

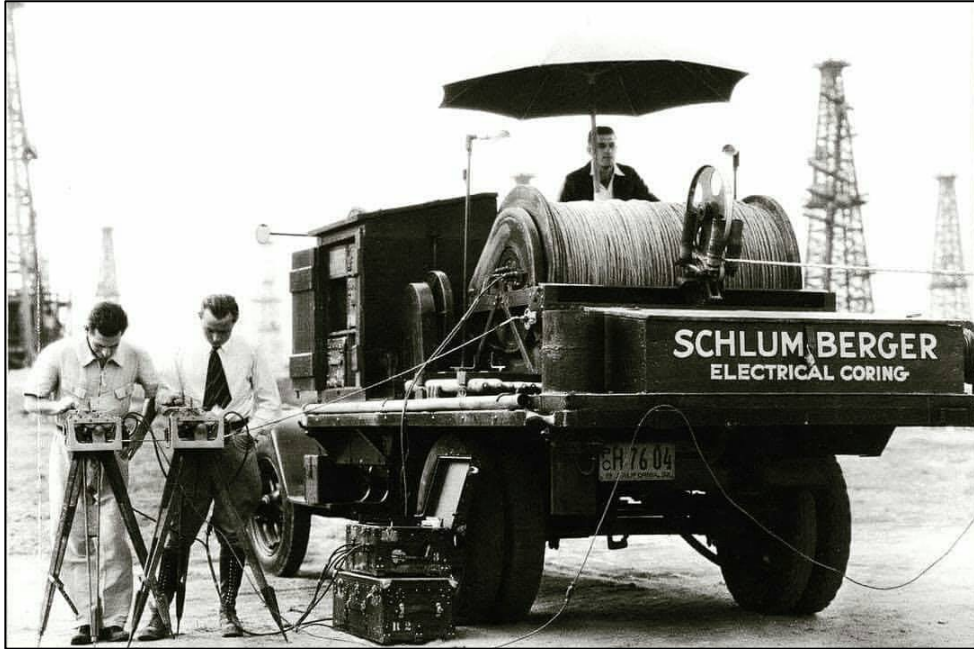


Adapting Oil and Gas Best Practices for Planetary Exploration and Prospecting

David Butler, Matt Miller, and Mohamed Amrouche



About SLB



Founded in 1926

~99k employees

100+ countries

Global technology company

SLB Focus



50 years of SLB space solutions!



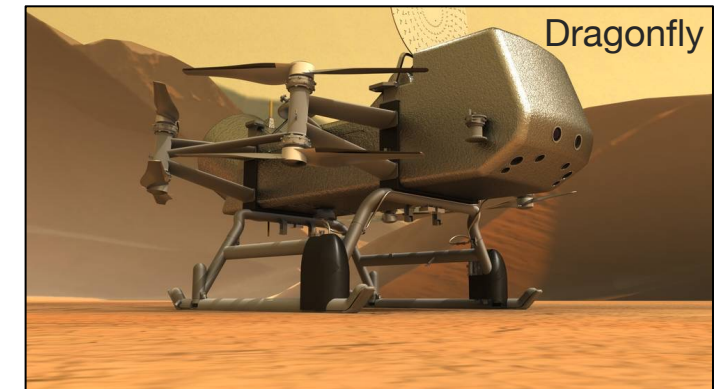
Contributions

- OAO-1 (1966)
- OAO-2 (1968)
- OAO-3 (1972)
- Orbiting Solar Observatory (1962)
- Advanced Orbiting Solar Observatory
- Apollo 17 (1968)
- OGO-E (1968)
- OGO-F (1969)
- Polar Orbiting Geophysical Observatories (1964-1969)
- Nimbus-D (1970)
- Mariner (1964-1967)
- Applications Technology Satellites (1966-1974)
- Apollo Telescope Mount
- Sky Lab
- Lunar Orbiter (1966)
- HEAO-B (1978)
- Galileo Jupiter Planetary Explorer (1989)
- Geosynchronous Orbital Environmental Satellite
- Solar Ultraviolet Spectral Irradiance Monitor
- Gamma Ray Observatory
- LITE Experiment
- Solar Heliosphere Observatory
- [Hubble Space Telescope](#) (1990)
- NEAR Spacecraft (1996)
- [Cassini](#) (1997-2004)
- [Apollo 17 SEGY](#) (2009)
- [Apollo 17 S-Wave](#) (2016)
- [Moonquake Site Effects](#) (2020)
- [Lunar Gravity Orientale Basin](#) (2021)
- [Lunar Aristarchus Plateau](#) (2024)
- **Dragonfly (ongoing)**
 - SLB designing + constructing PNG



Illustration of NASA's Cassini spacecraft during its final plunge into Saturn's atmosphere on Sept. 15, 2017.

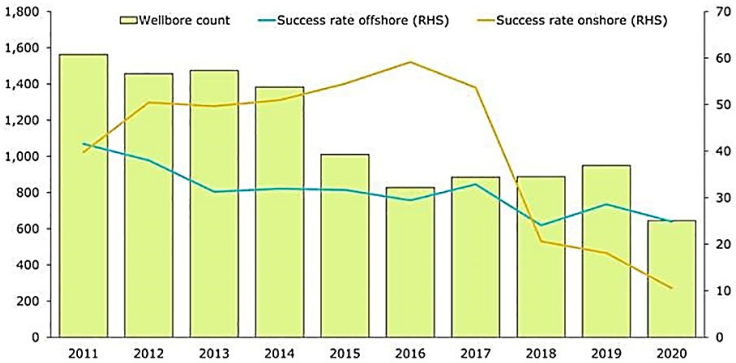
Credits: NASA/JPL-Caltech



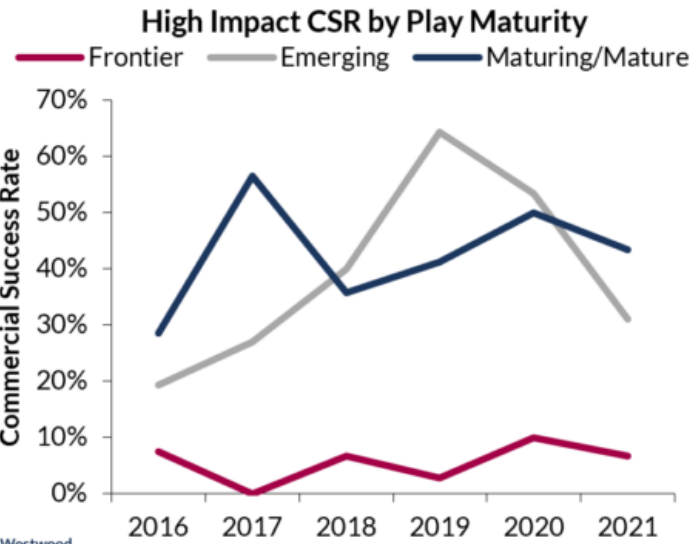
Artist's Impression of Dragonfly on Titan's surface.

Credits: NASA/Johns Hopkins APL

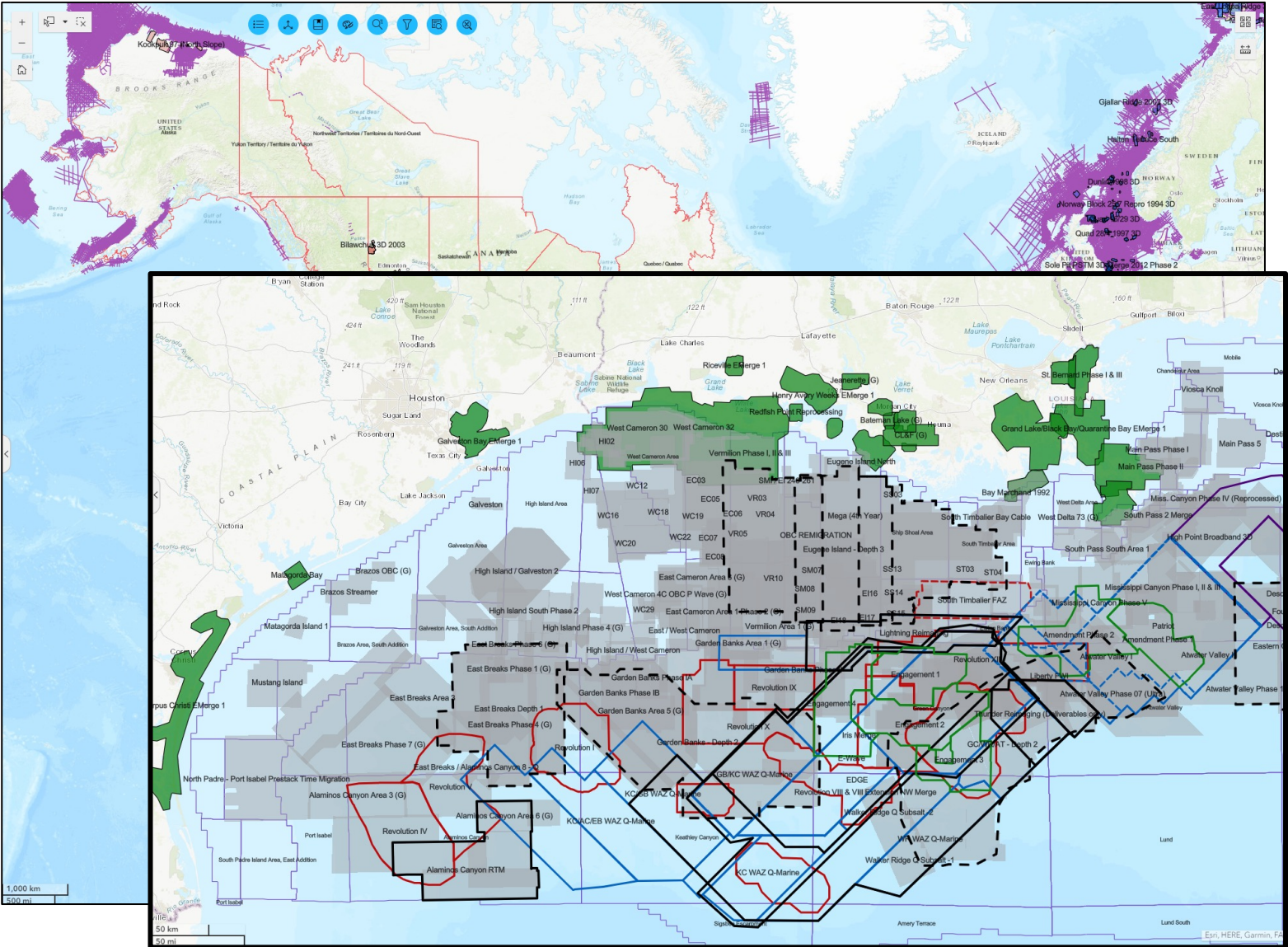
Oil and Gas Exploration



(Rystad Energy, Petroleum Review, 2021)



(Westwood Global Energy Group, 2021)



Exploration Data Best Practices



→ Use **standardized**, easily readable formats
whenever possible

Seismic → SEGY

Well info → LAS

Navigation → UKOOA

Exploration Data Best Practices



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- **Visualize and integrate** multiple data types in one place

Exploration Data Best Practices

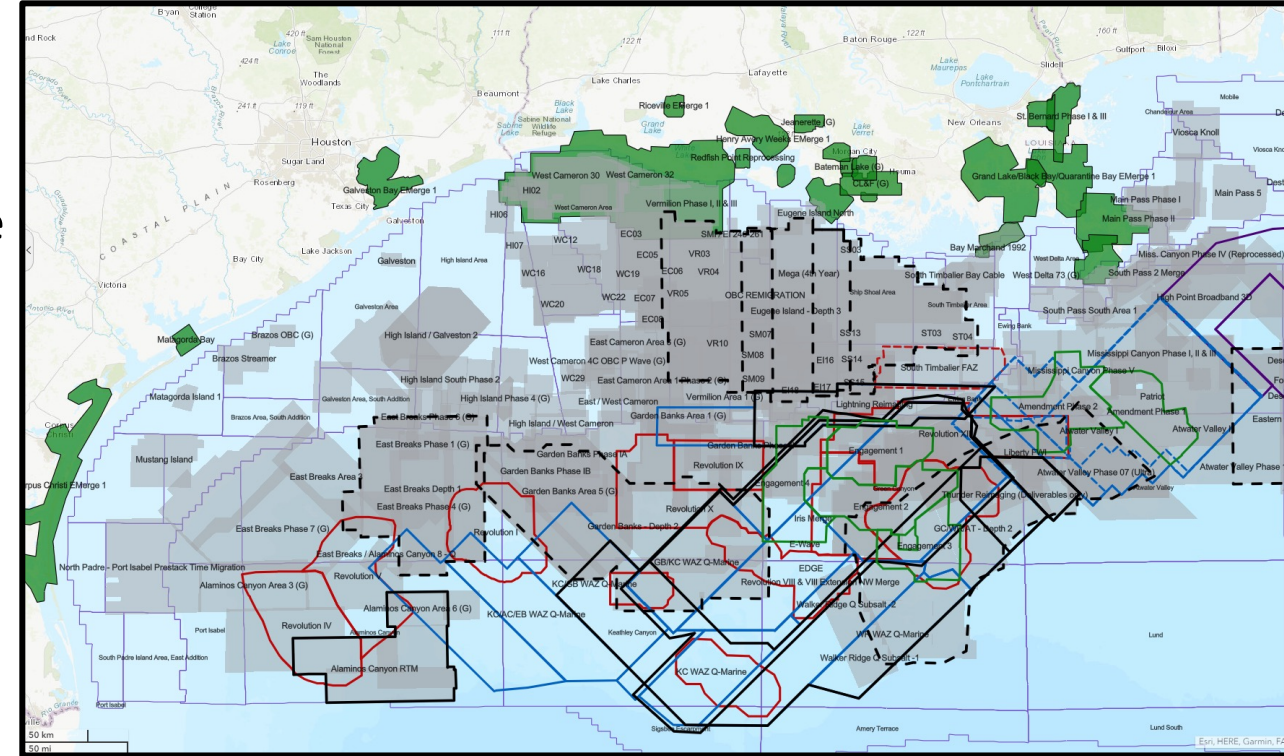


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Exploration Data Best Practices



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E-Octopus VIII and IX: acquired and processed 2010-2012

- Pre-Nav Merge
- NavMerge
- Demultiple
- Demultiple Noise Model
- Sediment Model
- Salt Flood Model
- Salt Body Model
- Sediment Flood KDM
- Salt Flood RTM
- Salt Body RTM
- Final KDM
- Final RTM



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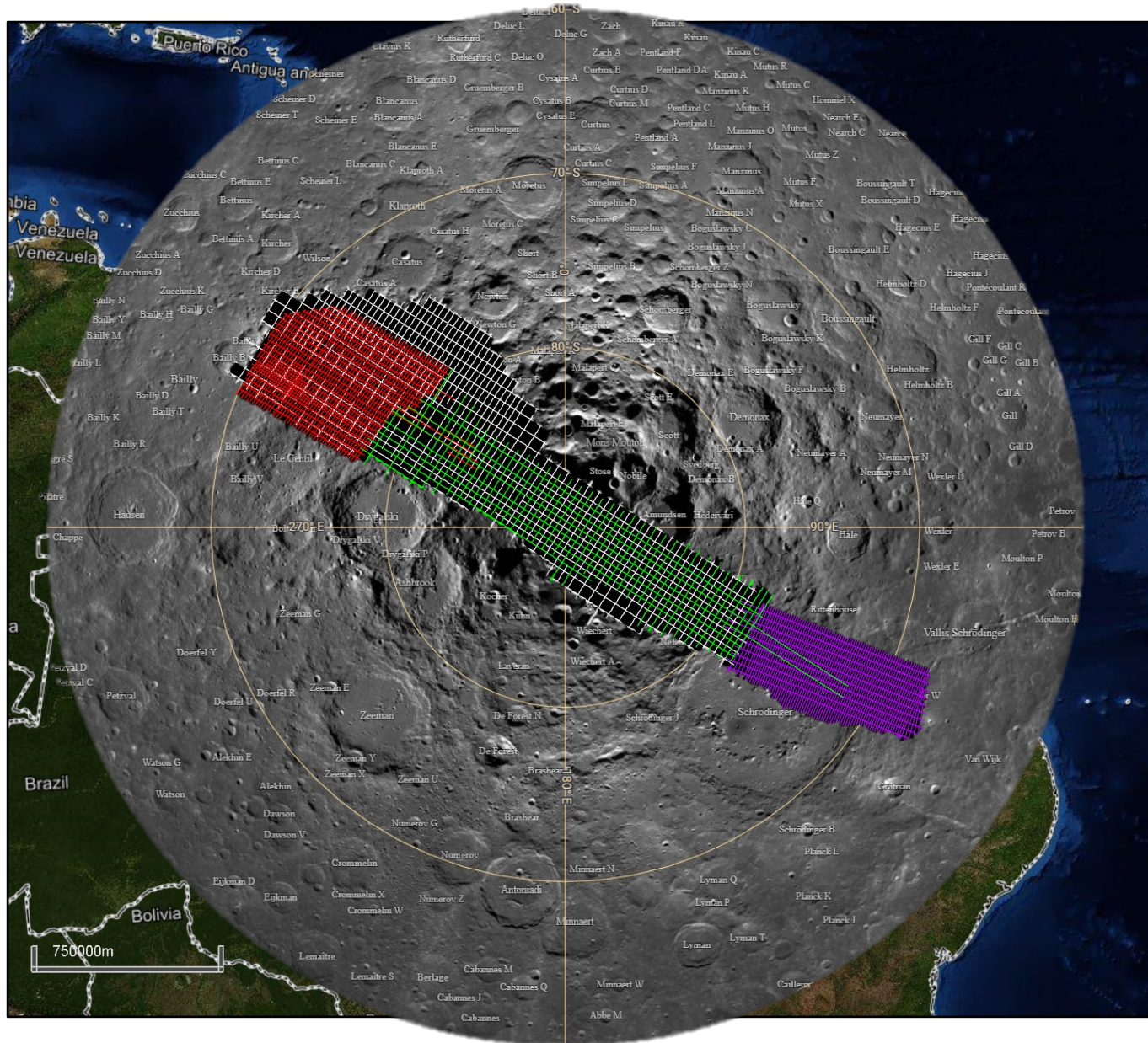
Terrestrial Cases

- Offshore Brazil
- Offshore Mexico

Extraterrestrial Cases

- Lunar Gravity
- Martian North Pole

Brazil 2D



- 2D??
- 4 surveys
- 275,000 km²
- Acquired 1999 and processed separately
- Reprocessed 2022-2023

Brazil 2D – Original (1999)



Brazil 2D – Unarchived and reprocessed (2023)

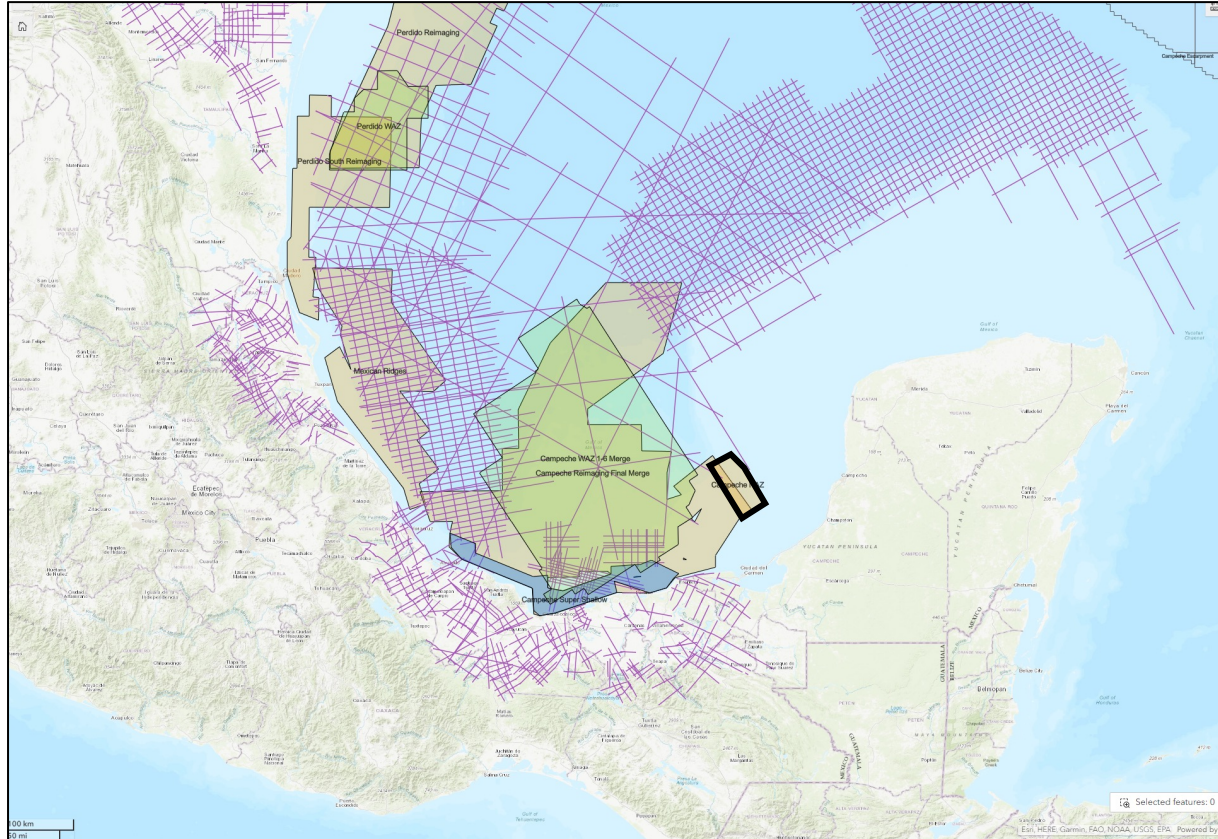


Brazil 2D

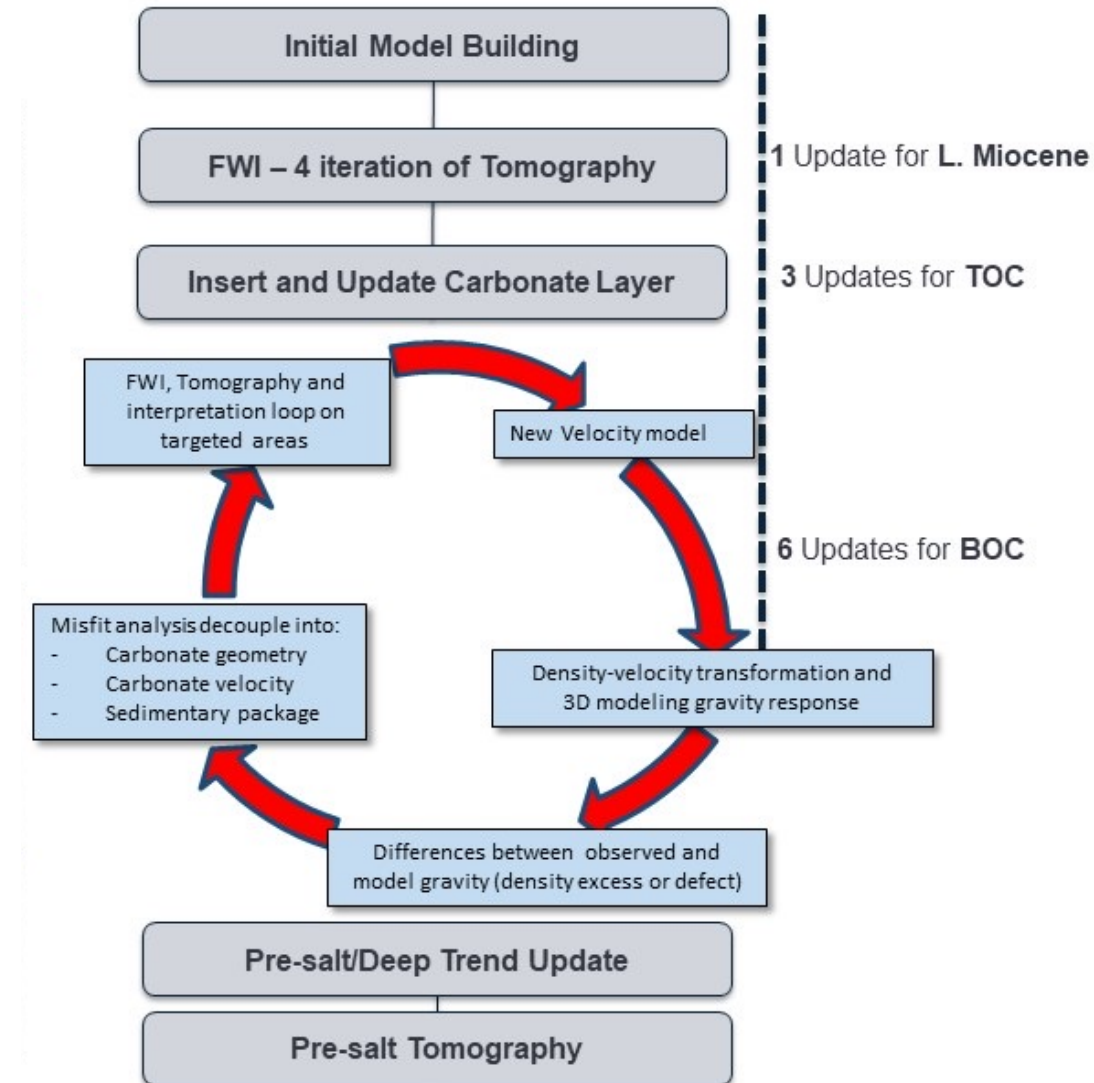
- Reprocessed 481 lines
- Reduced mistie between intersecting lines
- <1% mistie between wells
- Archived 475,000 km² 3D model
- Archived multiple data milestones for future reprocessing and potential data acquisitions



Campeche Bay Gravity & Seismic



- 2600 km²
- Yucatan Carbonate Platform
- Target – Upper Jurassic
- Narrow Azimuth Acquisition
- Acquired 2018
- Reprocessed 2021

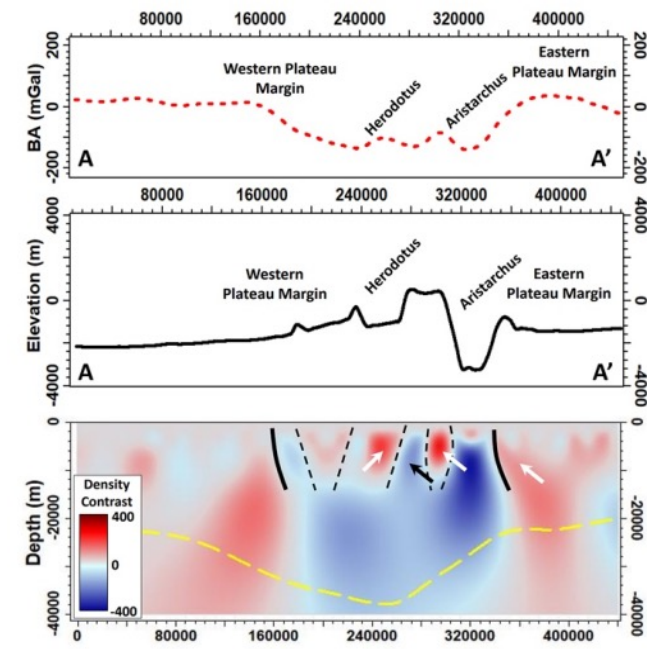
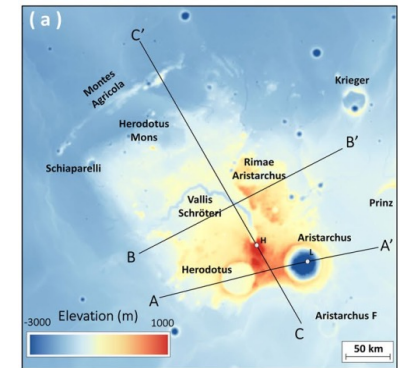
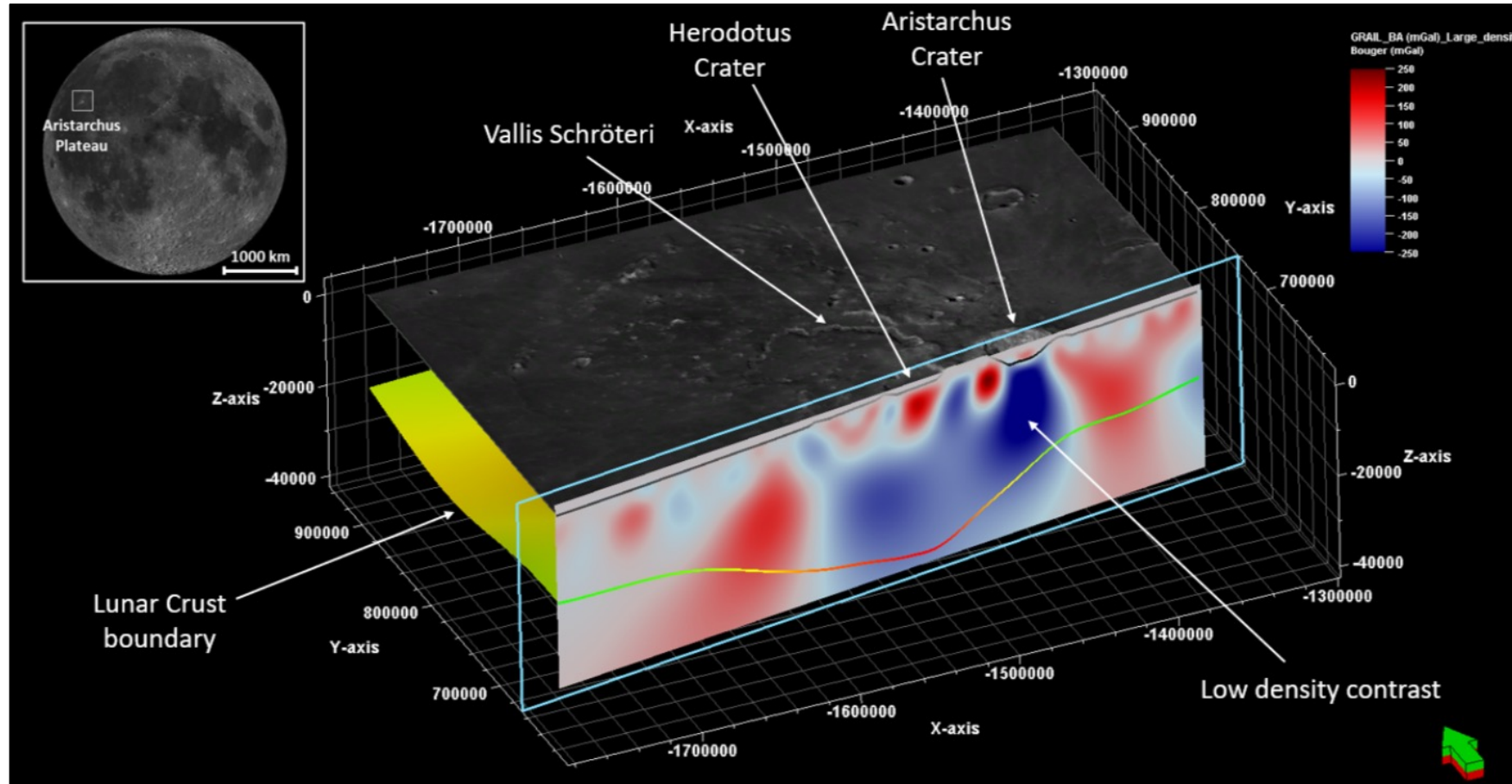


Campeche Results



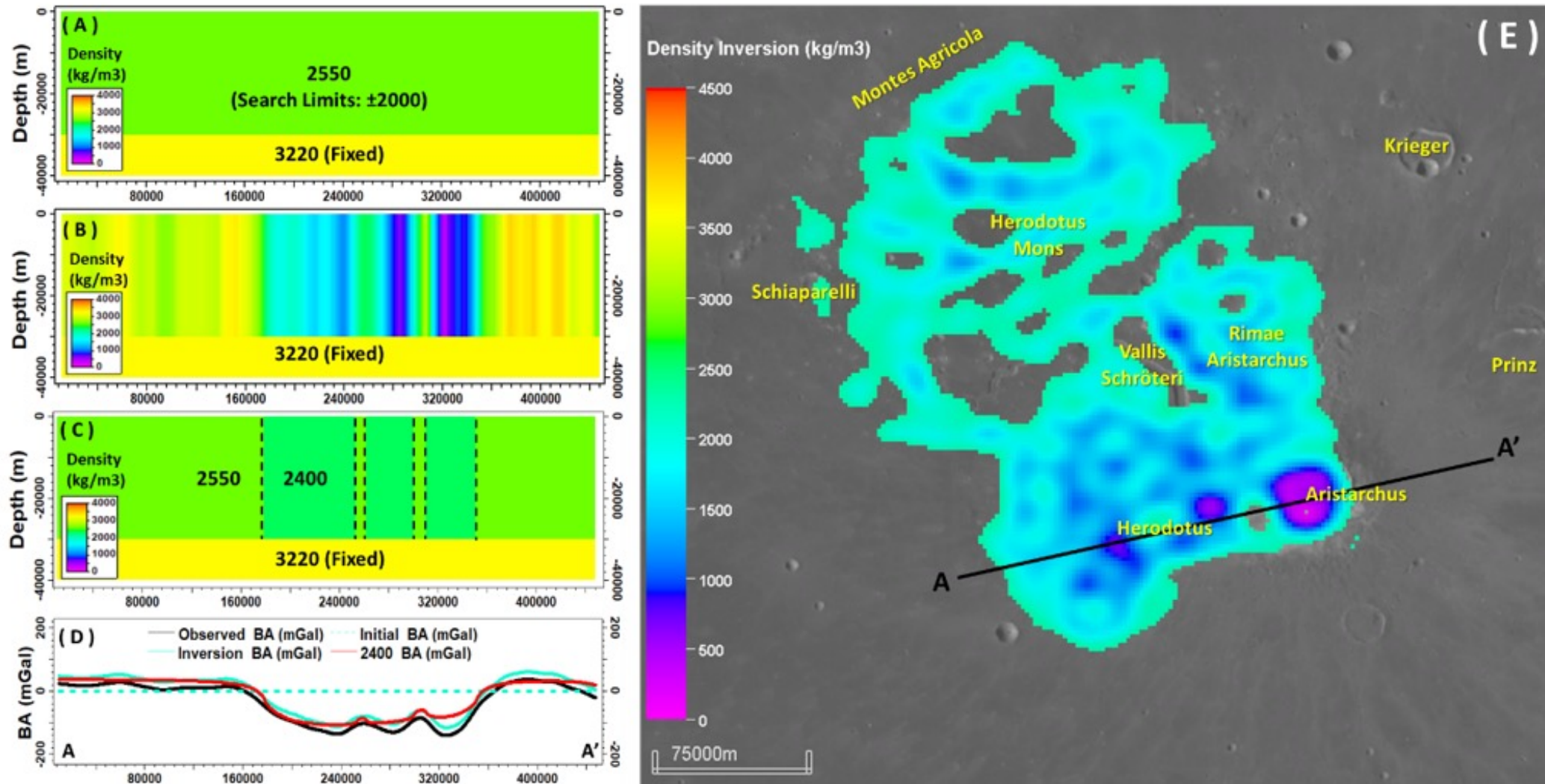
- Used standardized, easily readable formats whenever possible
- Visualization and integration of **gravity & seismic** data in one place
- Unseal data when possible, to build models, and incorporate new data frequently

Lunar Gravity Work (Aristarchus Plateau, Liang et al 2024)



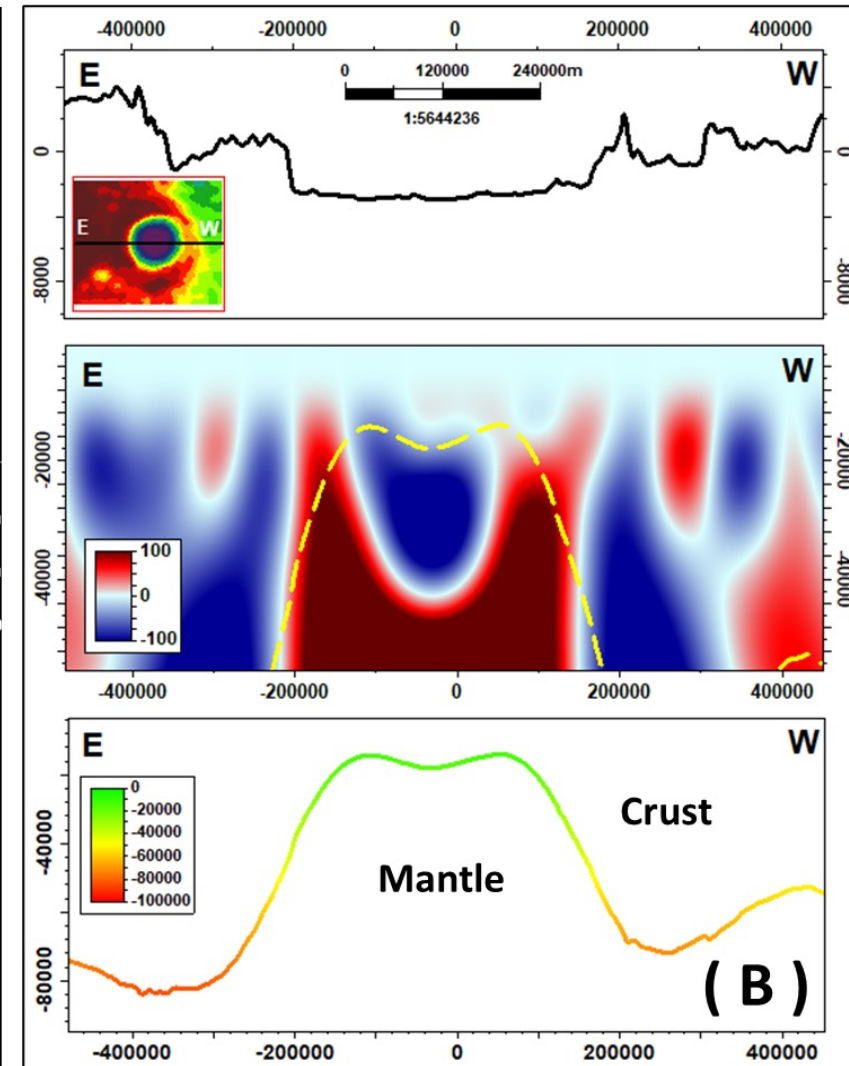
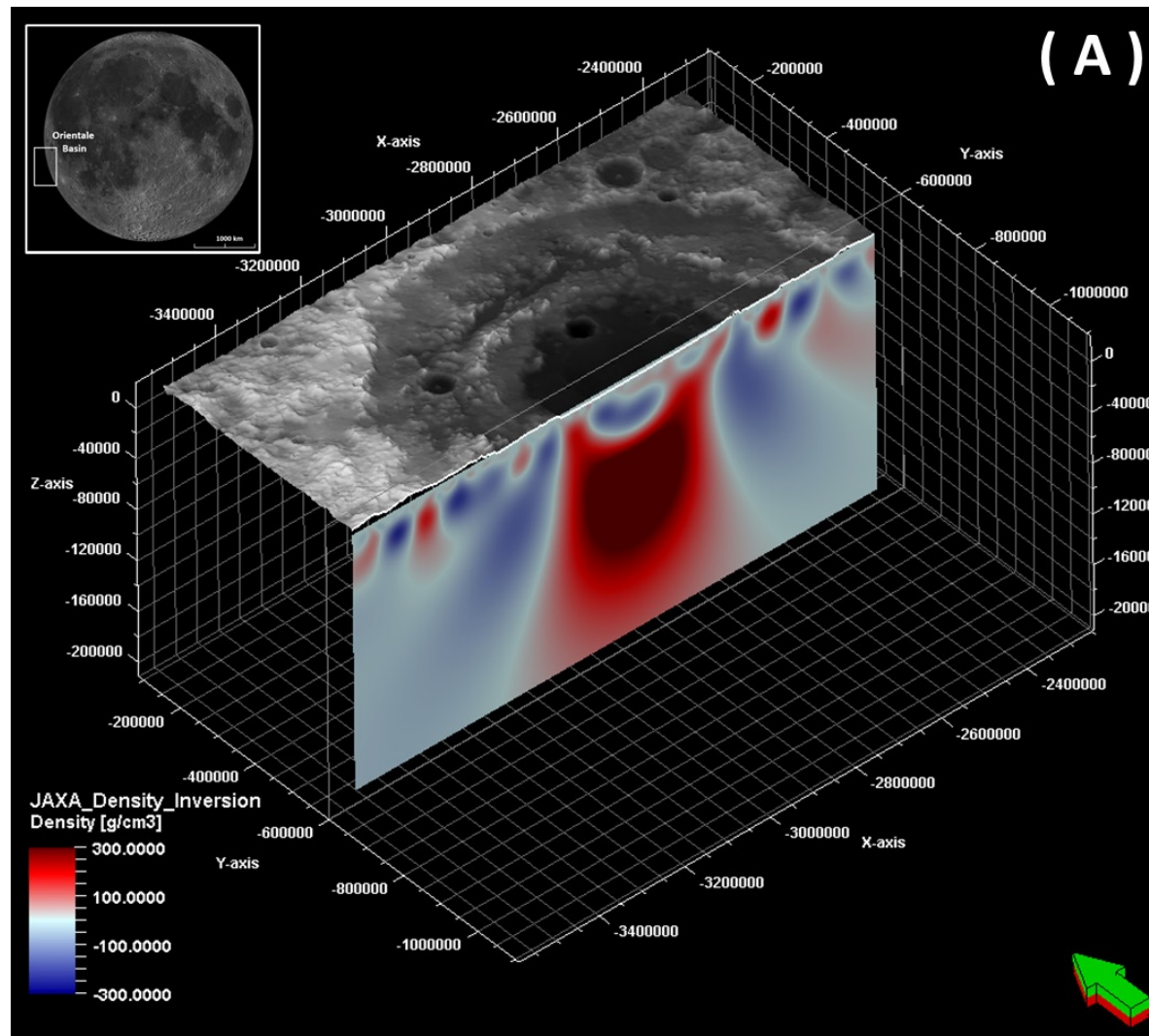
LIANG F., [AMROUCHE M.](#), YAN J., SAIBI H (2024) Detection of subsurface density structures of the Aristarchus plateau by gravity inversion. *Journal of Geophysical Research Planets*, Volume129, Issue2, e2023JE007856

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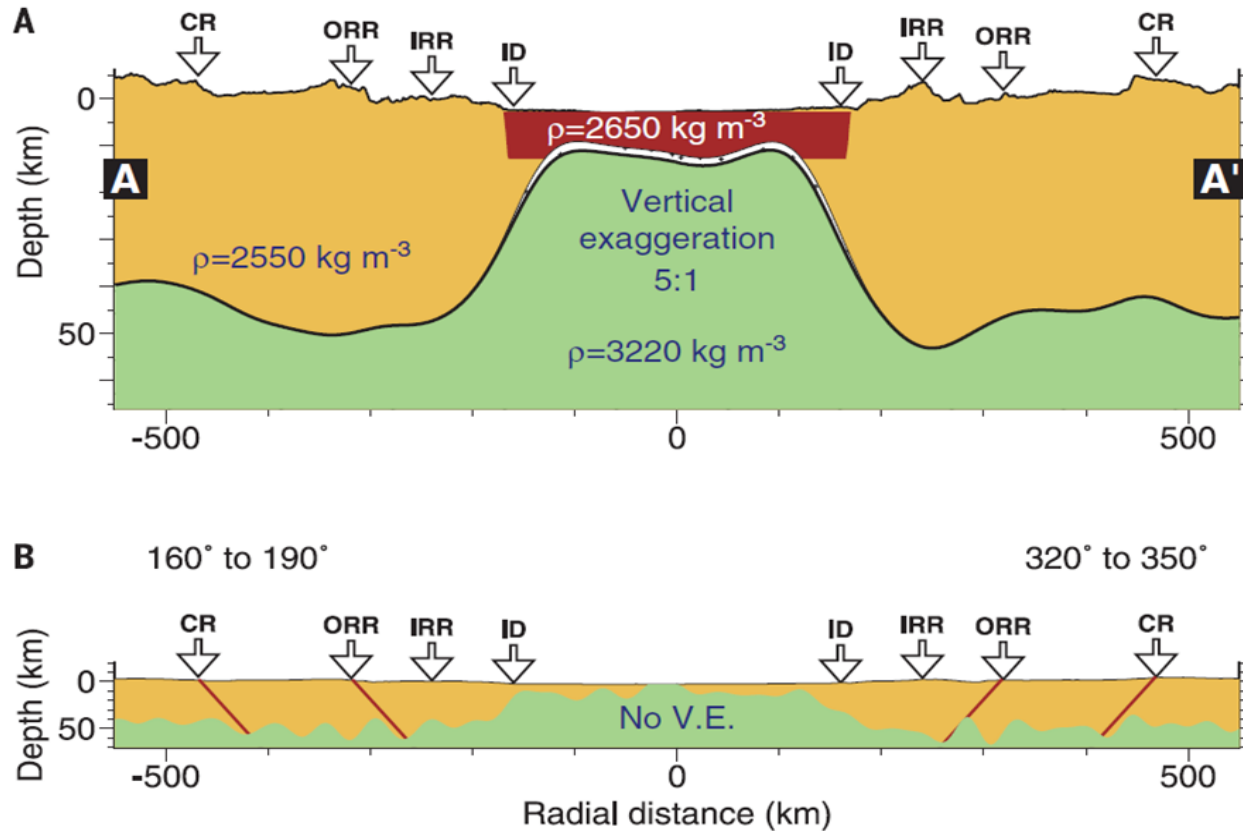
LIANG F., AMROUCHE M., YAN J., SAIBI H (2024) Detection of subsurface density structures of the Aristarchus plateau by gravity inversion. *Journal of Geophysical Research Planets*, Volume129, Issue2, e2023JE007856

Lunar Gravity Work (Orientale Basin, Amrouche et al 2021)

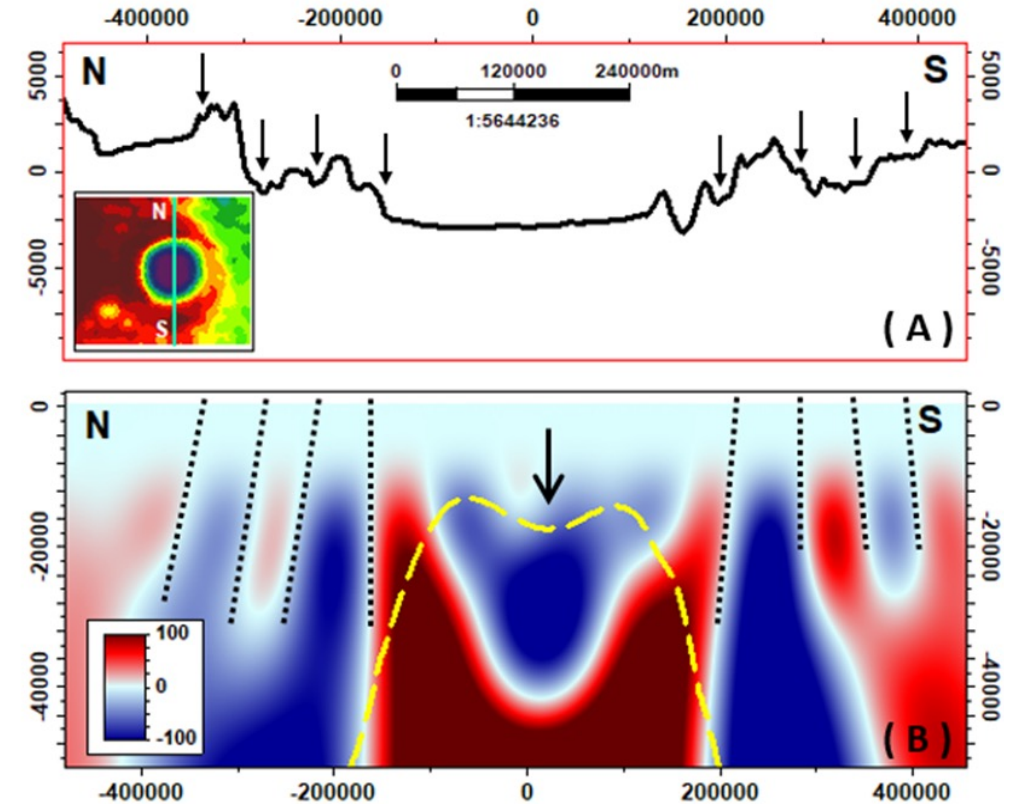


AMROUCHE M., SAIBI H. (2021) Lunar Orientale Basin subsurface structure estimated from the Kaguya (SELENE) orbiter gravity data inversion, Sixth International Conf. on Eng. Geophysics (ICEG), Al-Ain, UAE.

Lunar Gravity Work (Orientale Basin, Amrouche et al 2021)



Zuber et al. (2016)

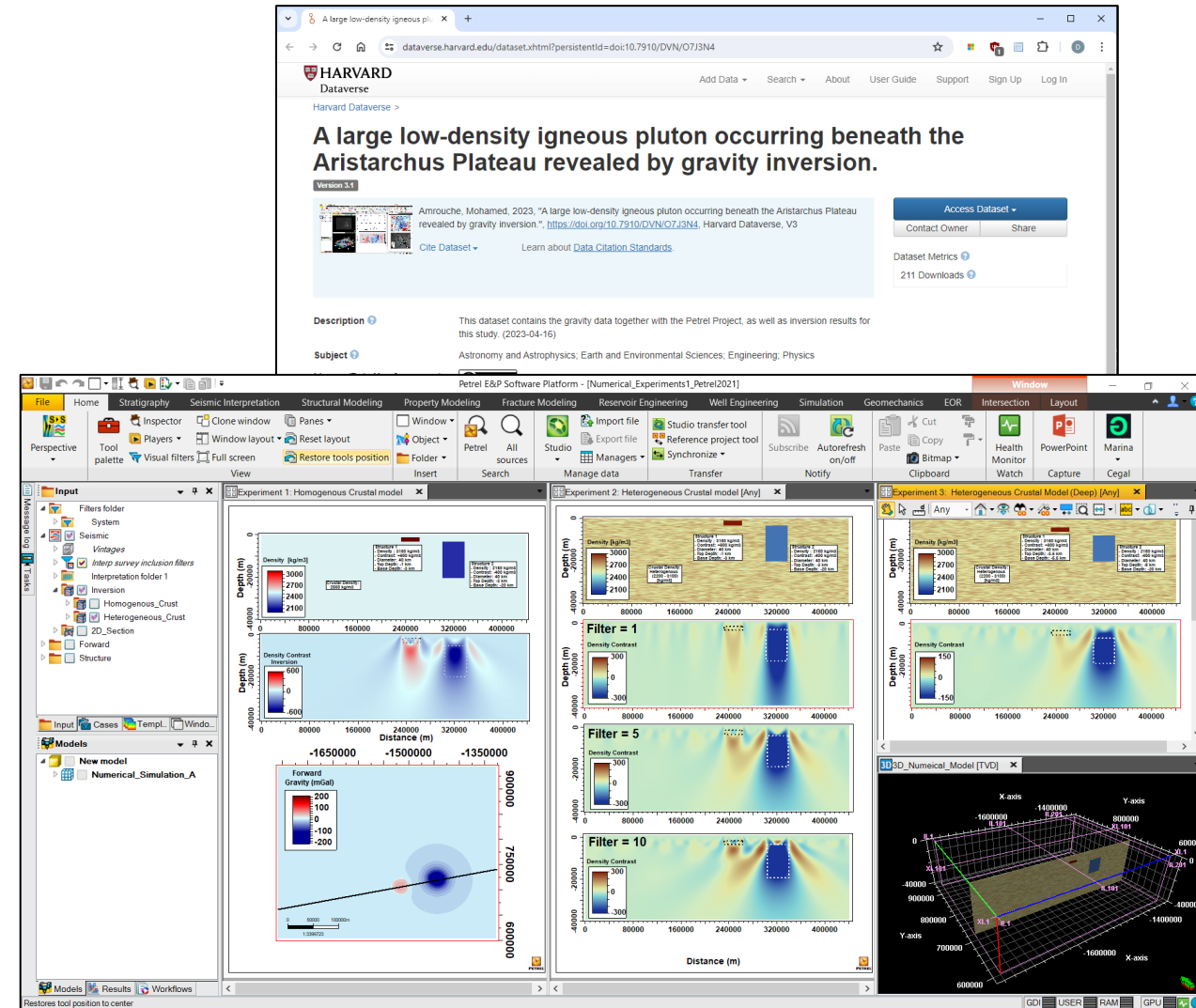


[AMROUCHE M., SAIBI H. \(2021\) Lunar Orientale Basin subsurface structure estimated from the Kaguya \(SELENE\) orbiter gravity data inversion, Sixth International Conf. on Eng. Geophysics \(ICEG\), Al-Ain, UAE.](#)

Lunar Gravity Work

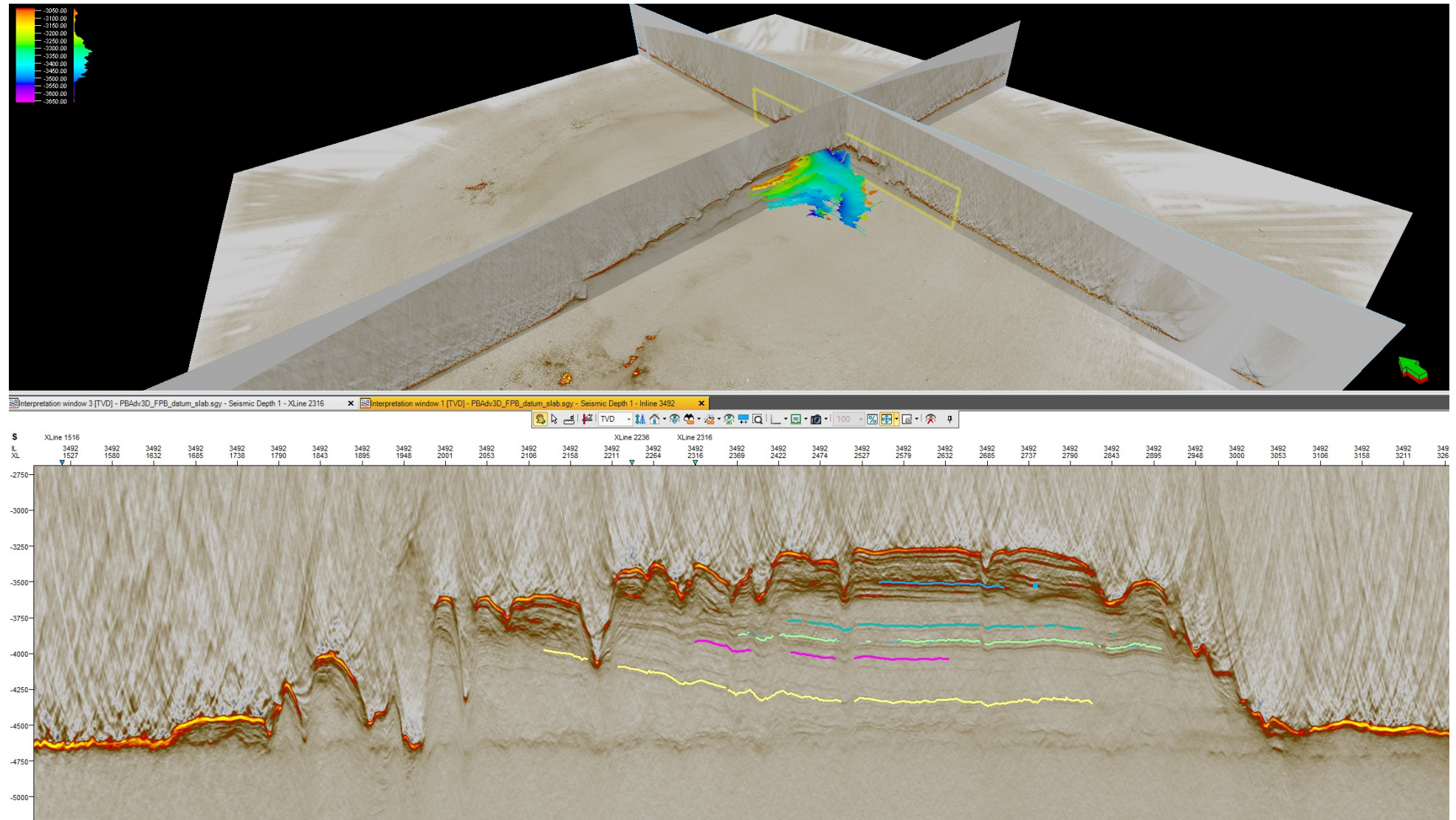


- Used standardized, easily readable formats whenever possible
- Visualization and integration of **gravity & imagery** data in one place
- Unseal data when possible, to build models, and incorporate new data frequently
 - Saved and publicly available for future study



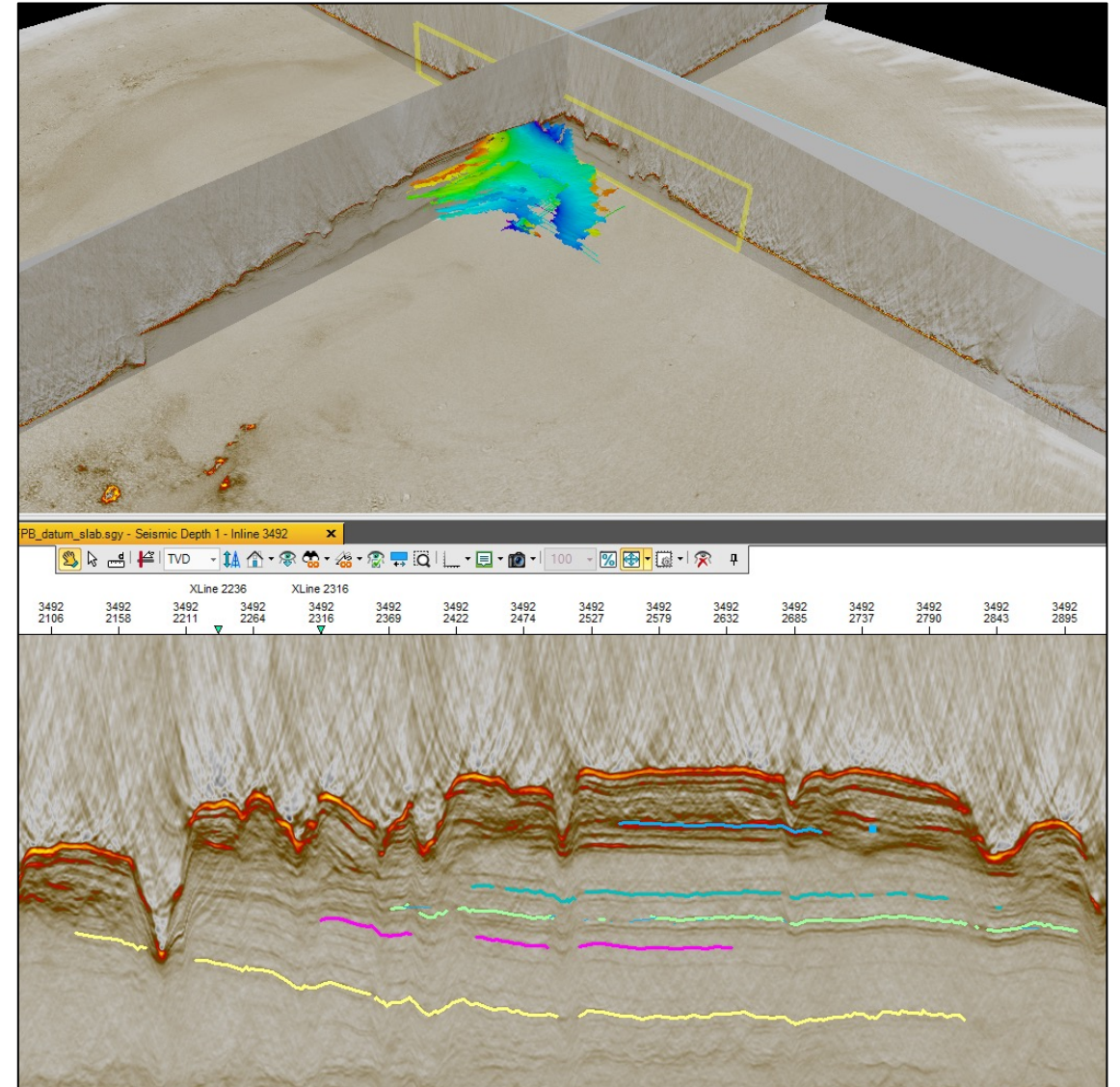
Ongoing Planum Boreium / Mars work

- SHARAD processed by PSI and saved as SEGY
- 3D interpretation
- **Future work:** Incorporate w/ other planetary datasets (i.e. gravity inversion)



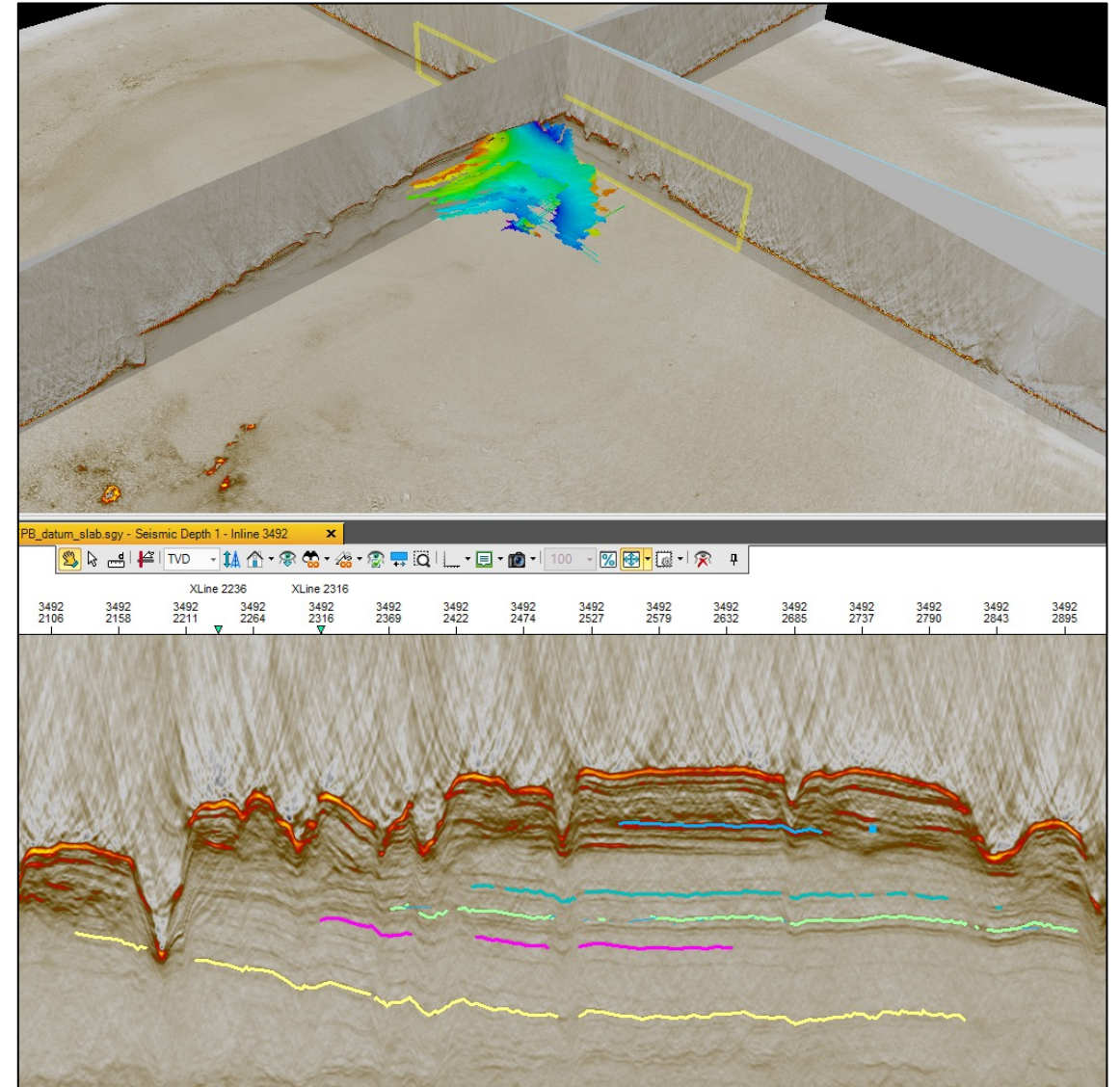
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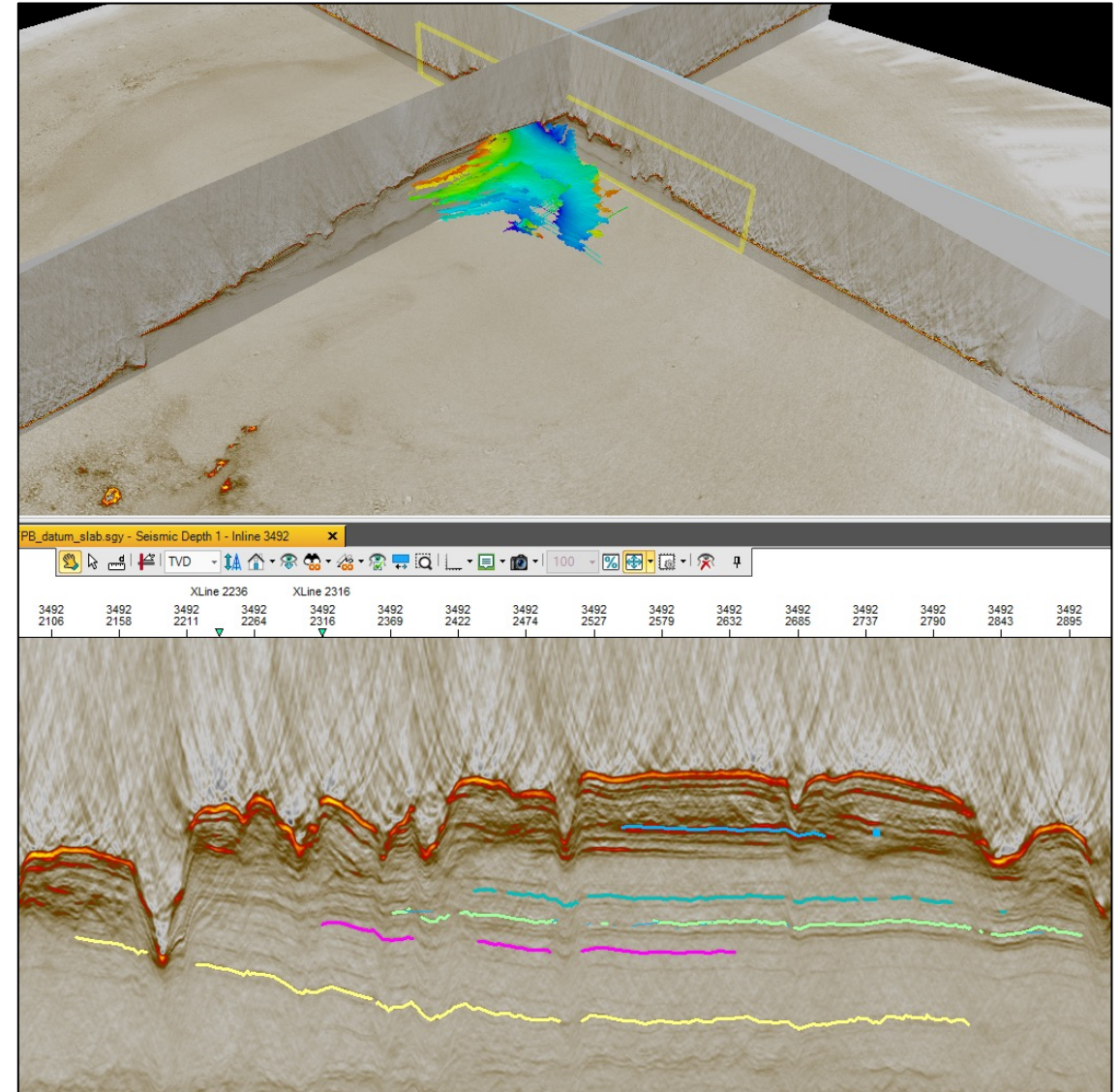
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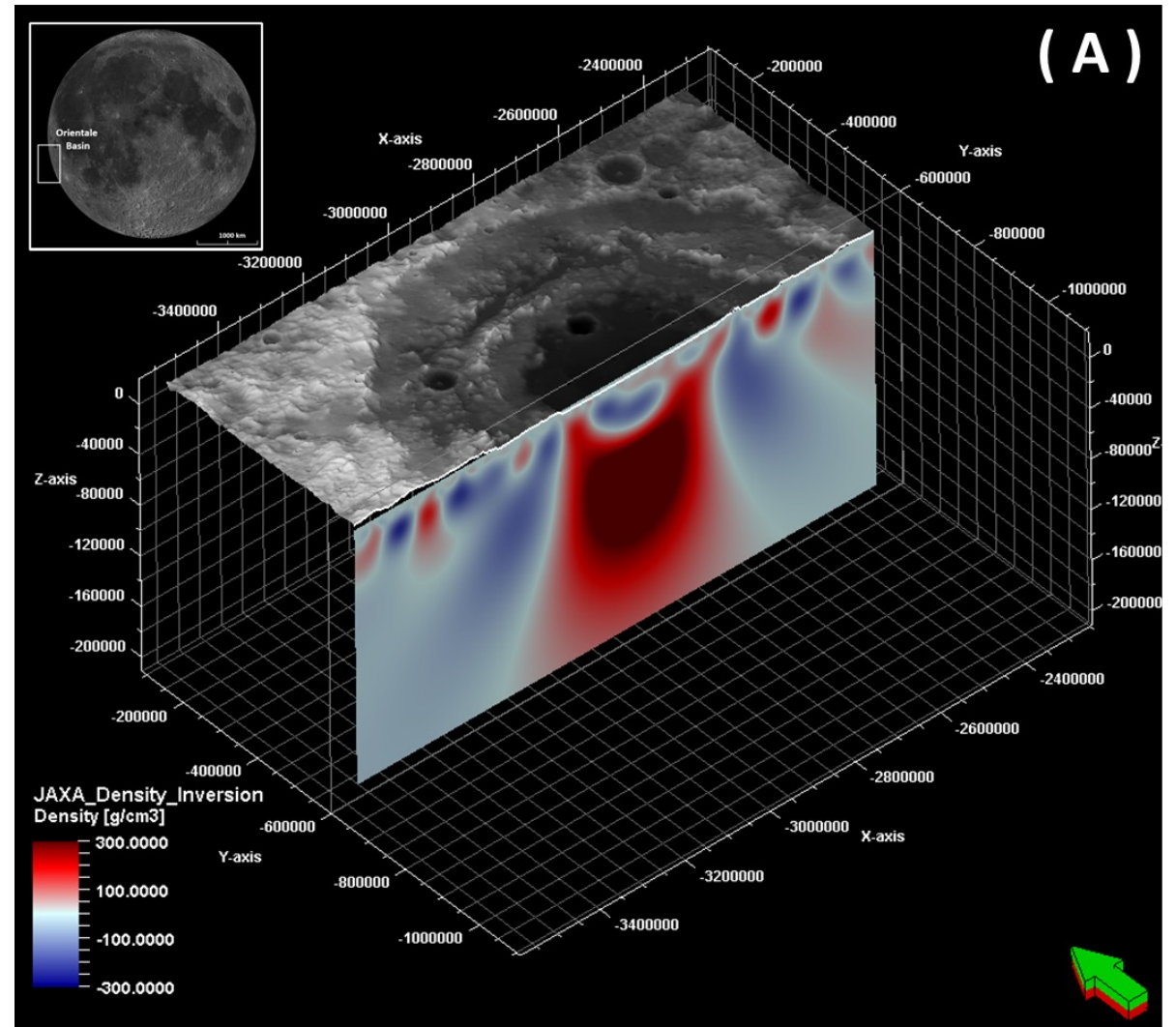
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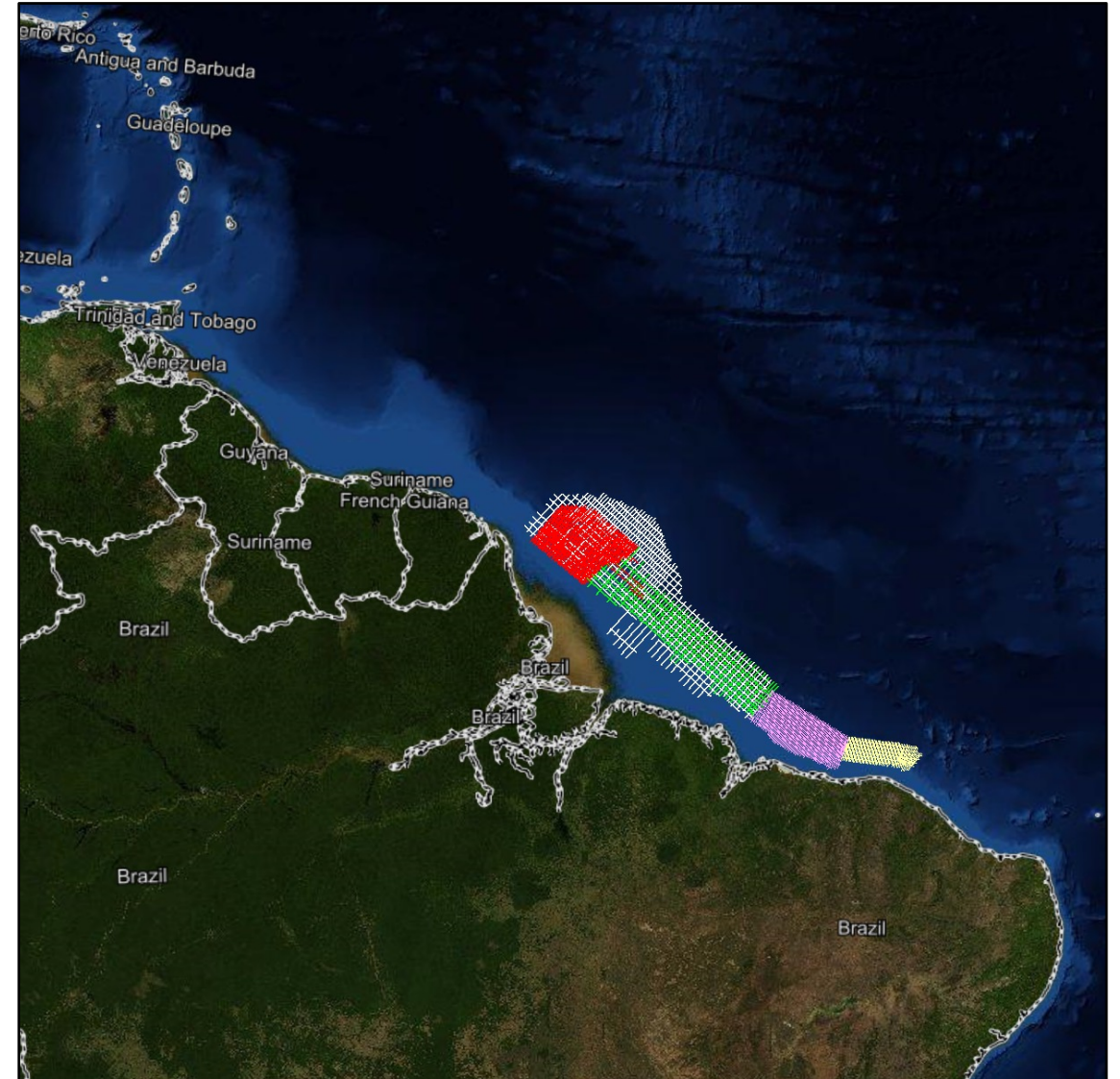
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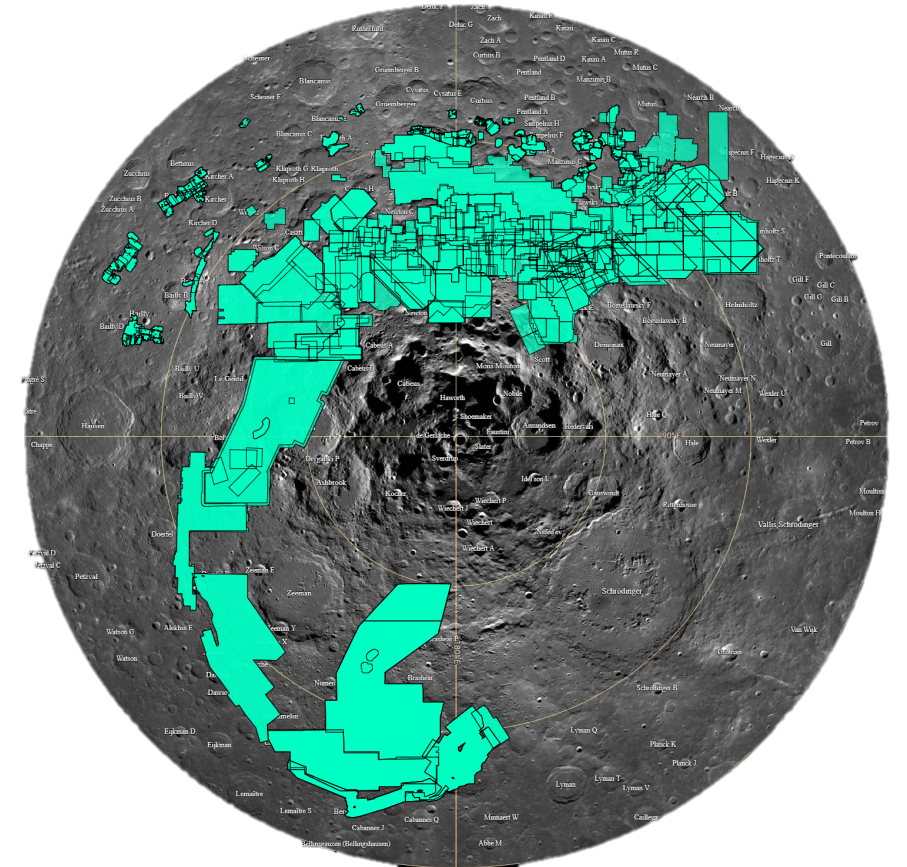
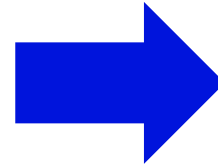
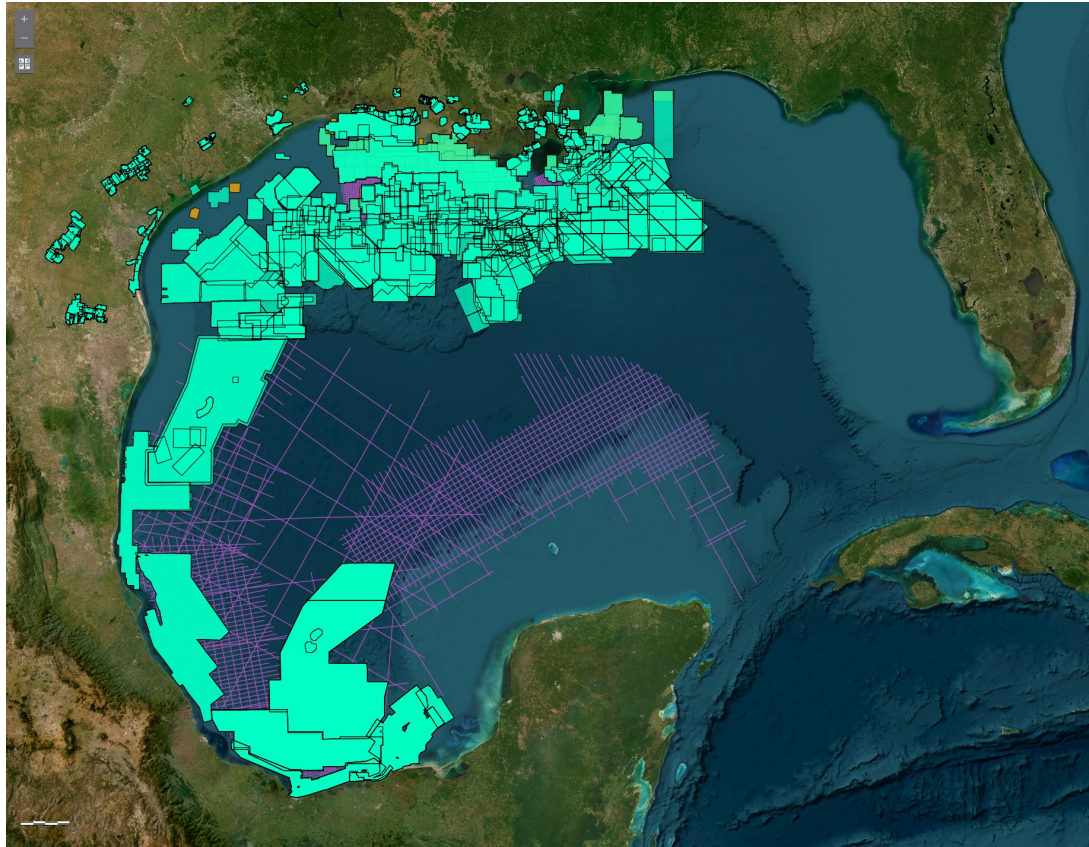


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Questions?



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