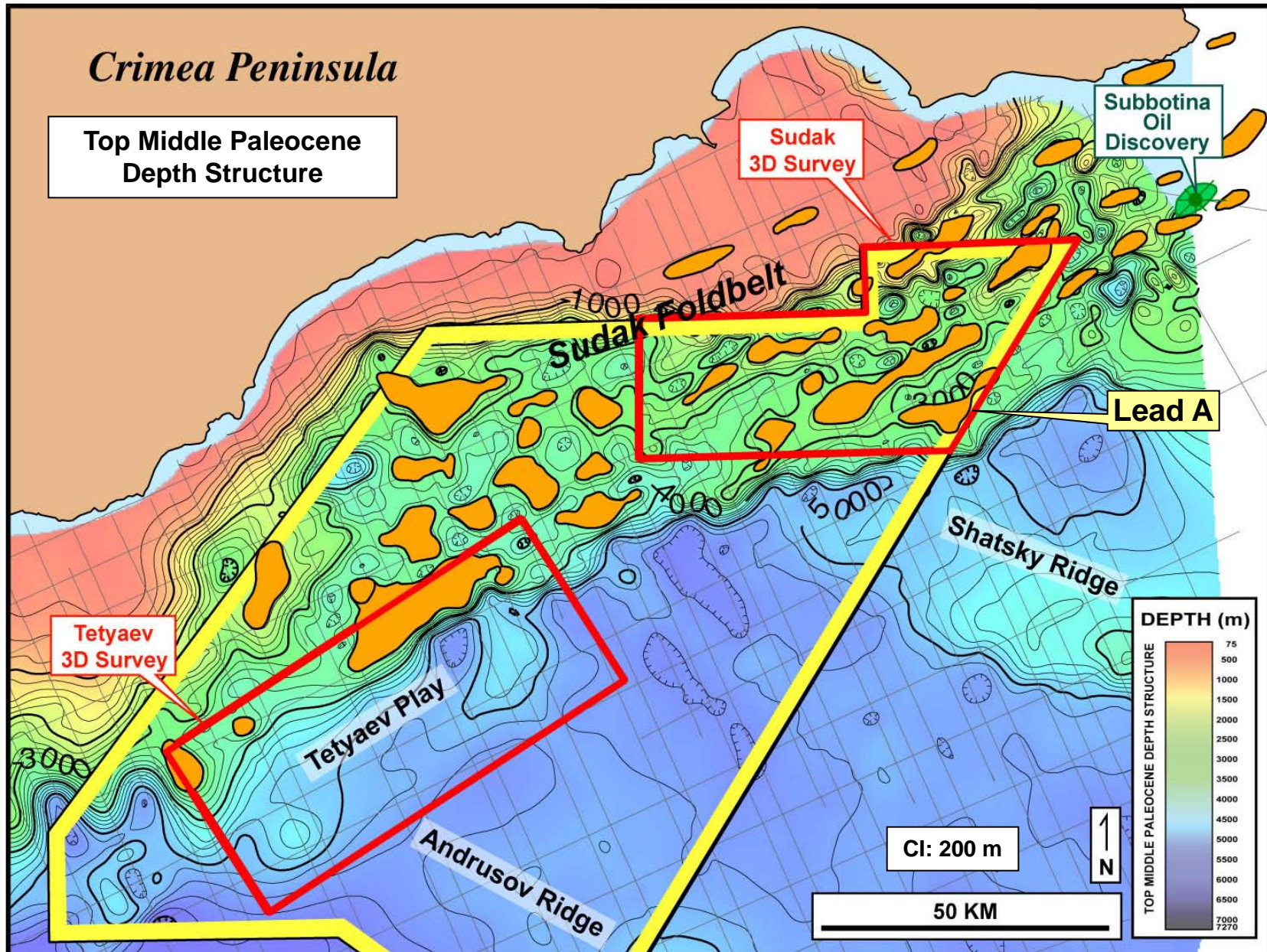
# Outcrop analogue of Jurassic carbonates, Crimea



Courtesy of Stephen Vincent, CASP

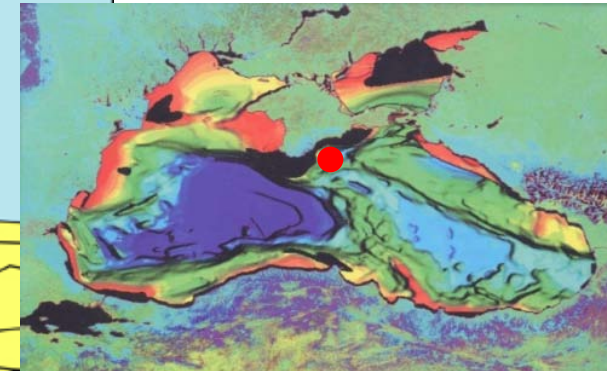
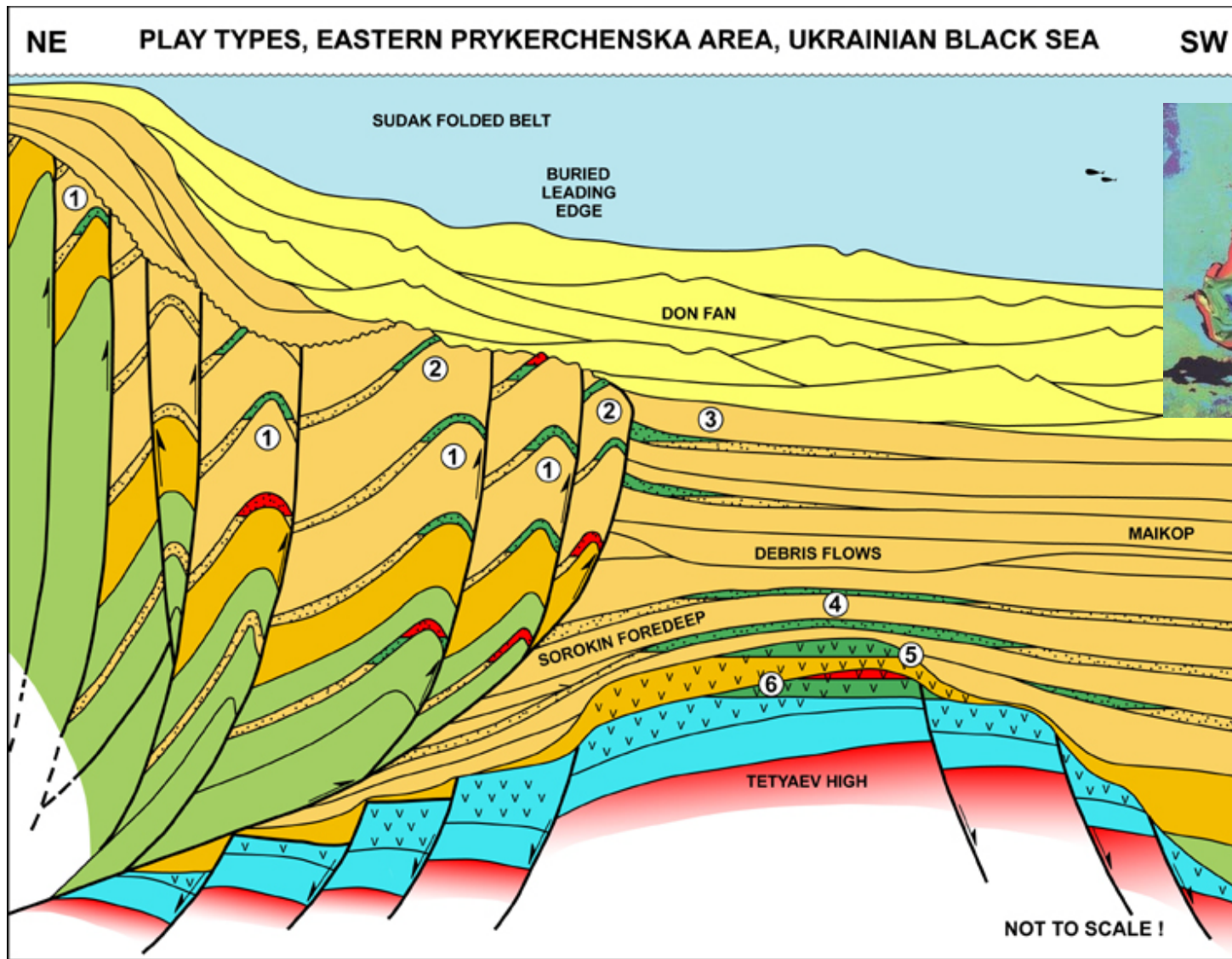


# Sudak Folded belt, offshore Crimea, Ukraine



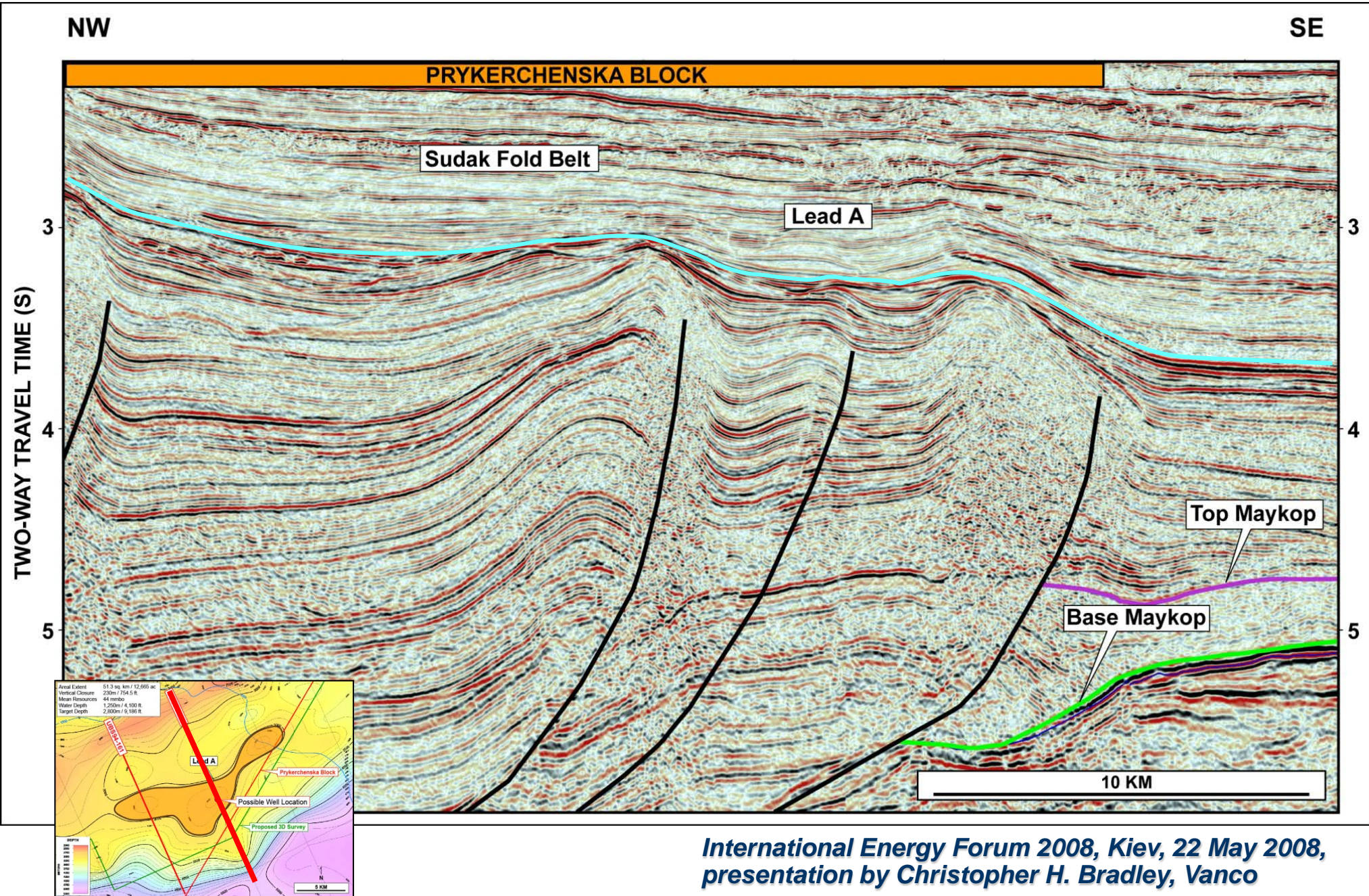


# Tetyaev High, exploration analogue, offshore Ukraine



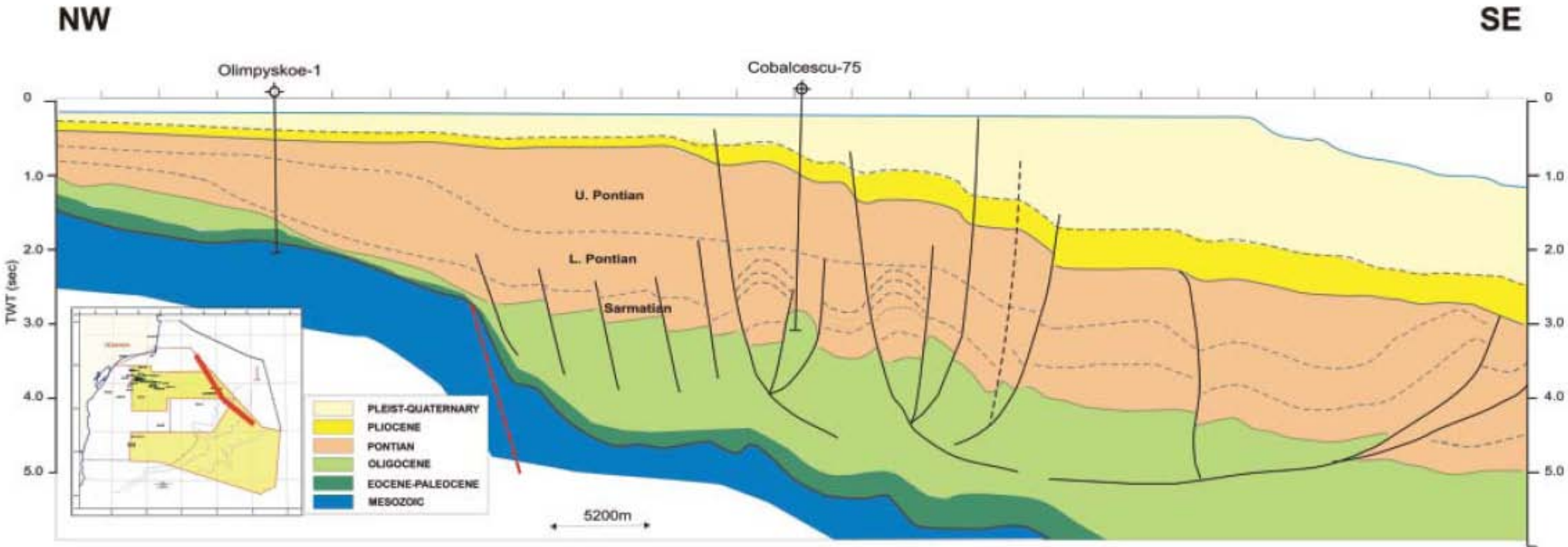


# Seismic profile across Lead A, deepwater Ukraine

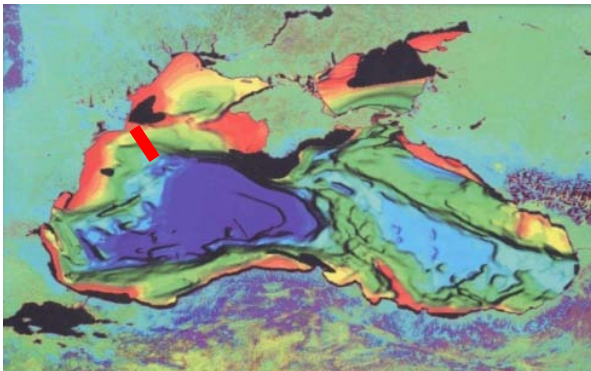




# Linked shale-detachment system, Romania



Bega and Ionescu (2009)



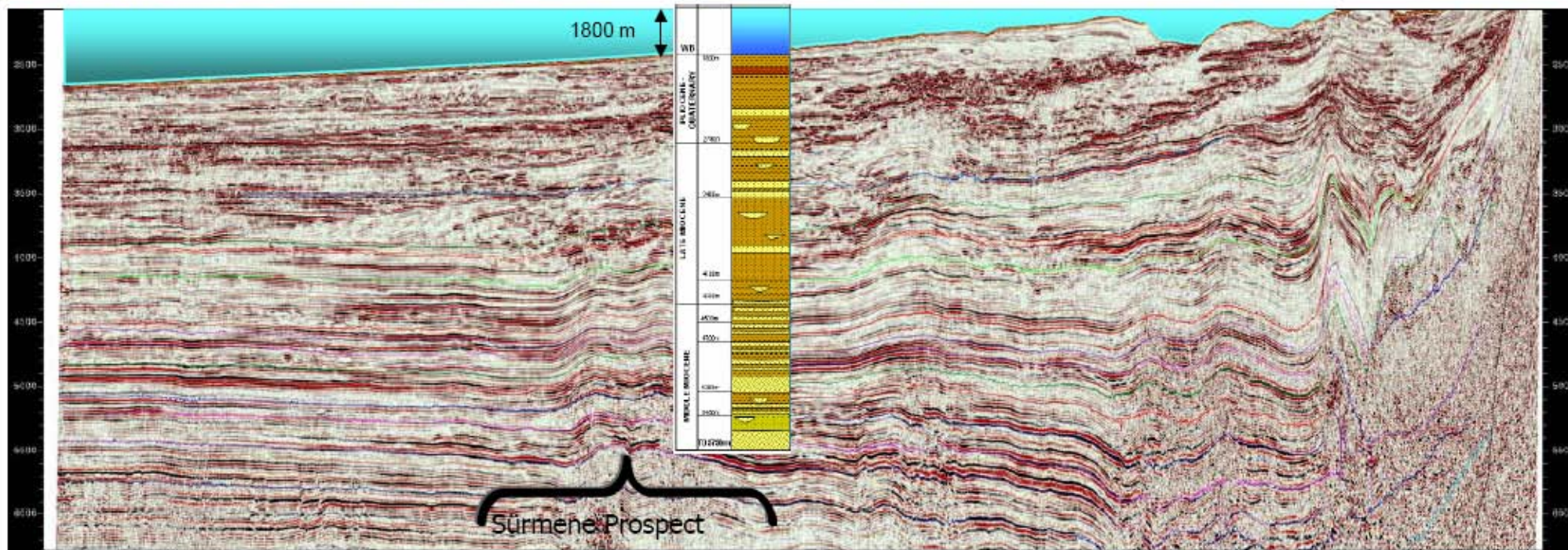
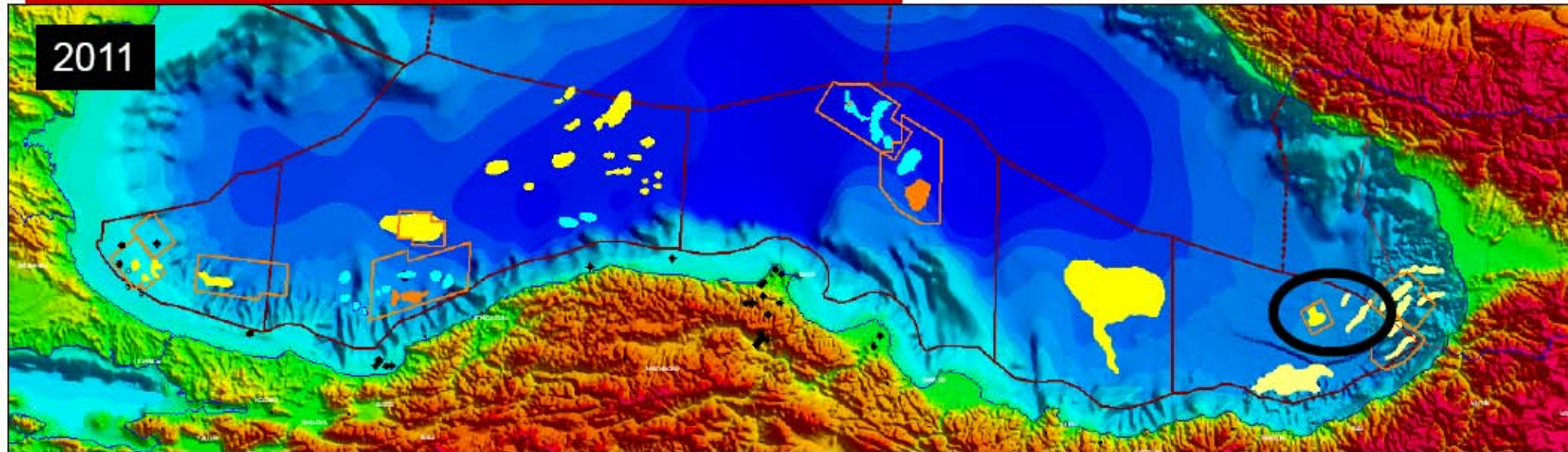


# Surmene (TPAO)

BBSPA Conference, 15 April 2010, Vienna, presentation by Yurdal Öztaş, TPAO



2011









# Conclusions

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- Large number of deepwater play types, which could be classified as pre/syn-rift and post-rift plays
- Pre/syn-rift play types:
  - fault blocks on a marginal ridge, e.g. Andrusov High
  - rotated/tilted fault block at the margin, e.g. Polshkov High
  - inverted syn-rift structure, e.g. Kozlu High
  - syn-rift carbonate platform, e.g. Shatsky Ridge
- Post-rift play types
  - Tertiary folded belts, e.g. Sudak
  - Tertiary detachment systems, e.g. Neptun
  - Compactional anticlines, e.g. Sürmene(?)
  - Tertiary fans, e.g. deepwater Akcakoca
- Most of these play types are untested to date, but some of them are being targeted by the ongoing deepwater drilling campaign (i.e. Sinop, Yassihöyük, Sürmene, Samsun, etc. wells)