Modern reprocessing techniques deliver significant seismic data improvement leading to new play concepts offshore Iran

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The Geological Society Tuesday May 16, 2017

AGENDA

GGS-Interica at a glance

E&P opportunities and uncertainties in Iran

Current international players in Iran

PC-2000 - Unique multiclient seismic data package

First reprocessing results

Conclusions

GGS-Interica at a glance

Global Geo Services AS (GGS), a Norwegian oil service company with its primary asset the seismic data library PC-2000

CEO
Bjorn Ursin-Holm

CEO
Simon Kendall

Interica Limited UK, a leading Data Management and Data Solutions Company

- Formed in 2016 to reprocess PC-2000 data and to market it to companies interested in the new bidding process in Iran

E&P opportunities in Iran

- The HC history of Iran is more than one century
- 4th largest oil reserves in the world (10% of global reserves) and the 2nd largest gas reserves in the world (18% of global reserves)
- 52 upstream oil/gas development projects and 18 exploration blocks
- No security problems and well developed infrastructures

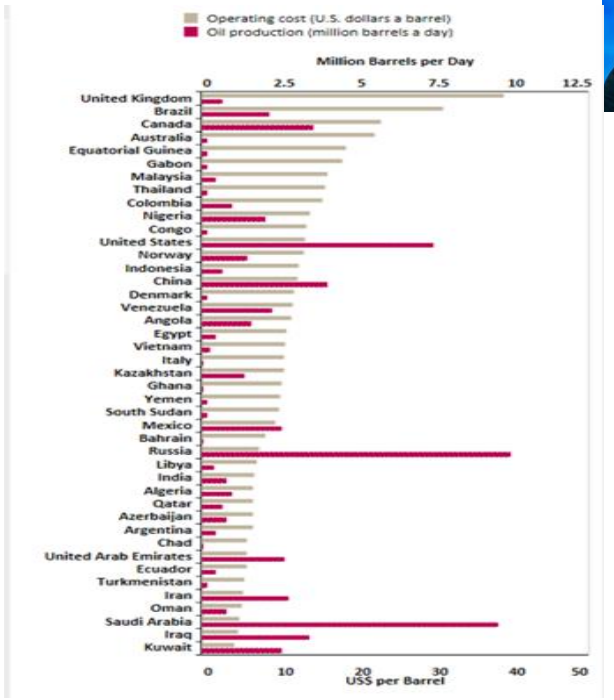
Offered Oil and Gas fields for development

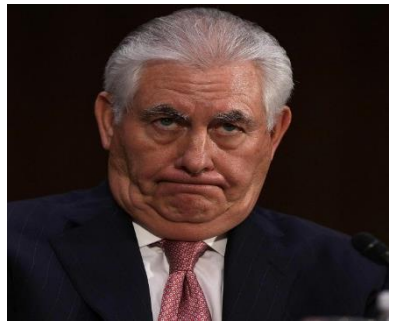
52 Hydrocarbon Fields (26 packages)							
Oil Fields (29)-STOIIP 391 BSTB				Gas Fields (23)-GIIP 255 TSCF			
Green (Undeveloped) Fields (12)		Brown (Developed) Fields (17)		Green (Undeveloped) Fields (21)		Brown (Developed) Fields (2)	
Onshore (9)	Offshore (3)	Onshore (12)	Offshore (5)	Onshore (13)	Offshore (8)	Onshore (2)	Offshore (0)
South Azadegan-Phase2	South Pars Oil Layer	Ahwaz-Bangestan	Foroozan	Halegan, Sefid-Baghoun, Sefid-Zakhor, Day and Aghar	South Pars (Phase 11)	Tang-e-Bijar and Ilam refinary	
Changuleh	Golshan&Ferdowsi Oil Field	Mansouri-Bangestan	Soroosh	Khami Reservoirs	Farzad-A		
Darquain-3rd Phase (Bangestan)		Ab-Teymour	Nowrooz	Karun-Bangestan&NGL-1700	Farzad-B		
Susangerd, Jufair, Sepehr, Sohrab, Band-e-Karkheh and Arvand		Aban, Paydar, West-Paydar, Danan, Cheshme-khosh, Dalpari, Naft-Shar, Dehloran and Sumar	Dorood		Balal Gas Field		
			Salman Oil Field		North Pars		
					Golshan&Ferdowsi Gas Field		
					Kish (Phase 2&3)		

* Ali Kolahdouz, CNPC International Ltd

Uncertainties

- American Policy
- Presidential elections in Iran
- Banking and insurance issues
- Other legal risks and limitations
- Low oil price





2017 [edit]

US-based pollsters [edit]

Fieldwork date	Poll source	Sample size	Margin of error	Rouhani	Raisi	Ghalibaf	Mir-Salim	Jahangiri	Hashemitaba
8–11 May 2017	iPPO[1]	1,212	[±2.81,±3.74]	29%	11%	12%	<1%	1%	<1%
7–10 May 2017	iPPO[2]	1,189	[±2.82,±3.75]	28%	10%	10%	<1%	<1%	<1%
6–9 May 2017	iPPO[3]	1,189	[±2.84,±3.82]	23%	9%	11%	1%	<1%	<1%
5–8 May 2017	iPPO[4]	1,076	[±2.99,±3.91]	24.4%	6.9%	10.3%	0.7%	0.7%	0.1%
4–7 May 2017	iPPO[5]	1,000	[±3.10,±3.90]	24.5%	4.6%	10.5%	0.8%	1.3%	0.4%
4–7 May 2017	iPPO[6]	947	[±3.18,±3.90]	26%	5.5%	11.8%	0.8%	1.4%	0.2%

Iran-based pollsters [edit]

According to the *Al-Monitor*, "it's not unusual in Iran for news outlets to publish reports of nonscienti

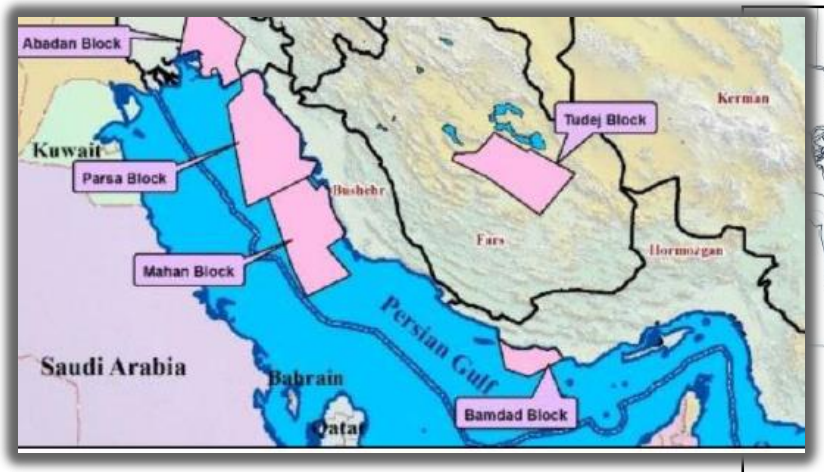
Fieldwork date	Poll source	Rouhani	Ghalibaf	Raisi	Jahangiri	Mir-Salim	Hashemitaba
7–8 May 2017	ISPA[8]	41.6%	24.6%	26.7%	3.2%	2.8%	1.2%
		47.7%	N/A	38.7%	N/A	N/A	N/A
		44.8%	44.1%	N/A	N/A	N/A	N/A
23–24 April 2017	ISPA[9]	43.5%	22.6%	17.4%	3.6%	2.1%	2.8%
		52.9%	N/A	32.4%	N/A	N/A	N/A
		49%	37.7%	N/A	N/A	N/A	N/A
Before 24 April 2017	IRIB[10]	1st	2nd	3rd	N/A	N/A	N/A
		43.3%	N/A	27%	N/A	N/A	N/A
		40.9%	34.6%	N/A	N/A	N/A	N/A
		N/A	36.5%	27%	N/A	N/A	N/A

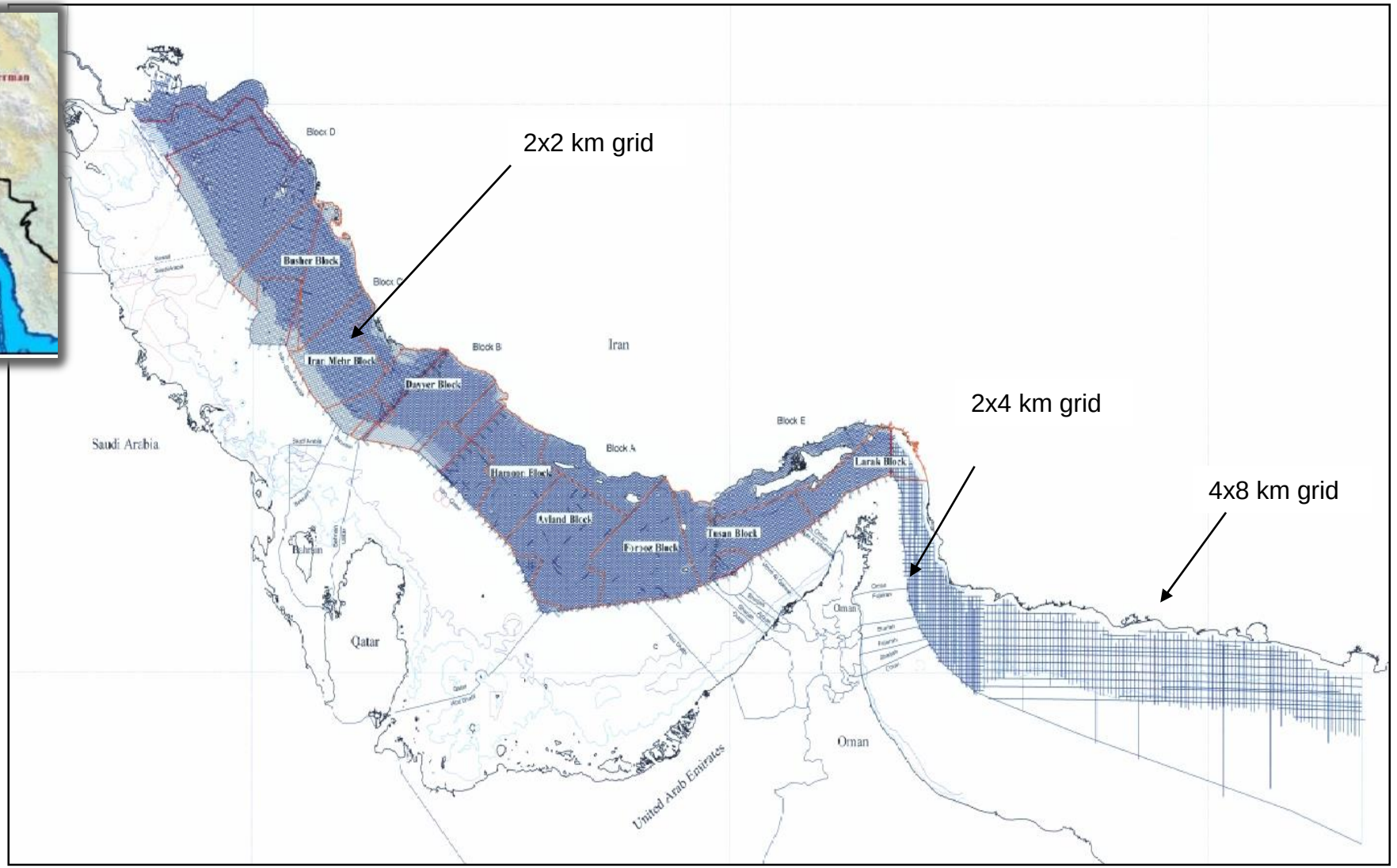
Current international players in Iran

The country aims to attract $200bn of oil and gas investment over the next five years.

- Total became the first western oil major to make a renewed commitment when it signed a deal in November to develop the next phase of Iran's giant South Pars gas field together with China National Petroleum Corp
- Shell followed in December with a more tentative agreement for studies of the Azadegan and Yadavaran oilfields in south-west Iran as well as the Kish gas fields in the Gulf
- Iran certified 29 international companies to bid for oil, gas projects in January
- Gazprom and National Iranian Oil Company (NIOC) signed a memorandum of understanding in Moscow for hydrocarbon exploration and production within Iran in March 2017

PC-2000: All available 2D lines





PC-2000: Data available

All data is available in Petrel and Kingdom projects!

SEISMIC DATA: approximately 100,000 km time migrated seismic data

WELL DATA:
Phase 1 – Tops in depth for 100 wells offshore (time for 50 wells)
Phase 2 – Tops in depth for 10 wells offshore (time for 5 wells)
Phase 3 – Tops in depth for 22 well near offshore (time for 11 wells)
Phase 4 – GR SON for 23 wells offshore (12 high quality)
Phase 5 – GR SON + other logs for 7 wells offshore (high quality)
Cyclolog study – based on phase 4 and 5

INTERPRETATION

REPORTS: Oman Sea Geological Report

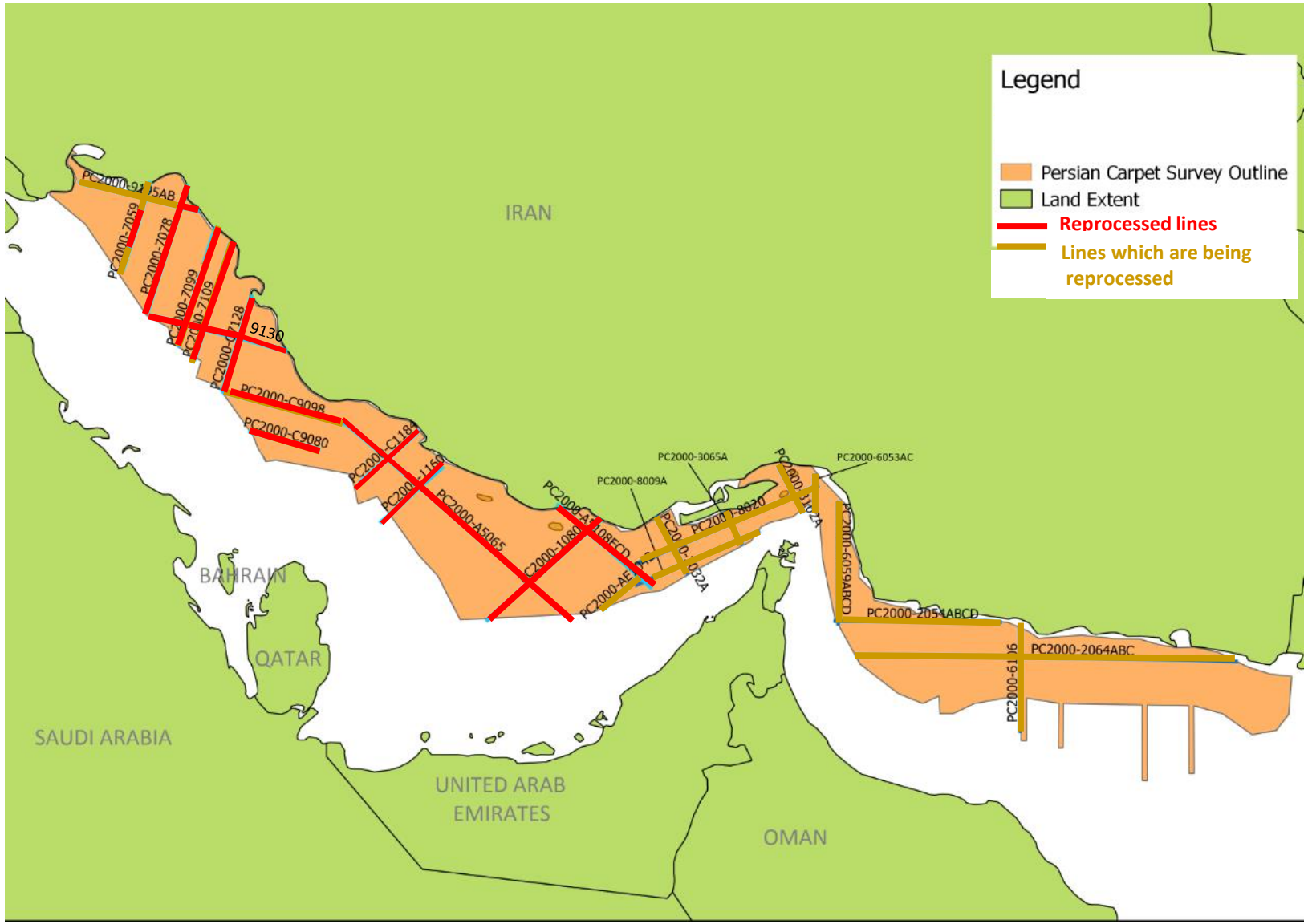
GRAVITY: 30000 km of gravity data + reports

WELL TIES FOR MOST WELLS

PROSPECTIVITY ATLAS

Reprocessing will be available soon

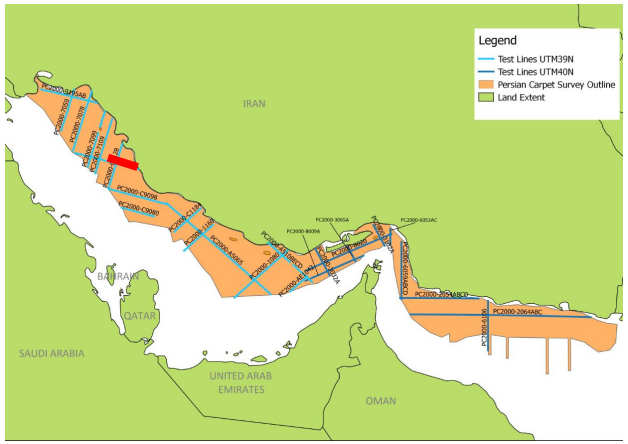
PC-2000: Base map – selected test lines for reprocessing

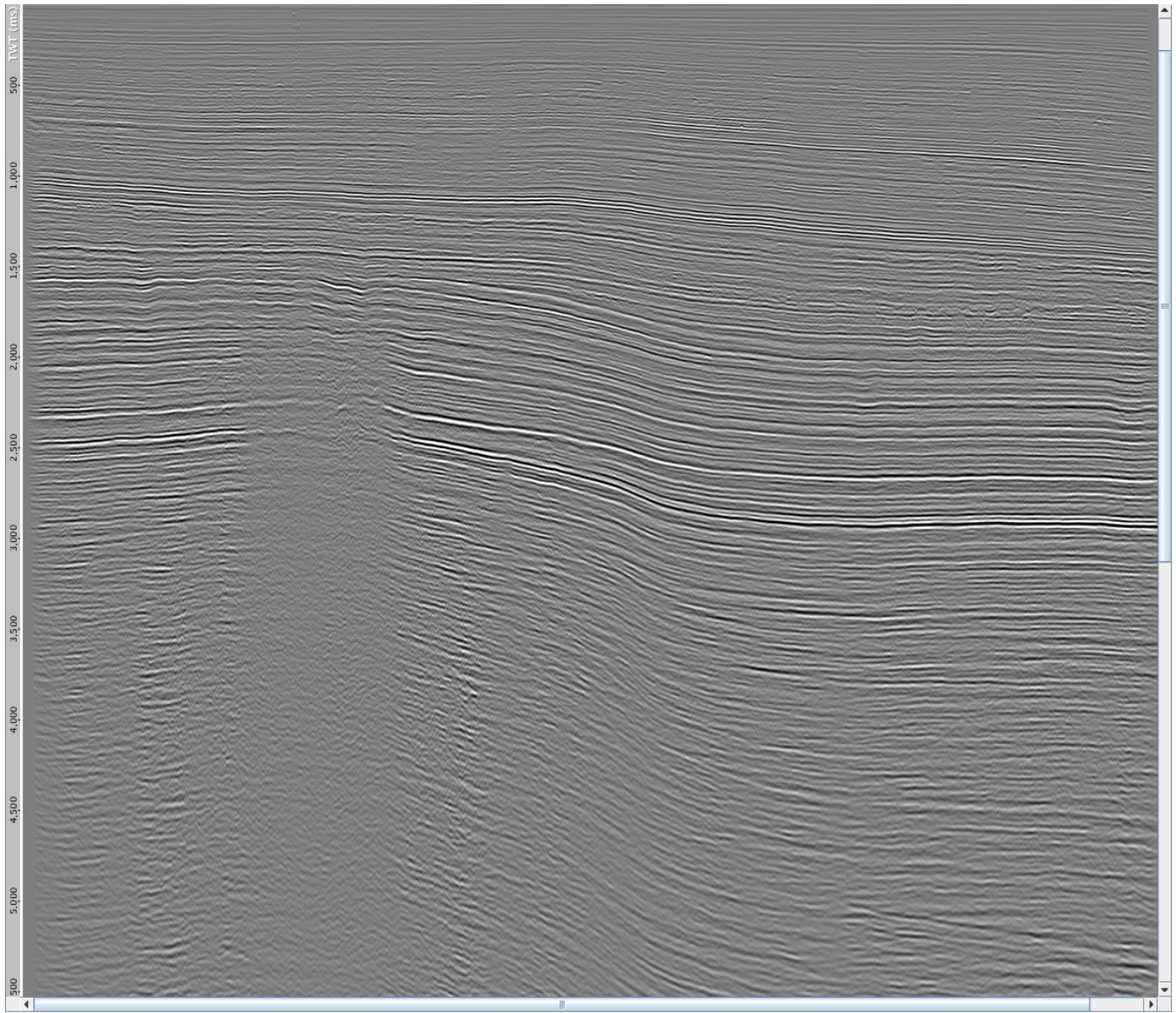


PC-2000: Preliminarily reprocessing sequence

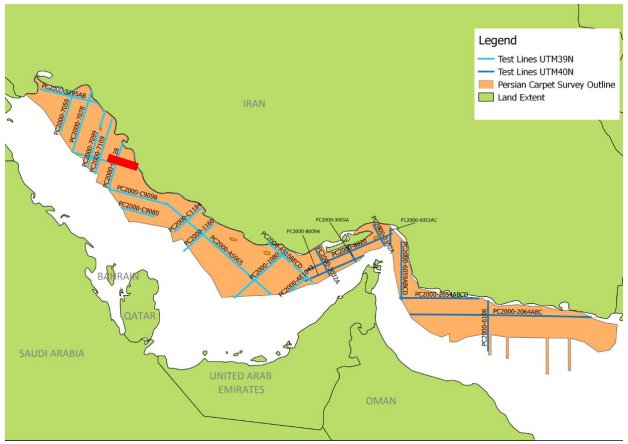
- Data load and transcription
- Spherical divergence correction
- Low cut filter – 3 Hz
- Swell noise attenuation – multi pass, multi domain, frequency split
- Direct arrival and guided wave noise attenuation
- Receiver motion compensation
- DUG Broad deghosting – source and receiver deghosting
- Debubble and zero phase- using extracted signature output to SEG standard (black = increase in AI)
- Inverse phase Q
- SRME – frequency split, multi domain adaptive subtractive
- Tau-p deconvolution
- DUG Shallow Water Demultiple – frequency split, multi domain adaptive subtractive
- Interbed multiple elimination (DUG IME) – 2 passes with simultaneous adaptive subtraction
- 1000m spaced velocity analysis
- Parabolic Radon demultiple
- Residual noise attenuation – multi domain, frequency split
- 200m spaced velocity analysis – automatic RMO picking and time domain tomography
- Pre-stack time migration
- 200m spaced residual moveout analysis – automatic RMO picking and time domain tomography
- Parabolic radon demultiple
- Mute – velocity dependent angle mute
- Stack
- Amplitude Q
- Residual Noise attenuation
- Gain corrections

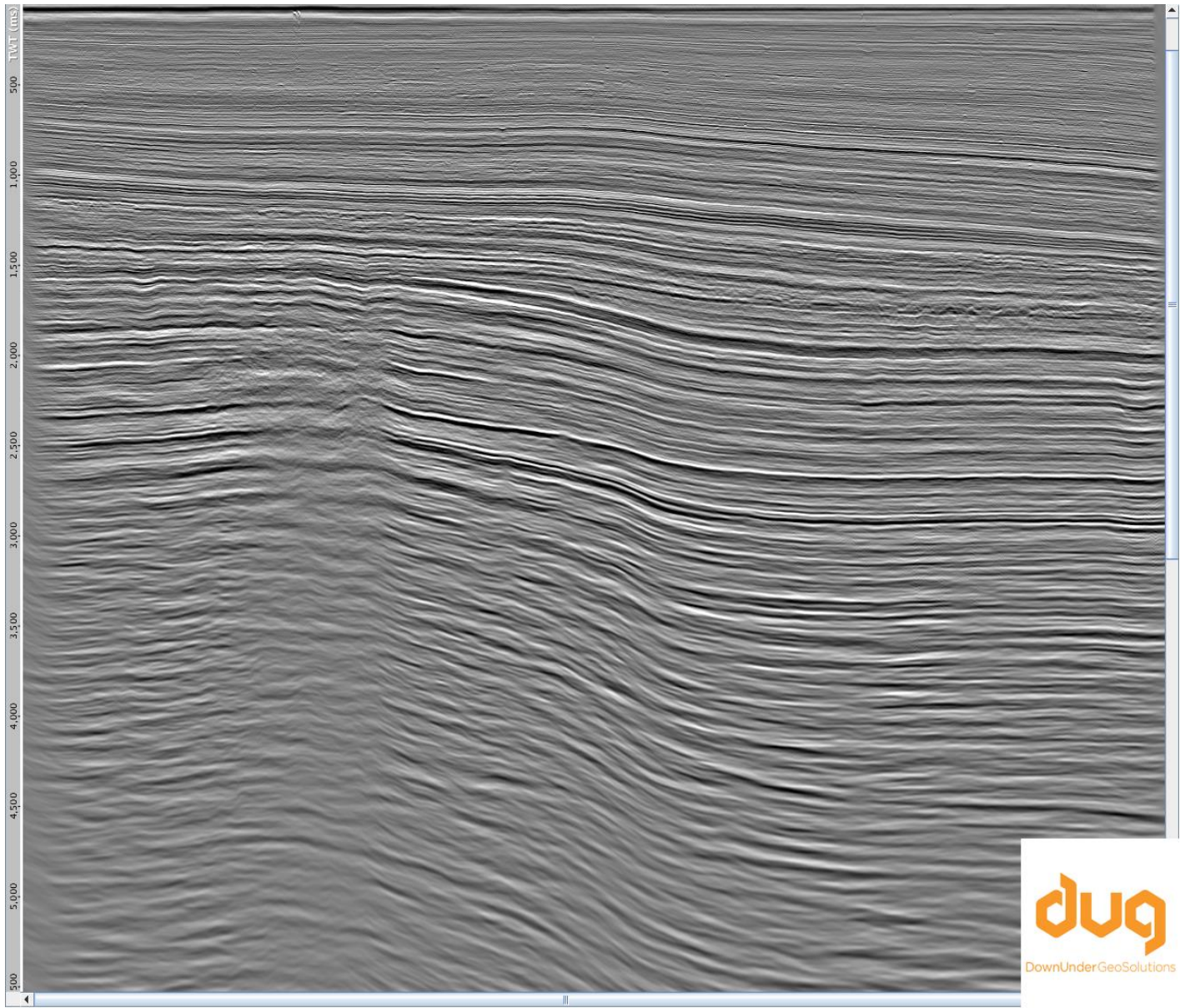
Line C9130 - legacy



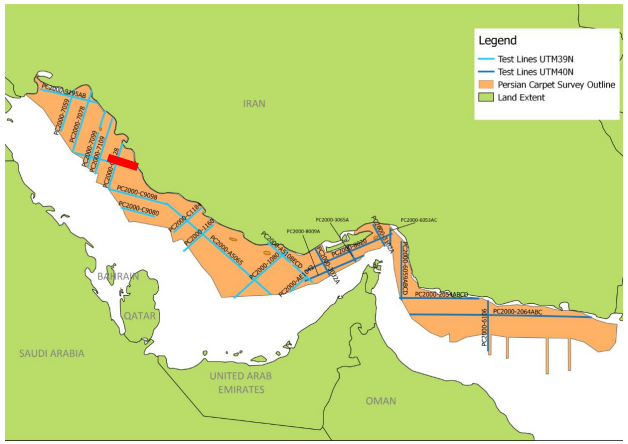


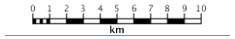
Line C9130 - reprocessed

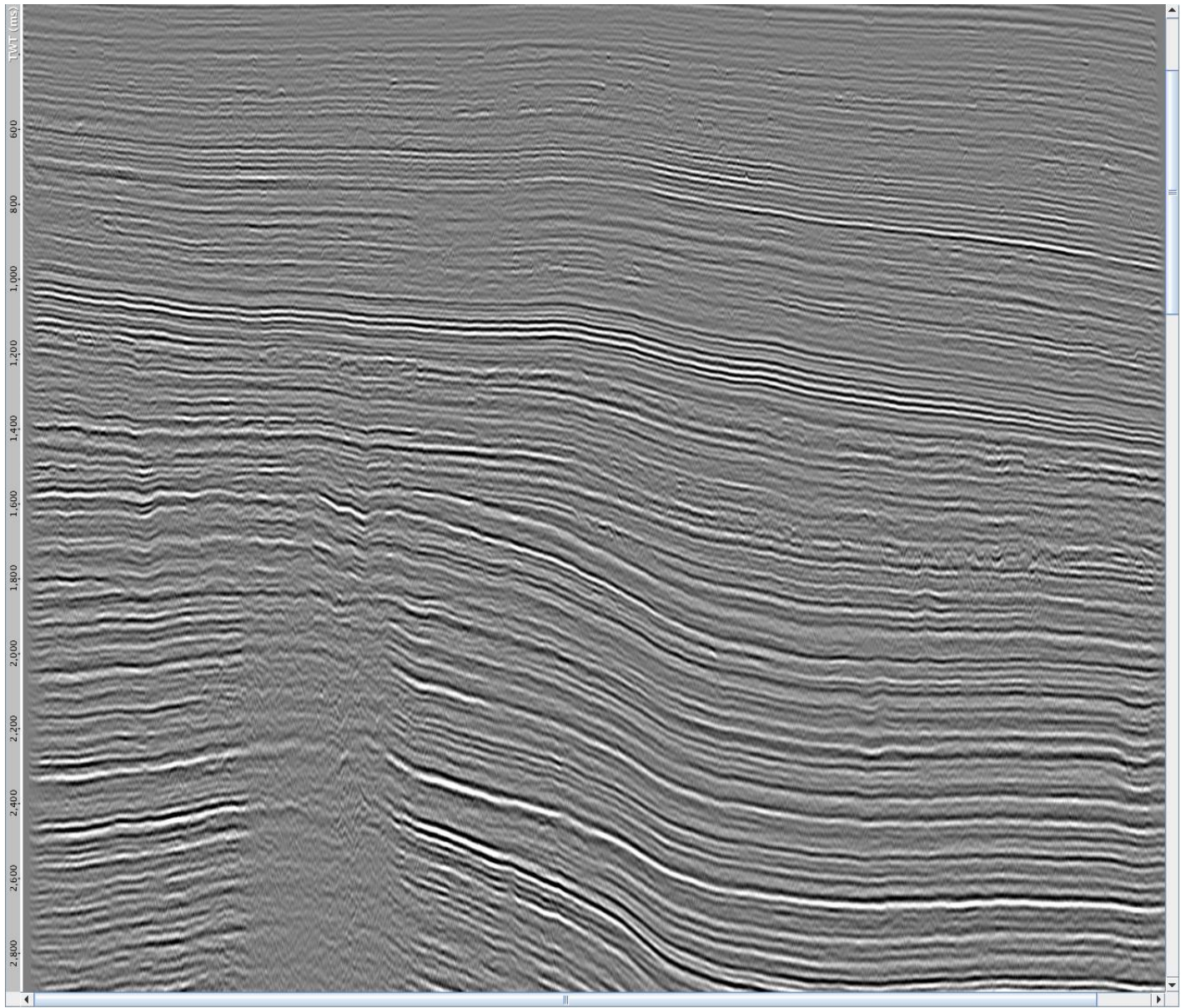




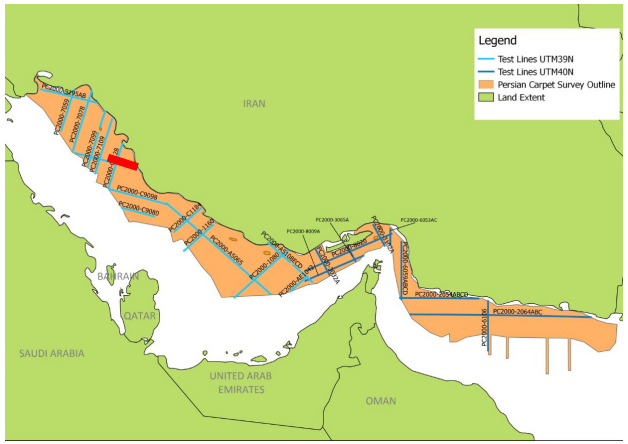
Line C9130 – legacy shallow zoom

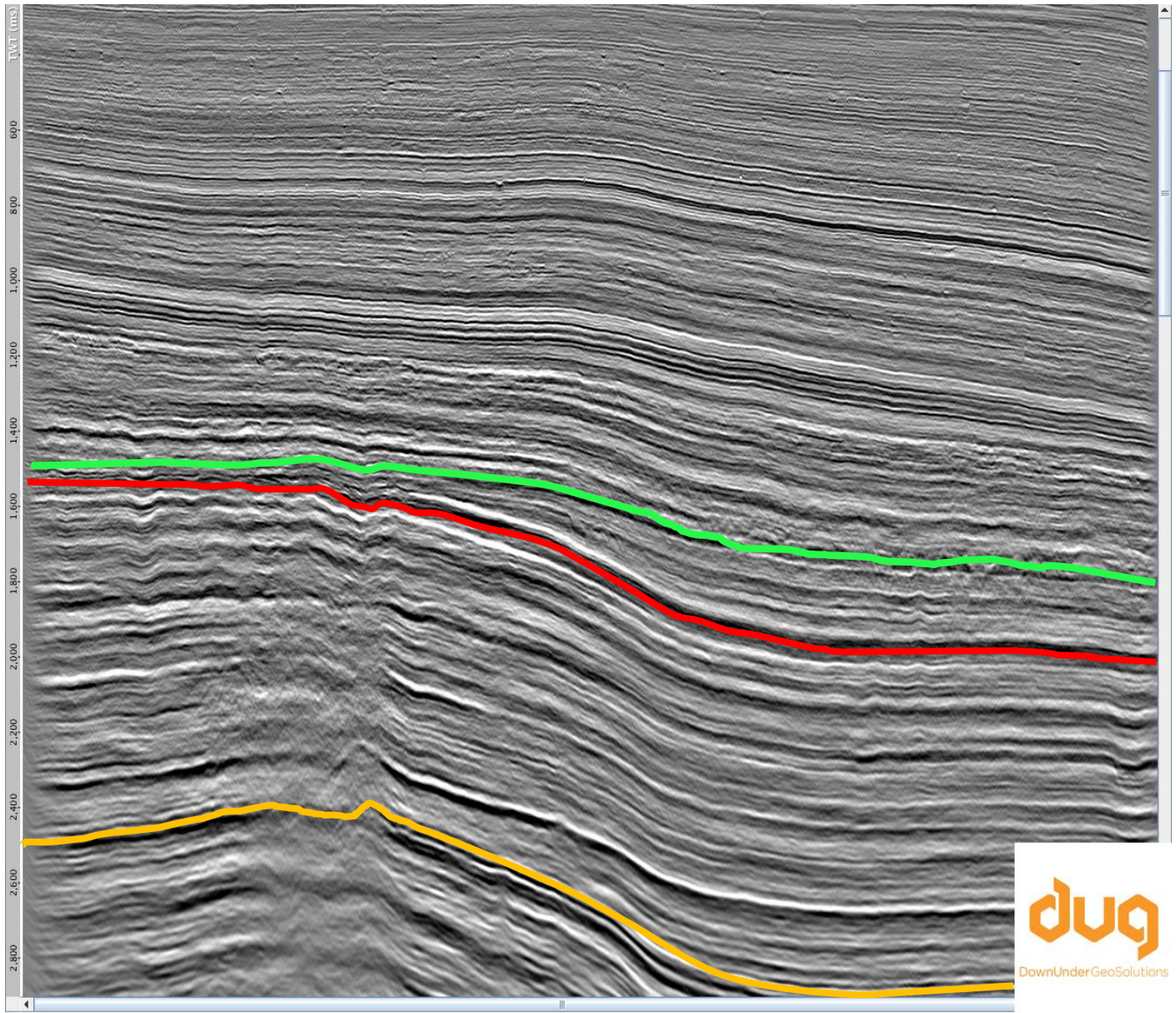






Line C9130 – reprocessed shallow zoom



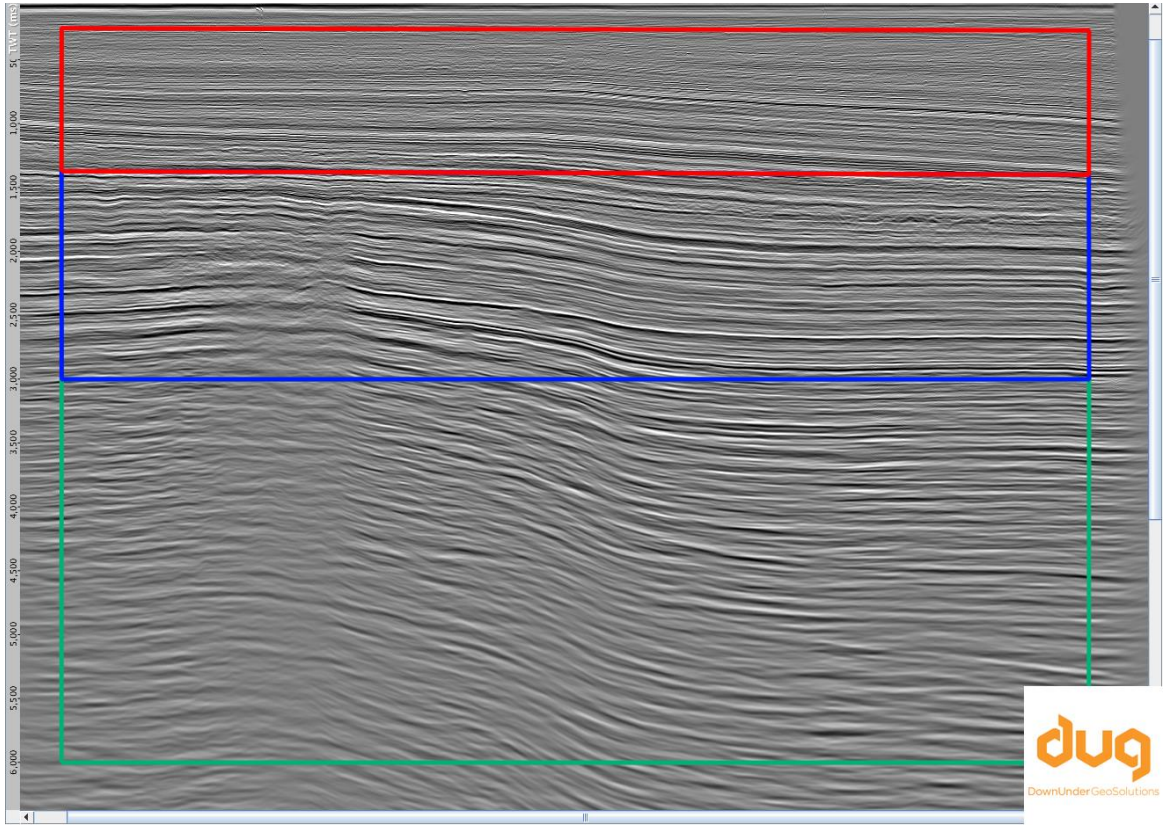


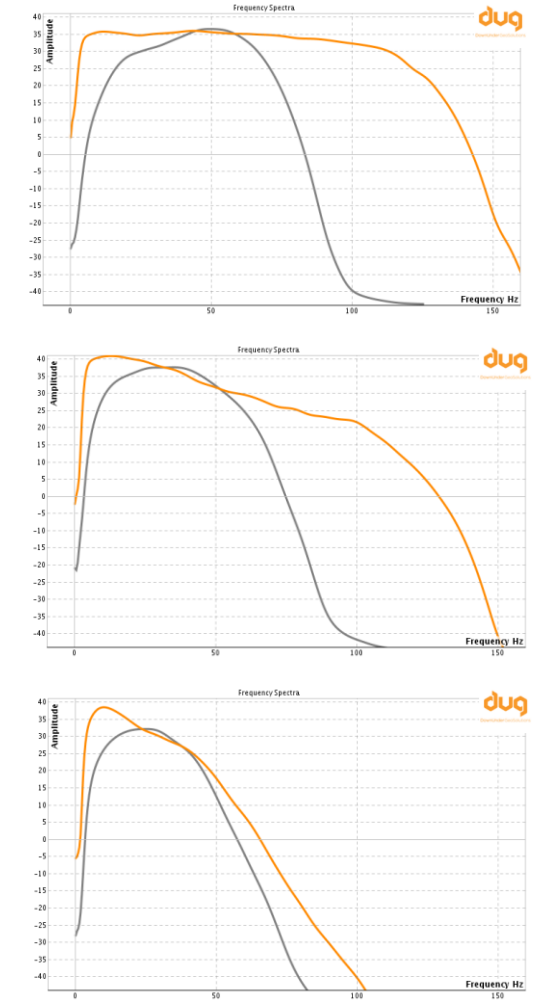
Turonian Unc.

Top Daryan

Top Sudair.

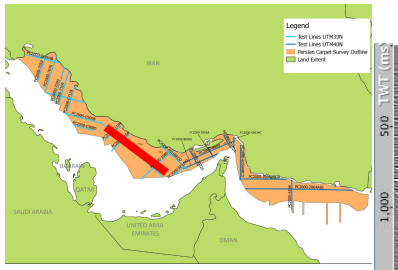
Line C9130 – amplitude spectra

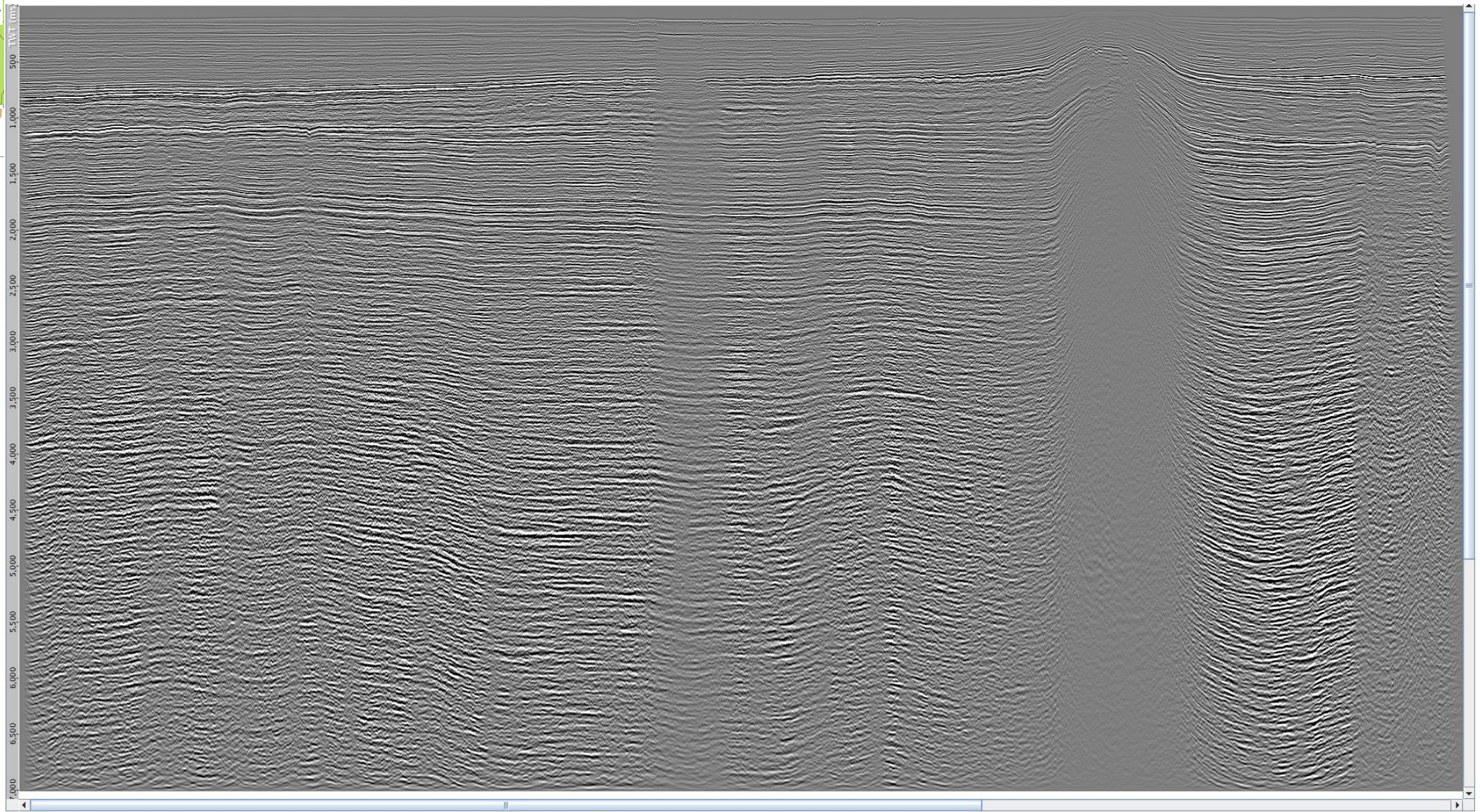




Legacy
Reprocessed

Line A5065AB - legacy





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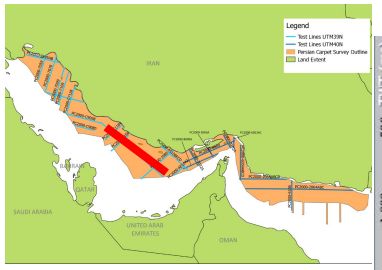
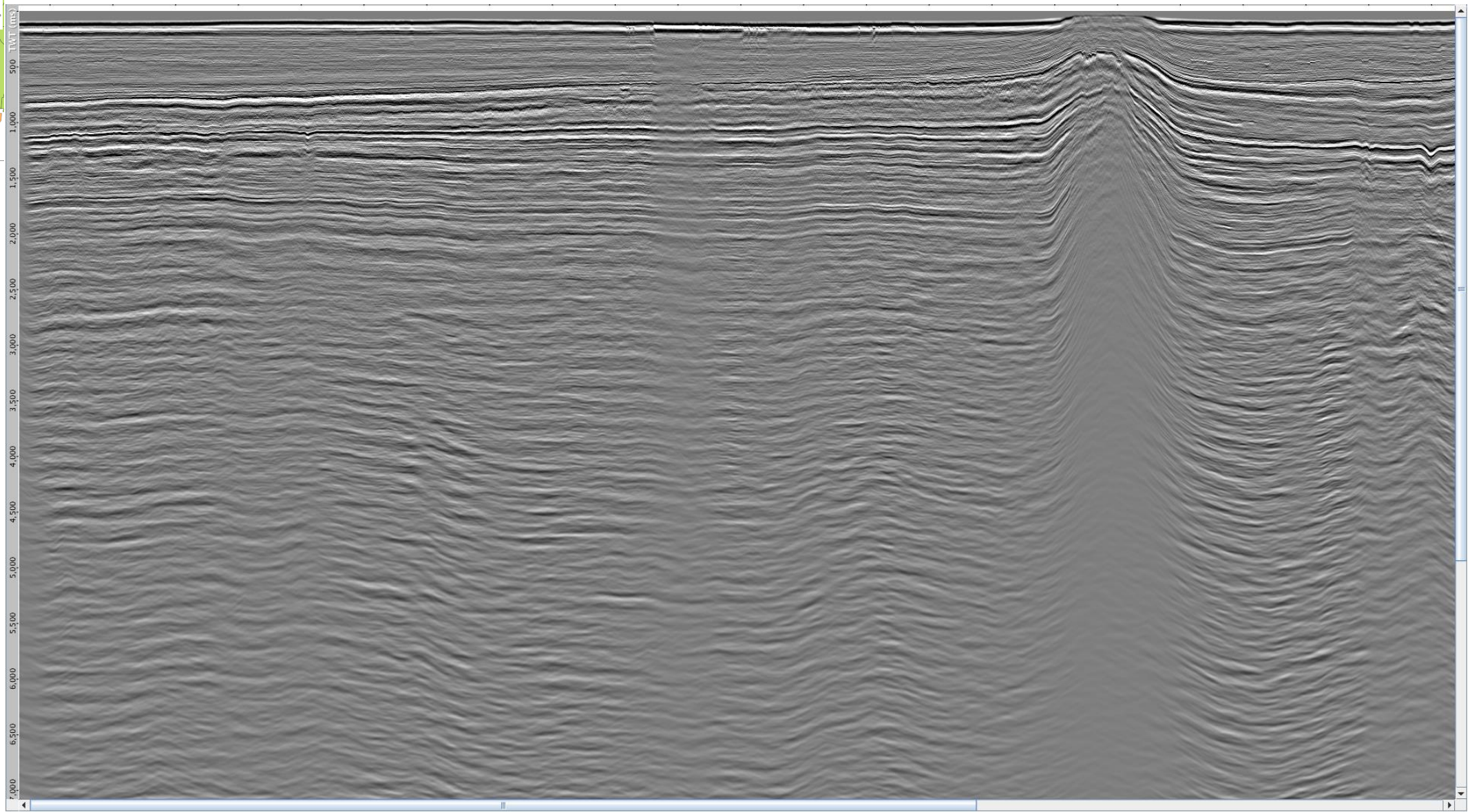
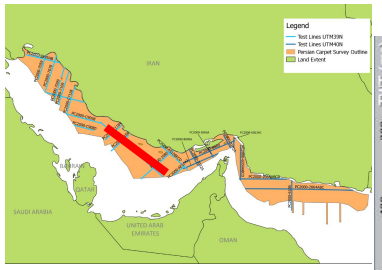
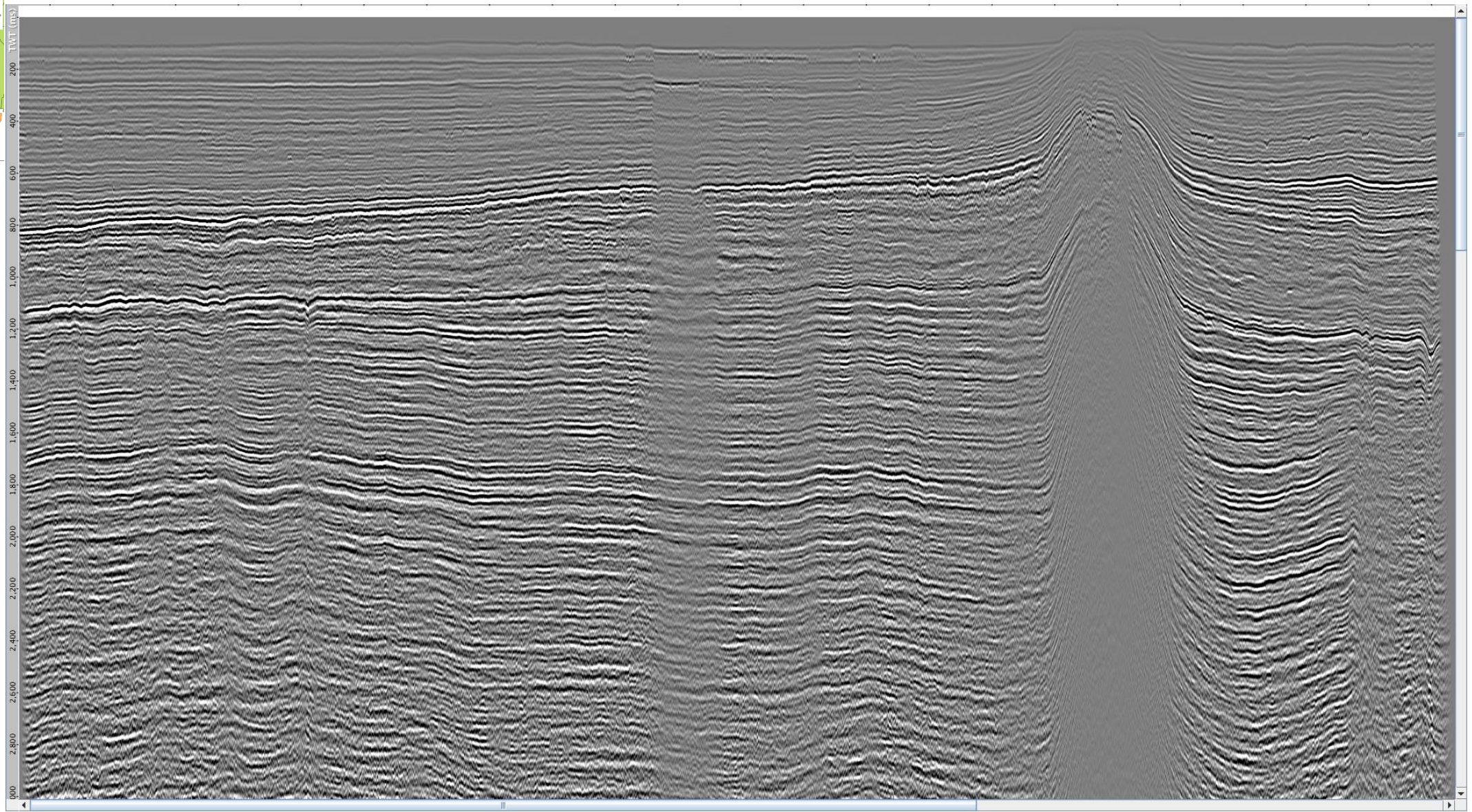




Line A5065AB – legacy shallow zoom





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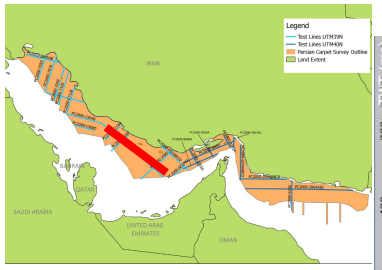
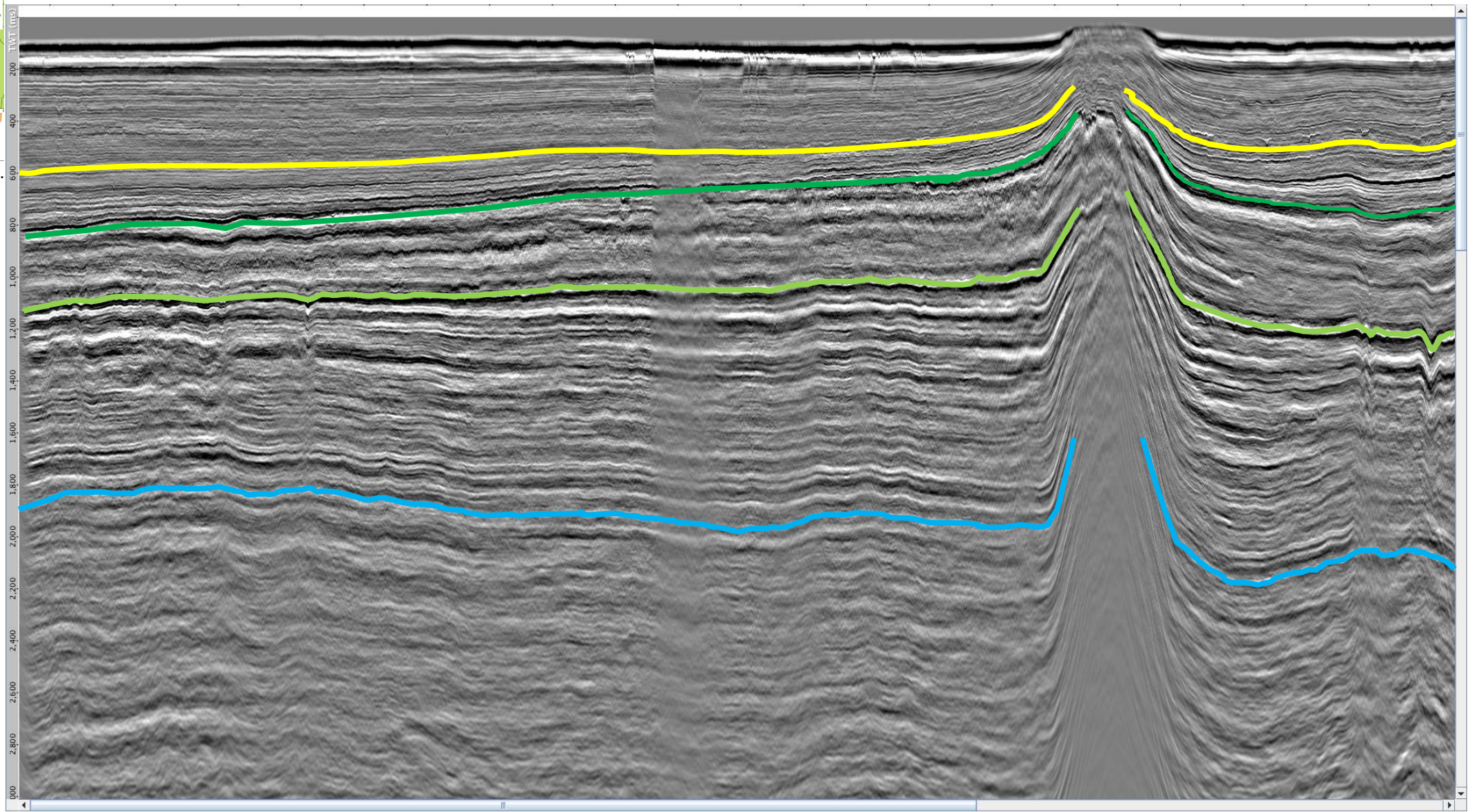


Intra- Lower Fars.

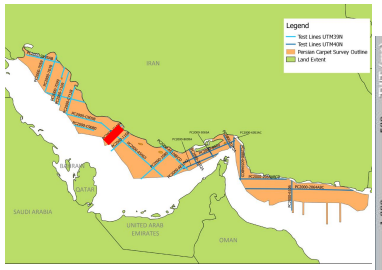
Oligocene Unc.

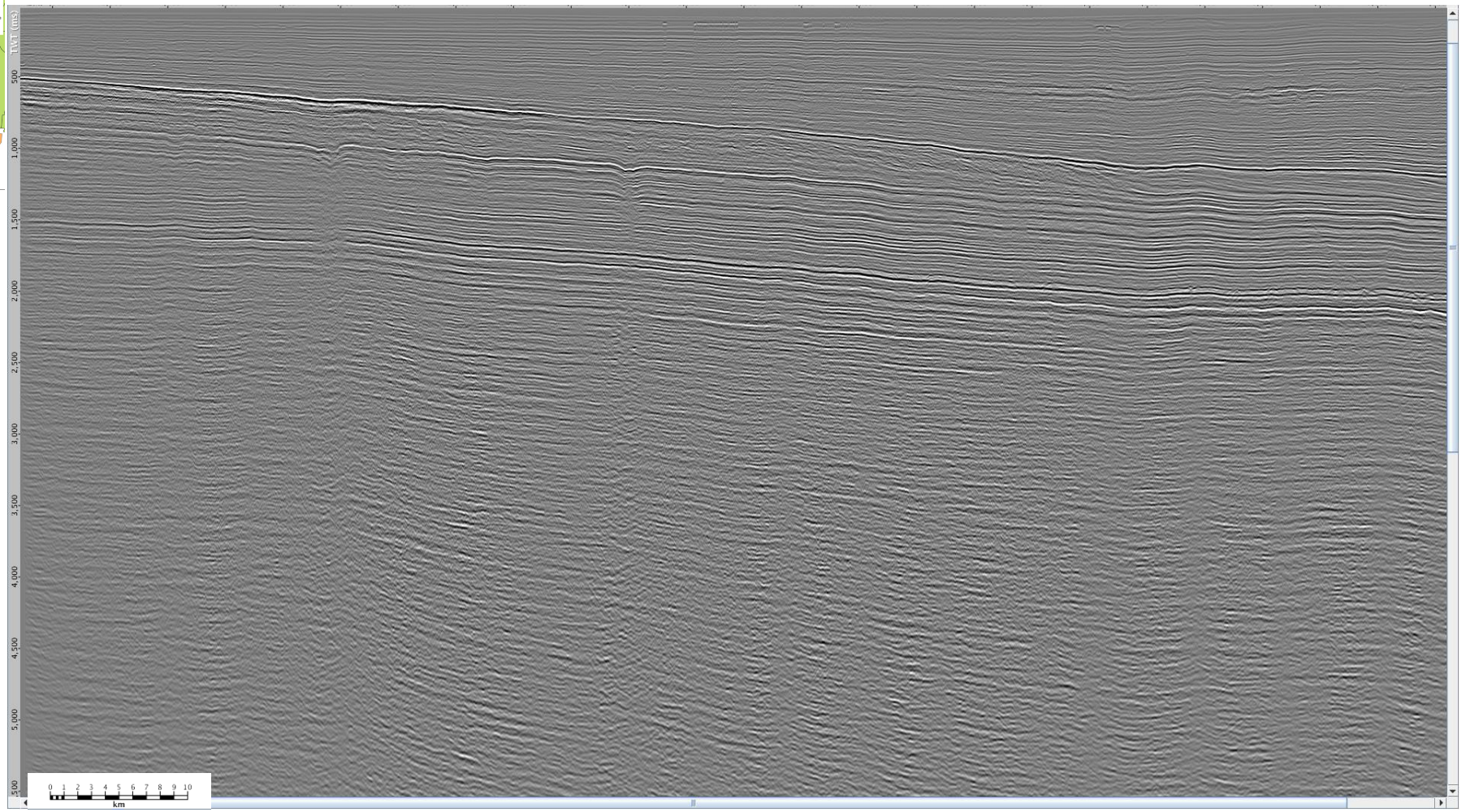
Turonian Unc.

Khuff



Line B1184 - legacy





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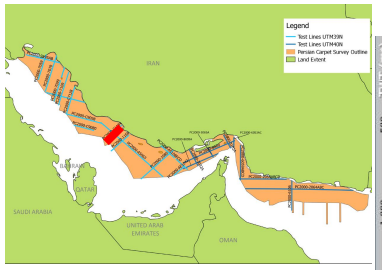

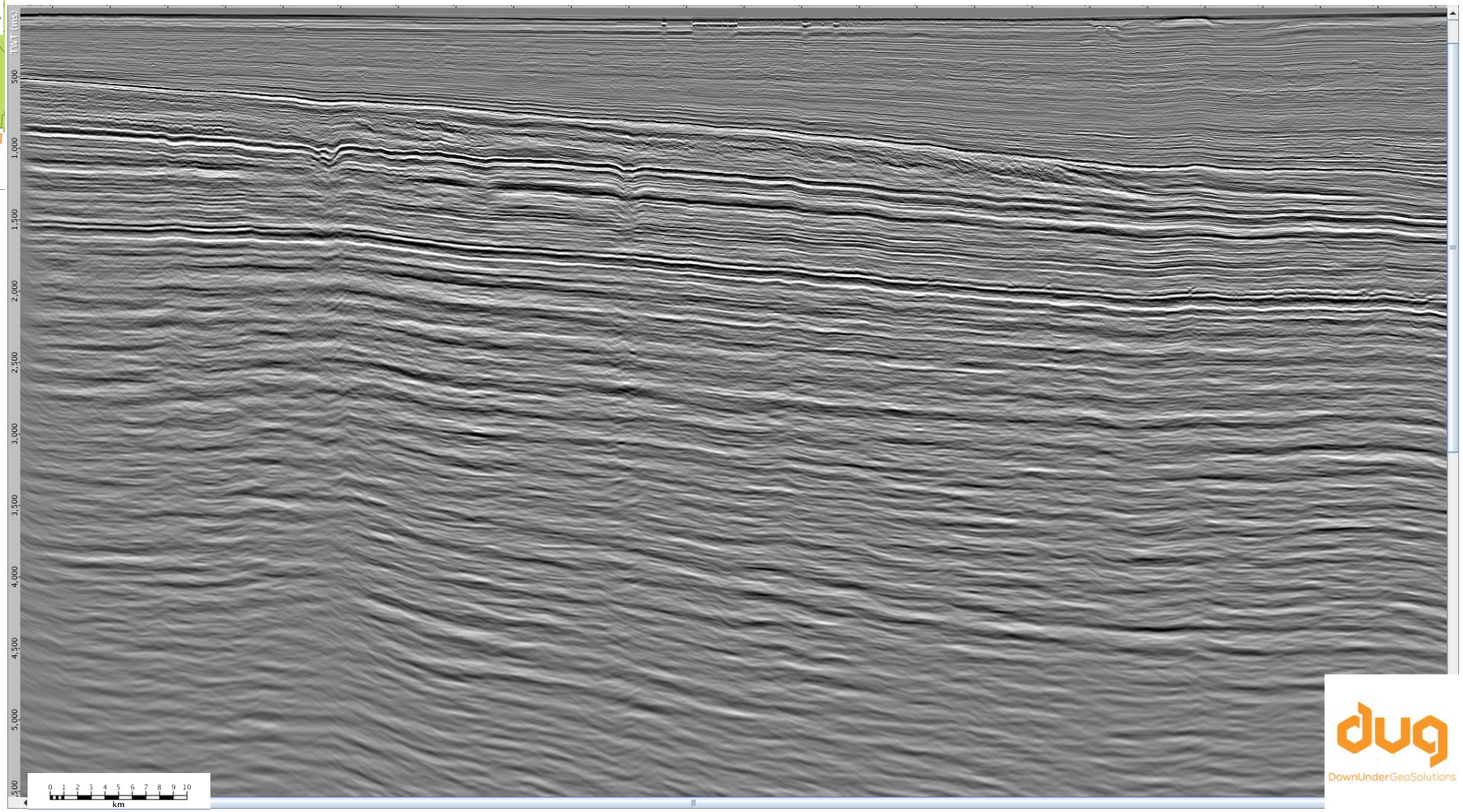

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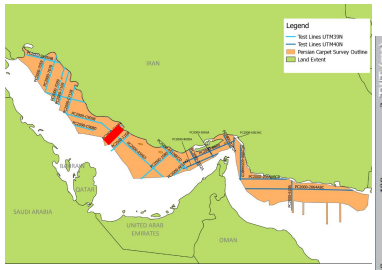

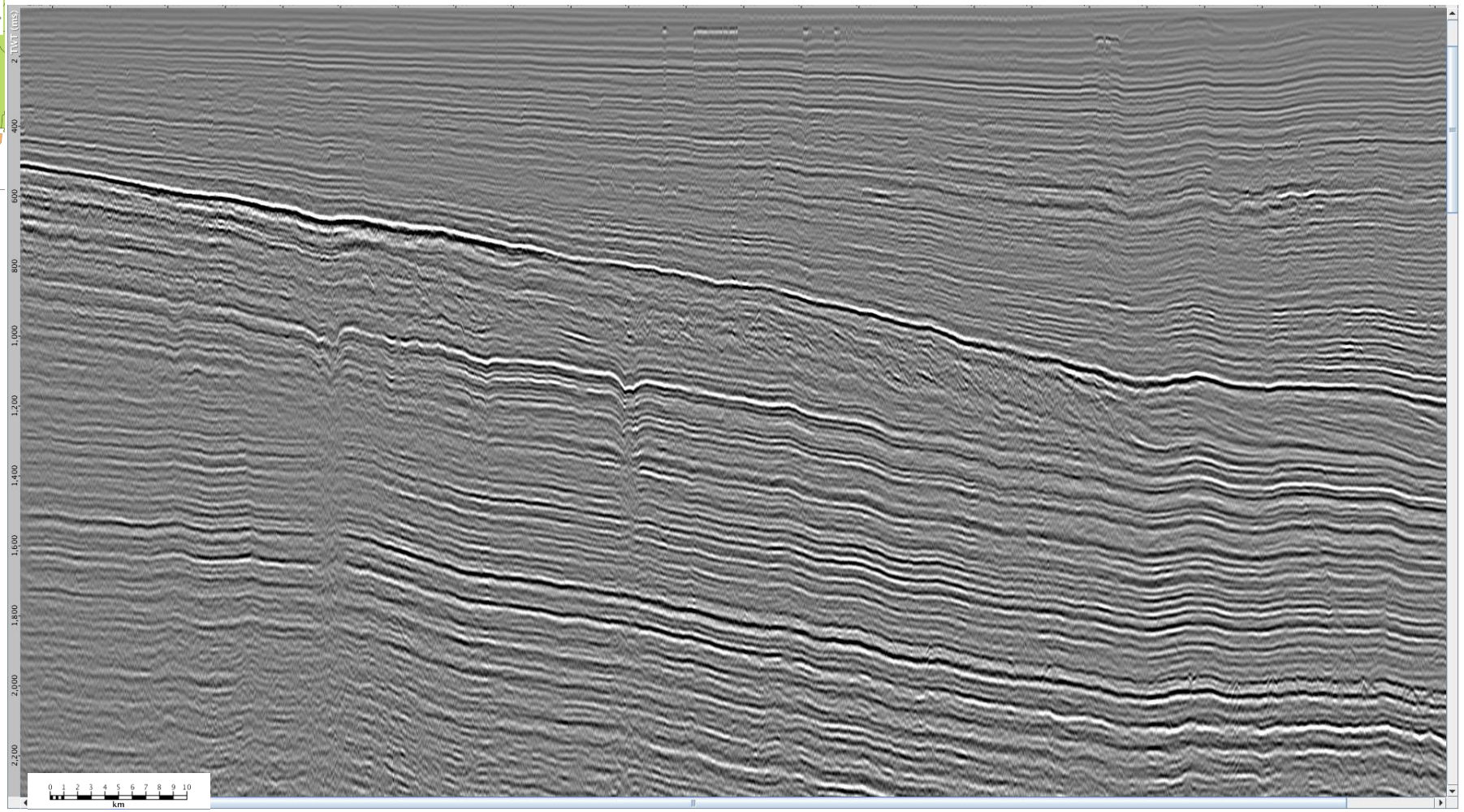

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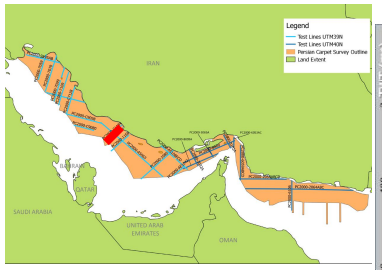


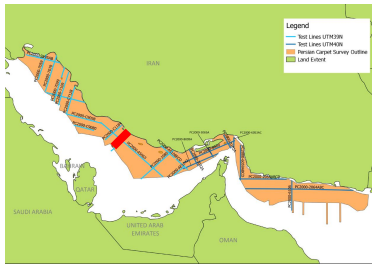
Asmari Fm. Pinch-out

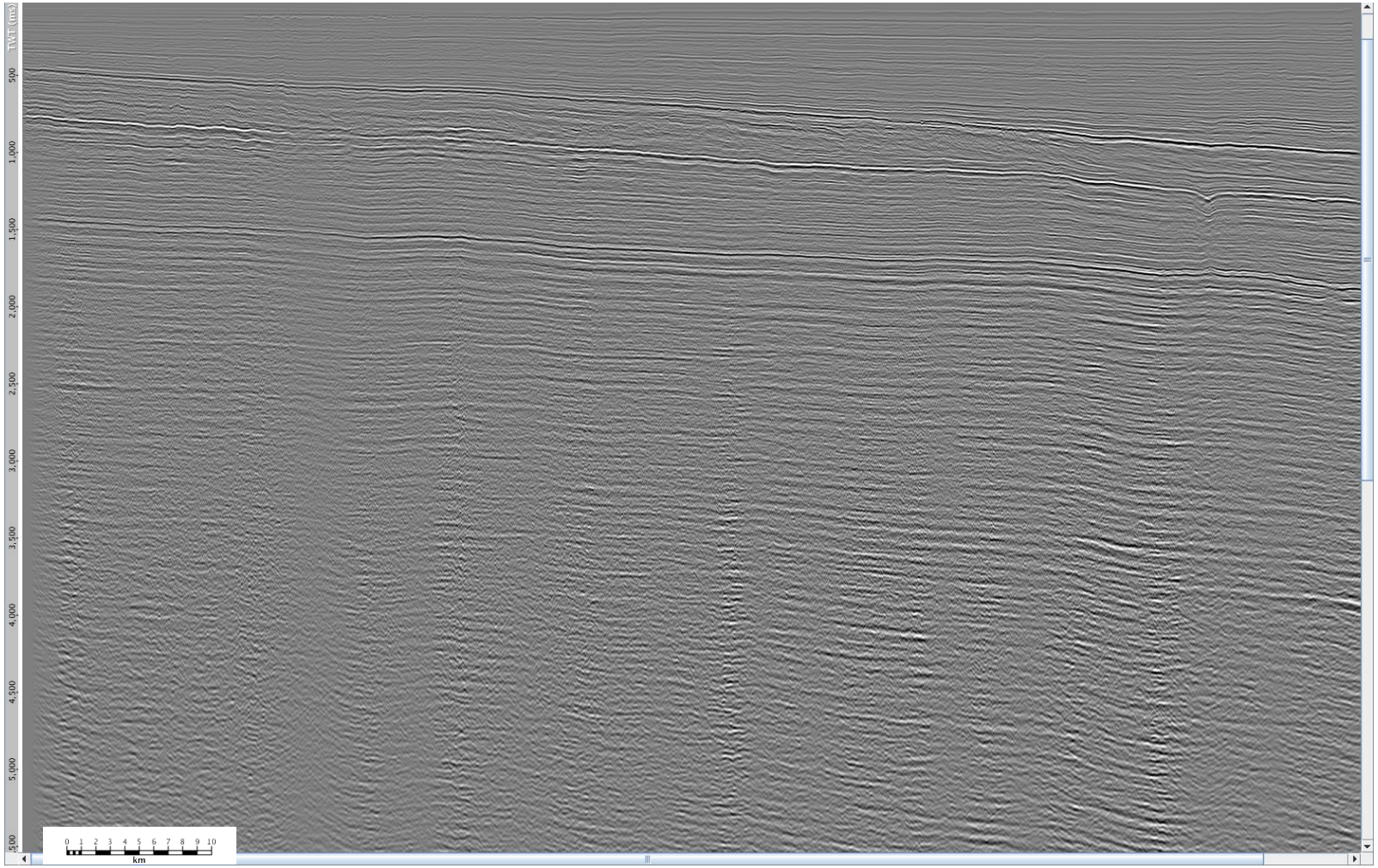
Intr- Lower Fars.

Oligocene Unc.

DownUnderGeoSolutions

Line 1160 - legacy





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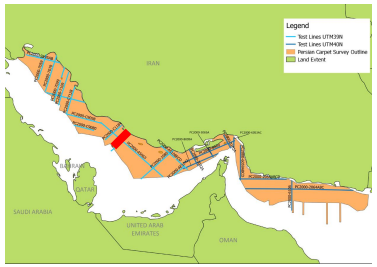
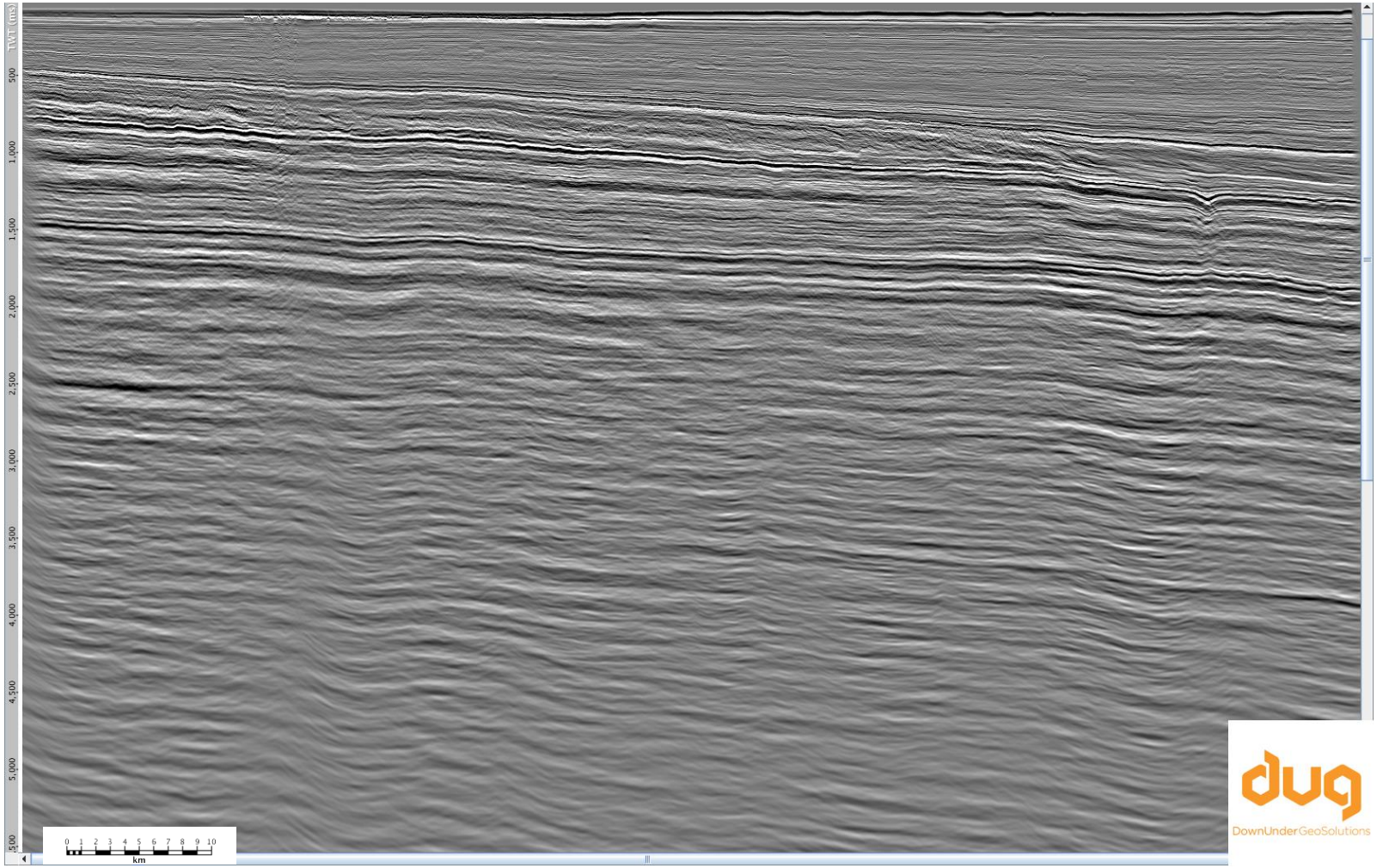
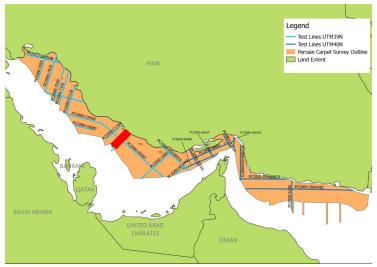
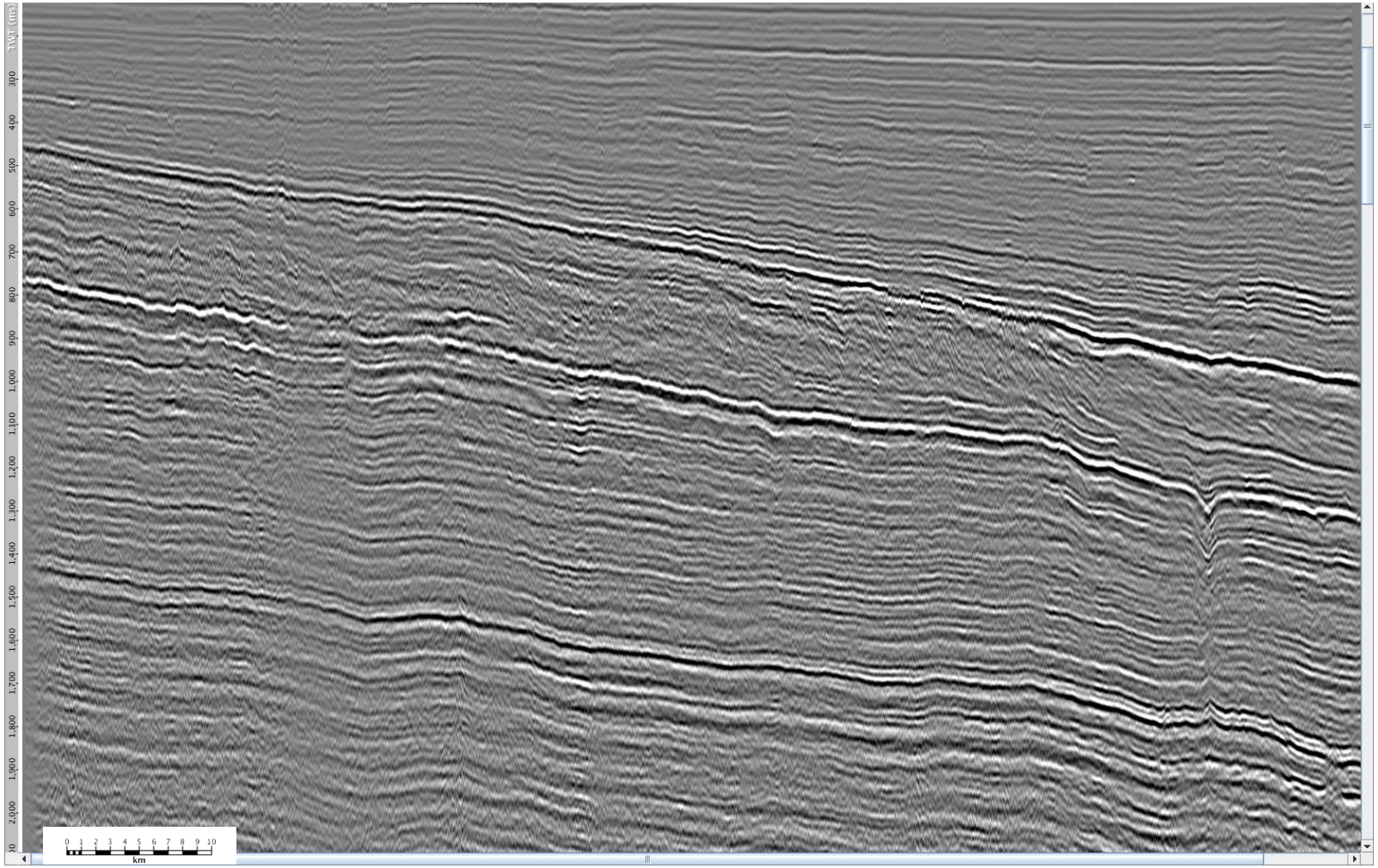


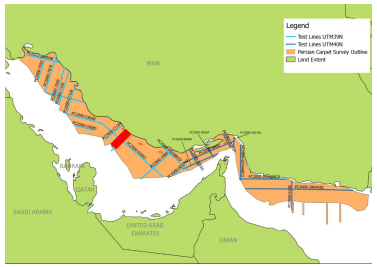


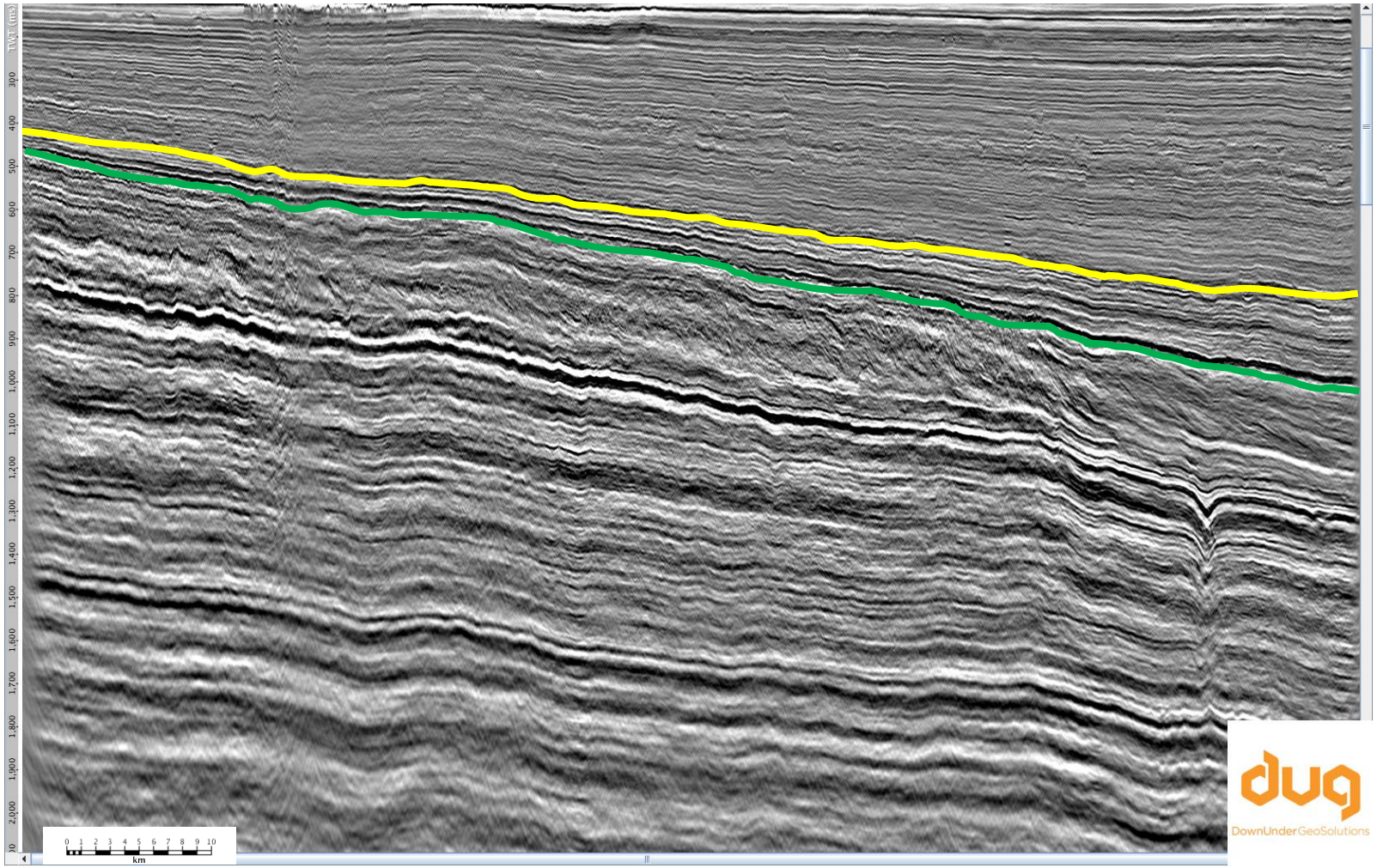
Line 1160 – legacy shallow zoom





Line 1160 – reprocessed shallow zoom

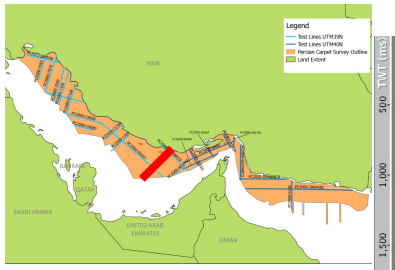


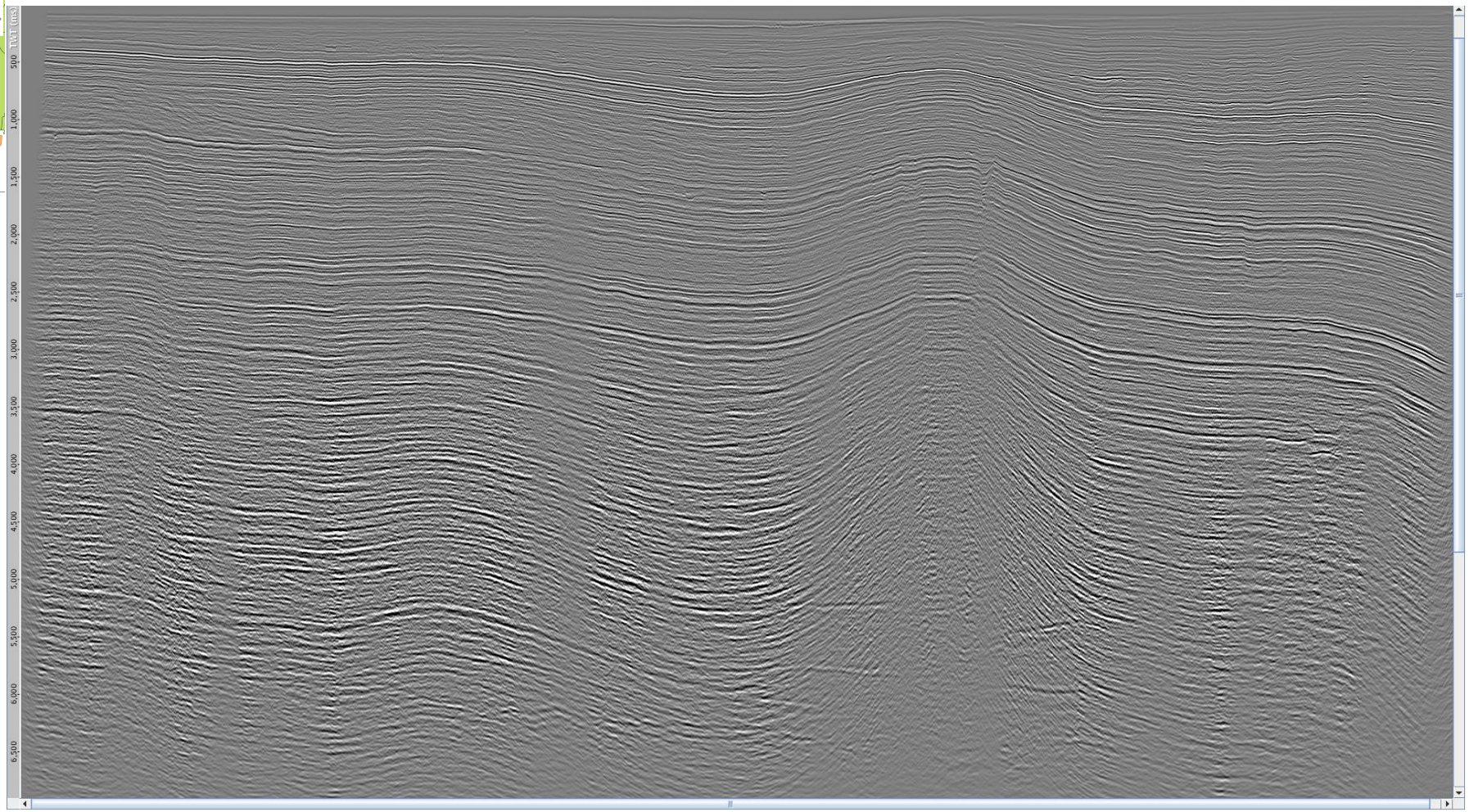


Intr- Lower Fars.

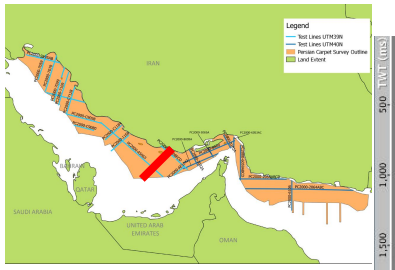
Oligocene Unc.

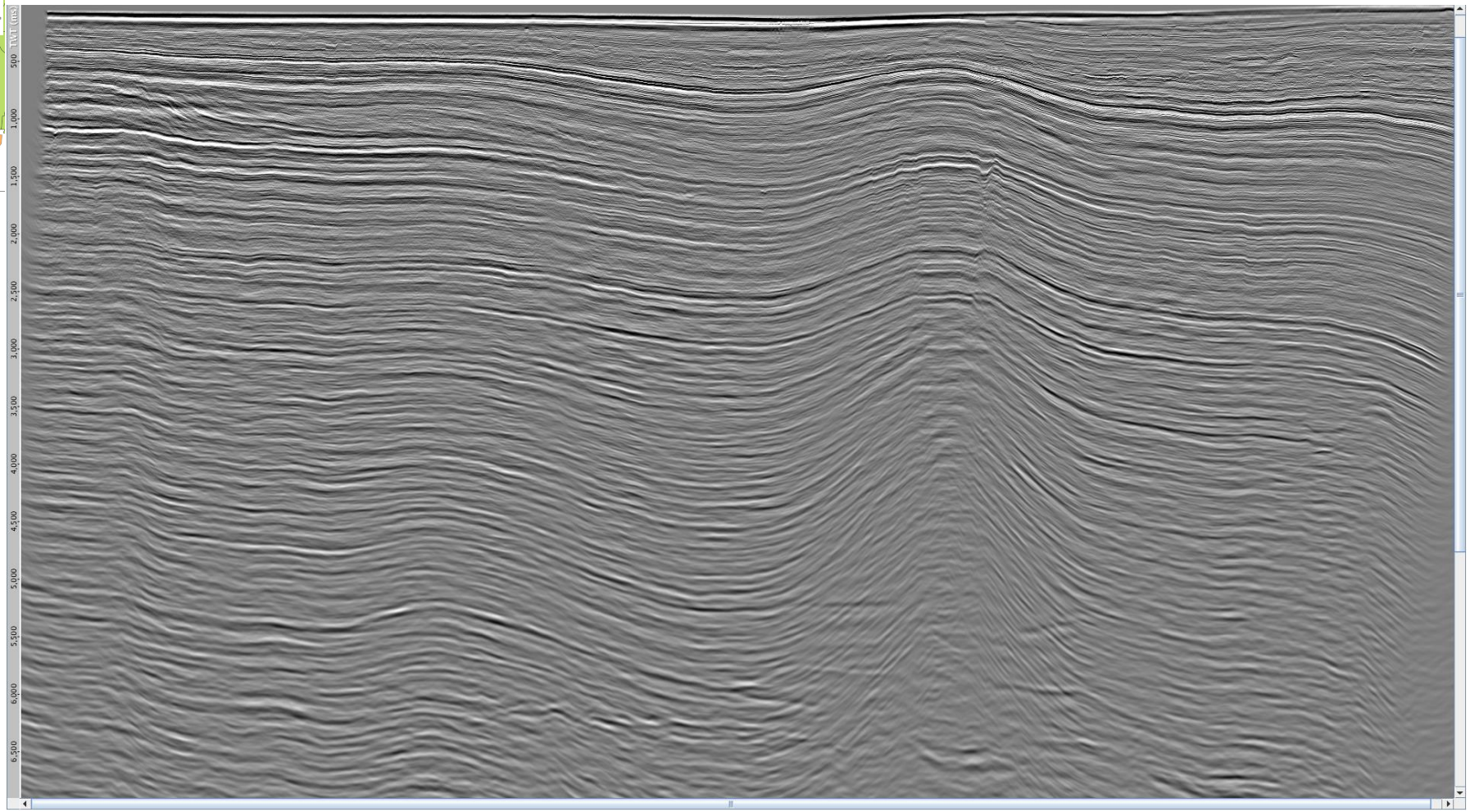
Line 1080 - legacy



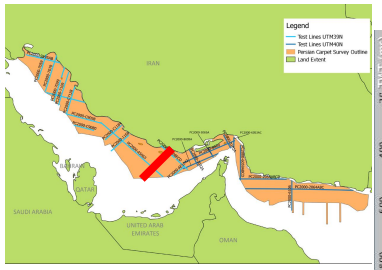


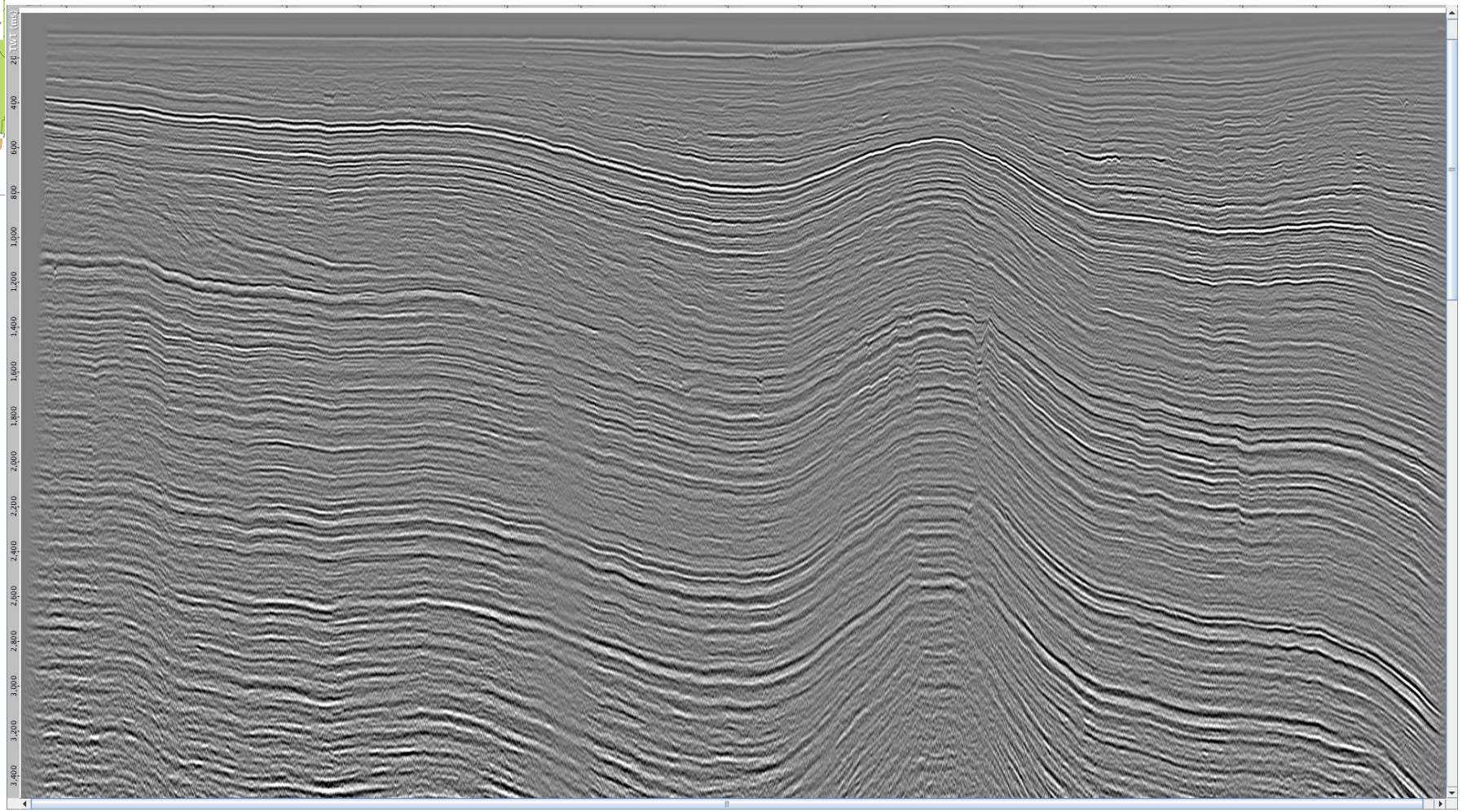
Line 1080 - reprocessed



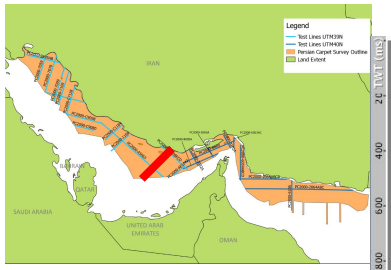


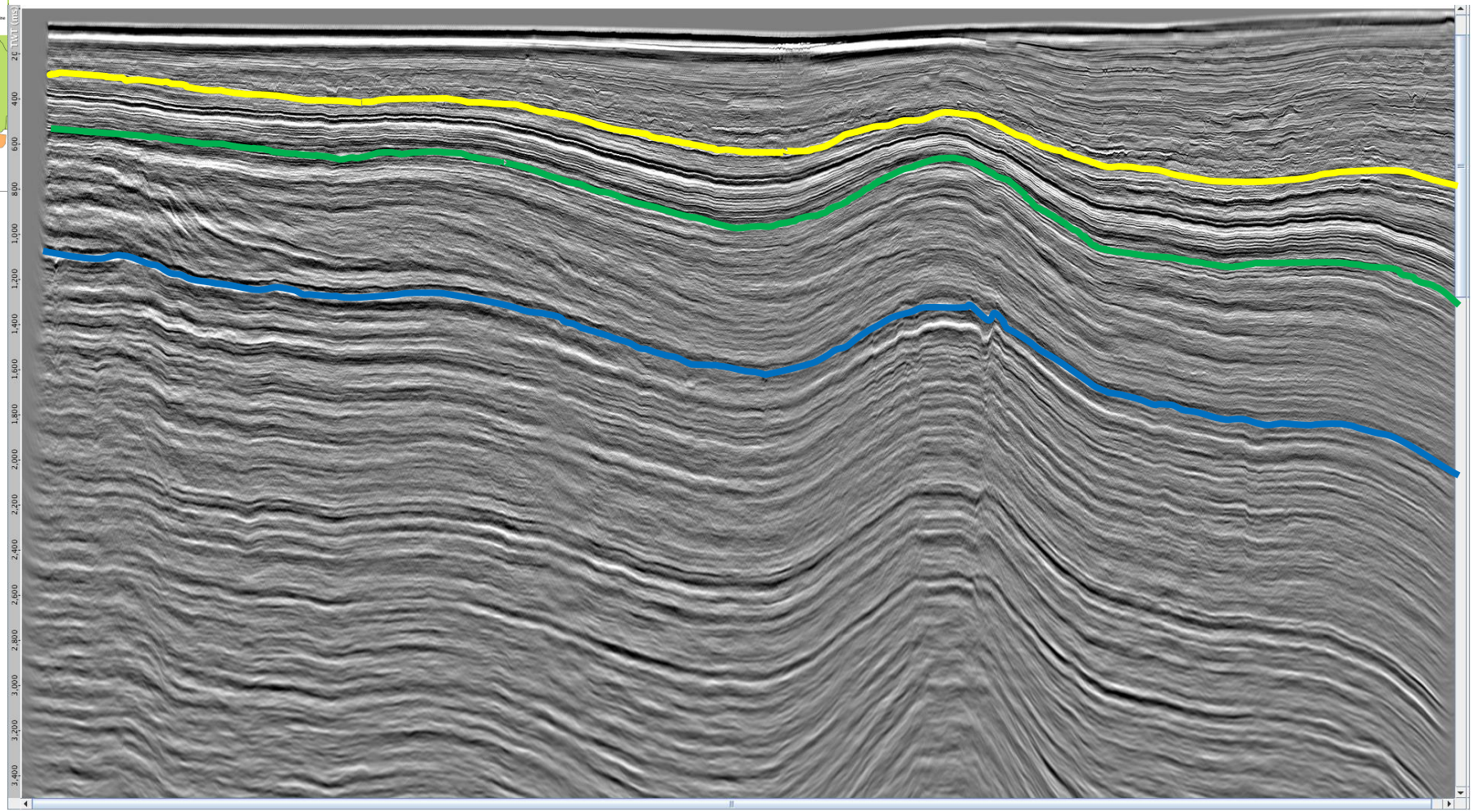
Line 1080 – legacy shallow zoom





Line 1080 – reprocessed shallow zoom





Intra- Lower Fars.

Oligocene Unc.

Turonian Unc.

Conclusions

With the sanctions lifted and with vast oil & gas reserves Iran is a very attractive country for foreign investment.

The reprocessed PC-2000 multiclient seismic data package will help:

- **To evaluate properly the potential of offshore Iran**
- **To define successfully core areas of interest for E&P companies**
- **To increase significantly applicant's scores in any bidding procedure in Iran (technical capability is 40%)**