

Using ArcGIS Pro for structural and paleotectonic modelling

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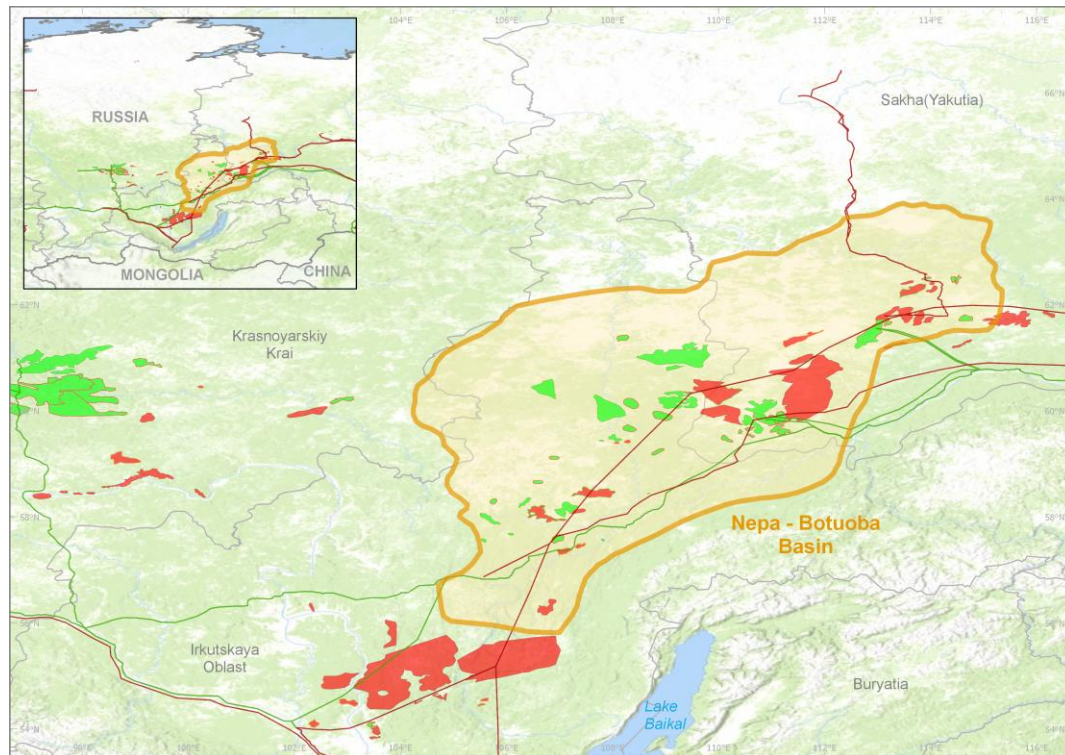
GIS Transformation at Wood Mackenzie & Verisk

Background

- In 2017 Wood Mackenzie and our parent company Verisk made a significant investment Geospatial technology:
 - » A vehicle to integrate data;
 - » To create a collaboration environment where innovation could flourish;
 - » To develop client solution more rapidly to match the dynamic nature of our business.
- Deployed ArcGIS Enterprise using AWS to geo-enable the business.
 - » Tools for analysis, ArcGIS Pro / Desktop, Insight, Web maps, Web App Builder, Story maps, centralised data store;
- GIS CoE to support to Research Analysts, Developers and the evolving role of Geospatial Data Analytics;
 - » Drive the strategic agenda for wider integration and usage with senior stakeholders.
- Problem solving and extracting more insight and value.
 - » Delivering better solutions to our clients
 - » Results can be unexpected, push boundaries and transform how we work.

Overview

- Stratigraphic data overview
- Complications while modelling on the raw data
- Automated checks and preparation of the data
- Creating structural model and paleotectonic model
- Time animation for basin exploration history

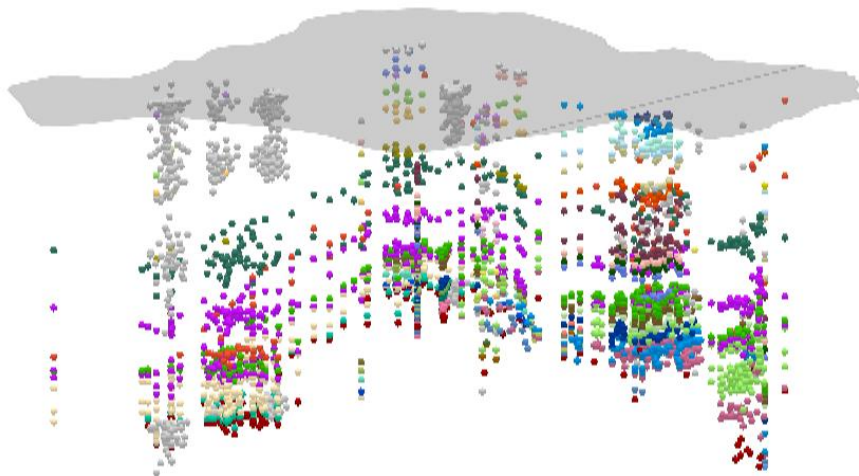




Stratigraphic data analysis

Quick modelling without losing richness of detailed data

- Raw data is collected from operators and various geological databases
- Original names and depths of stratigraphic units are kept
- Data with different level of detail: formations and members, broken down by age and lithology

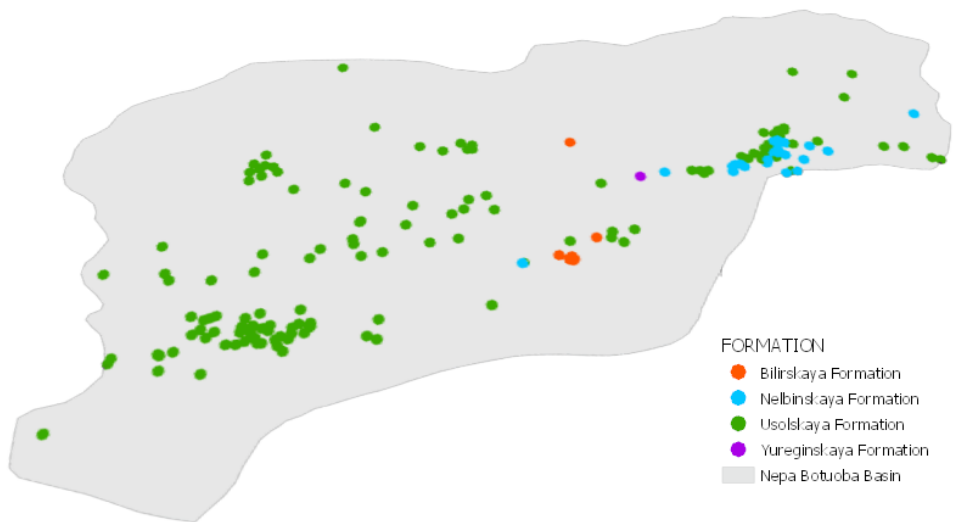


Classifying the stratigraphy

One formation – different names

Usolskaya

Nelbinskaya
Yureginskaya
Bilirskaya



нефтегазовая область (НГО)		Предгазская НГО (Июно-Дабеловская ангина)	Ненецко-Богурбская НГО (Пелудинский овод)	Ненецко-Богурбская НГО (Моринский вывет)	Предгазская НГО (Березовая ангина)	основная формация	тракты	
Структурно-фациальный район		Предгазский		Согордино-Березовый				
источн.	орден	реликтовый горизонт, толща	свита, подвита	продуктивный горизонт (ПГ)	свита, подвита	продуктивный горизонт (ПГ)	свита, подвита	продуктивный горизонт (ПГ)
С	С ₁	Б ₁ Б ₂	челюнинская	гаганцевская	челюнинская	челюнинская	челюнинская	челюнинская
		И ₁	чарская	кетский	кетский	чарская	чарская	чарская
	С ₂	В	оленевская	бурлакская	бурлакская	оленевская	оленевская	оленевская
		И	в тольчанская и тольчанская	ооль	ооль	тольчанская	тольчанская	тольчанская
		И	ильинская	в. Уваров	в. Бельская	ильинская	ильинская	ильинская
		И	неблизкая	ооль	неблизкая	неблизкая	неблизкая	неблизкая
	С ₃	Т	уольский ПГ	уольская	уольская	уольская	уольская	уольская
		Т	беловская	ооль	беловская	беловская	беловская	беловская
	V ₁ -С ₁	В ₁ -С ₁	кряжская	уольский-кряжский	уольский-кряжский	уольский-кряжский	уольский-кряжский	уольский-кряжский
		В ₂	данковская ПГ	кудряковская	вернековская	кудряковская	кудряковская	кудряковская
V	В ₂	уольская	уольская	уольская	уольская	уольская	уольская	
	Т	уольская	уольская	уольская	уольская	уольская	уольская	
V ₂	В ₂	уольская	уольская	уольская	уольская	уольская	уольская	
	Т	уольская	уольская	уольская	уольская	уольская	уольская	

Рис. 2. Схема сопоставления стратиграфических подразделений нефтегазовых областей. Ненецко-Богурбская нефтегазовая провинция

	Июно-Дабеловская		Предгазская		Кудряковская		Уольская	
	свита	подвита	свита	подвита	свита	подвита	свита	подвита
Июно-Дабеловская								
Предгазская								
Кудряковская								
Уольская								

	Стратиграфическая шкала для нефтегазовых областей				Стратиграфическая шкала для нефтегазовых областей			
	свита	подвита	горизонт	свита	подвита	горизонт	свита	подвита
Июно-Дабеловская								
Предгазская								
Кудряковская								
Уольская								

Creating the ArcGIS Pro tool

Key steps



Pre-processing validation logic in interactive parameters



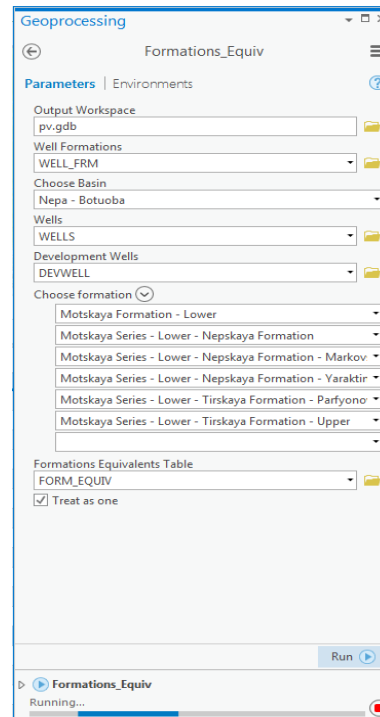
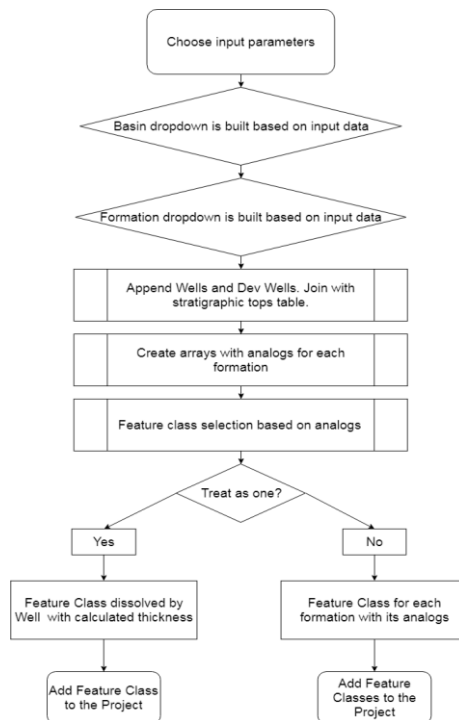
Users can quickly test different assumptions about region's stratigraphy



Detecting errors



All layers are collected in specified workspace and added to current project

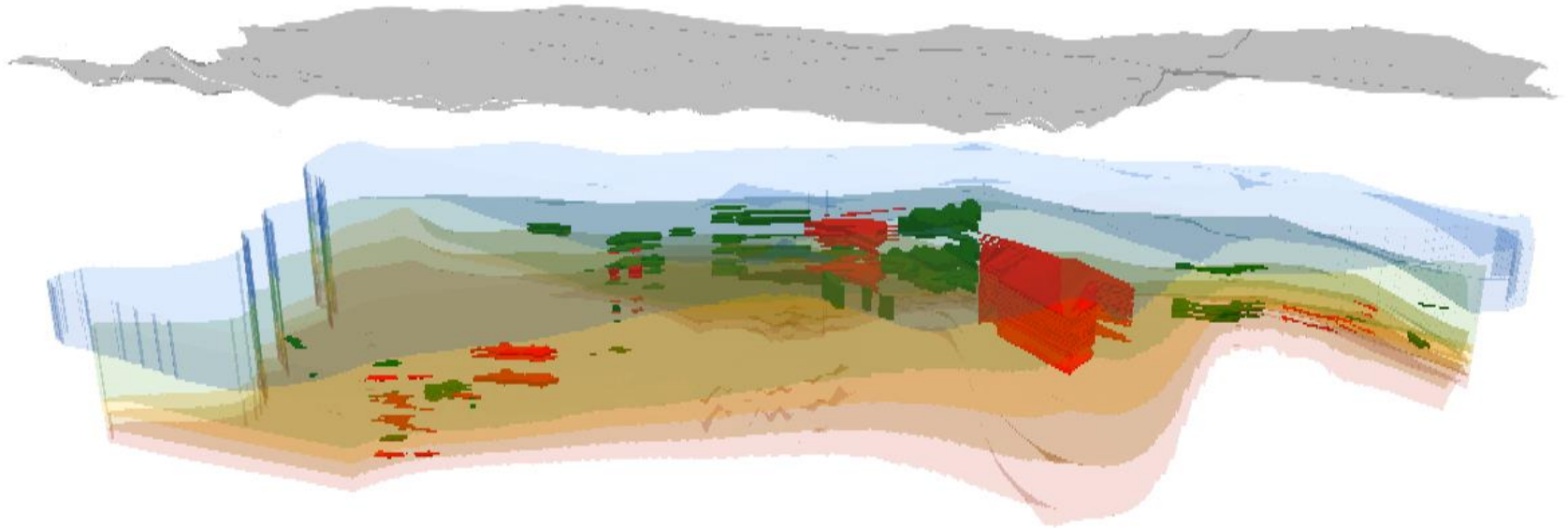


Formation	Analogue
Belskaya Formation	Belskaya Formation
Tolbachanskaya Formati...	Belskaya Formation
Tolbachanskaya Formati...	Belskaya Formation - Lower
Belskaya Formation - Lo...	Belskaya Formation - Lower
Belskaya Formation - Mi...	Belskaya Formation - Middle + ...
Tolbachanskaya Formati...	Belskaya Formation - Upper
Belskaya Formation - Up...	Belskaya Formation - Upper
Motskaya Formation - L...	Motskaya Formation - Lower
Motskaya Series - Lower...	Motskaya Formation - Lower
Byuuskaya Formation	Motskaya Formation - Lower
Byuuskaya Formation - L...	Motskaya Formation - Lower
Botuobinskiy Formation	Motskaya Formation - Lower
Byuuskaya Formation - L...	Motskaya Formation - Lower
Iktekhszkaya Formation - ...	Motskaya Formation - Lower
Byuuskaya Formation - L...	Motskaya Formation - Lower
Byuuskaya Formation - ...	Motskaya Formation - Lower
Yerbogachenskiy Format...	Motskaya Formation - Lower
Talakhskiy Formation - V...	Motskaya Formation - Lower
Uspunskaya Formation	Motskaya Formation - Lower
Uspunskaya Formation - ...	Motskaya Formation - Lower
Kursovszkaya Formation	Motskaya Formation - Middle
Motskaya Formation - M...	Motskaya Formation - Middle
Parshinskaya Formation...	Motskaya Formation - Middle
Parshinskaya Formation...	Motskaya Formation - Middle
Khamakinskiy Formation	Motskaya Formation - Middle
Talakhskiy Formation	Motskaya Formation - Middle
Yuryakhskaya Formation...	Motskaya Formation - Upper
Teterskaya Formation	Motskaya Formation - Upper
Yuryakhskaya Formation...	Motskaya Formation - Upper



3D structural model of the basin

Impact of structural setting on hydrocarbon accumulation

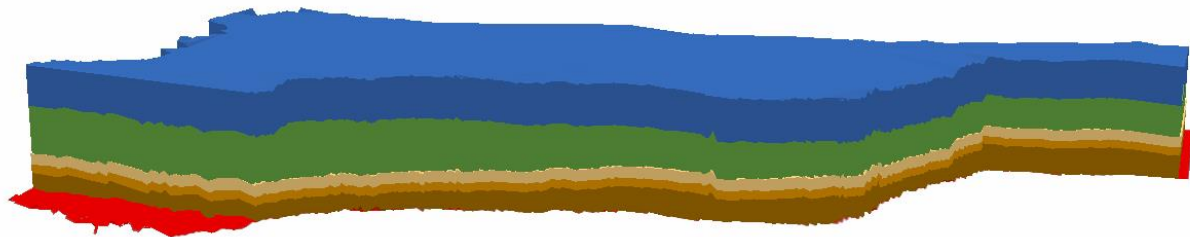




Visualising the sedimentation history

Time animation for stratigraphy data

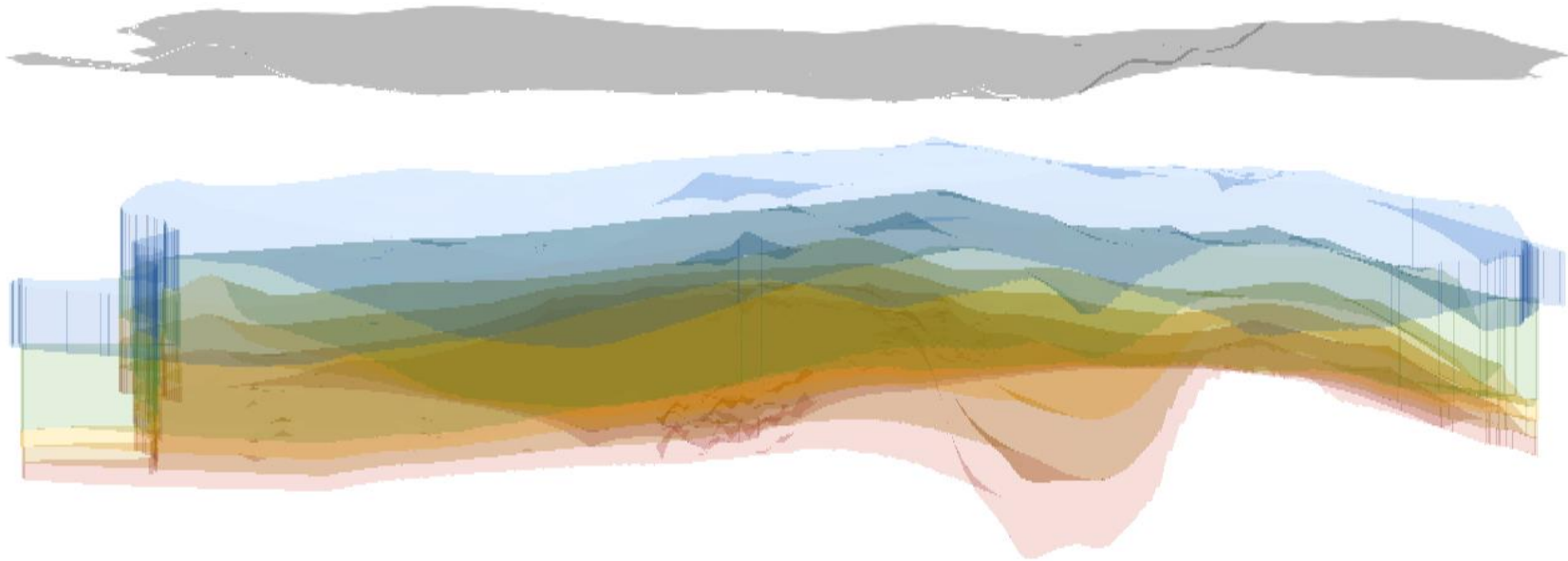
- Historical conditions of deposition allow to model the uplift of Nepa arch
- Thicknesses of the formations are consistent throughout the basin indicating the absence of significant erosion processes
- Presence of the hydrocarbons in eroded basement suggests possible lateral migration



Exploration of the basin

Time-based data on the structural model

1961





Conclusions

- Geological data is hard to check unless it is represented on a map, and preferably in 3D.
- Data clean up is essential when it is sourced from a variety of different sources.
- Tools need to be repeatable and adaptable, work with new data and in different regions.
- ArcGIS Pro and ArcGIS Enterprise provide the capability to do this high level, initial geological screening, as a pre-cursor to more in-depth analysis.
- By enabling our analysts with these tools we are allowing them to go further with data, extract more value and provide better insight to our clients.
- Combining innovation and knowledge - Together we do more.



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