Microstructural and Petrophysical Effects of Overthrusting on the Aztec Sandstone, Buffington Window, SE Nevada

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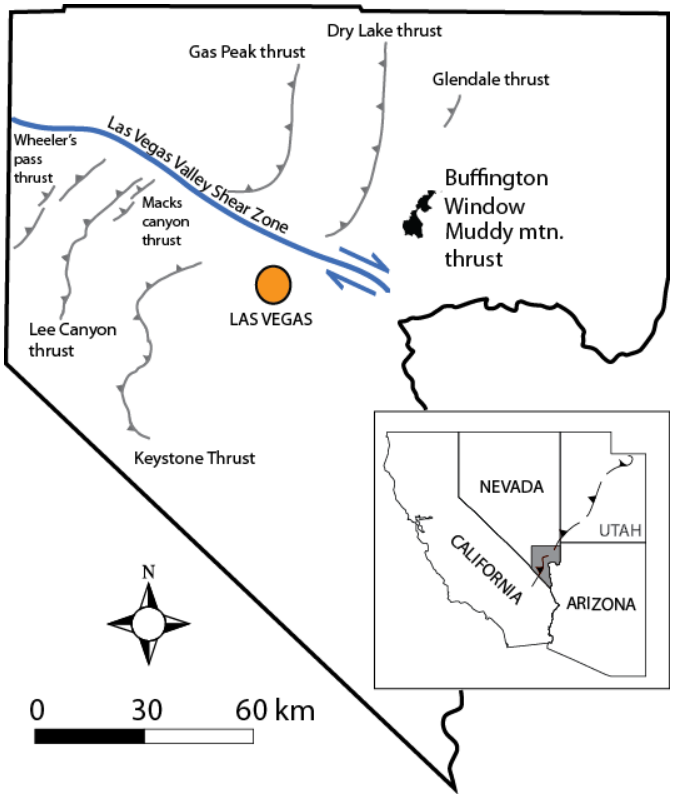
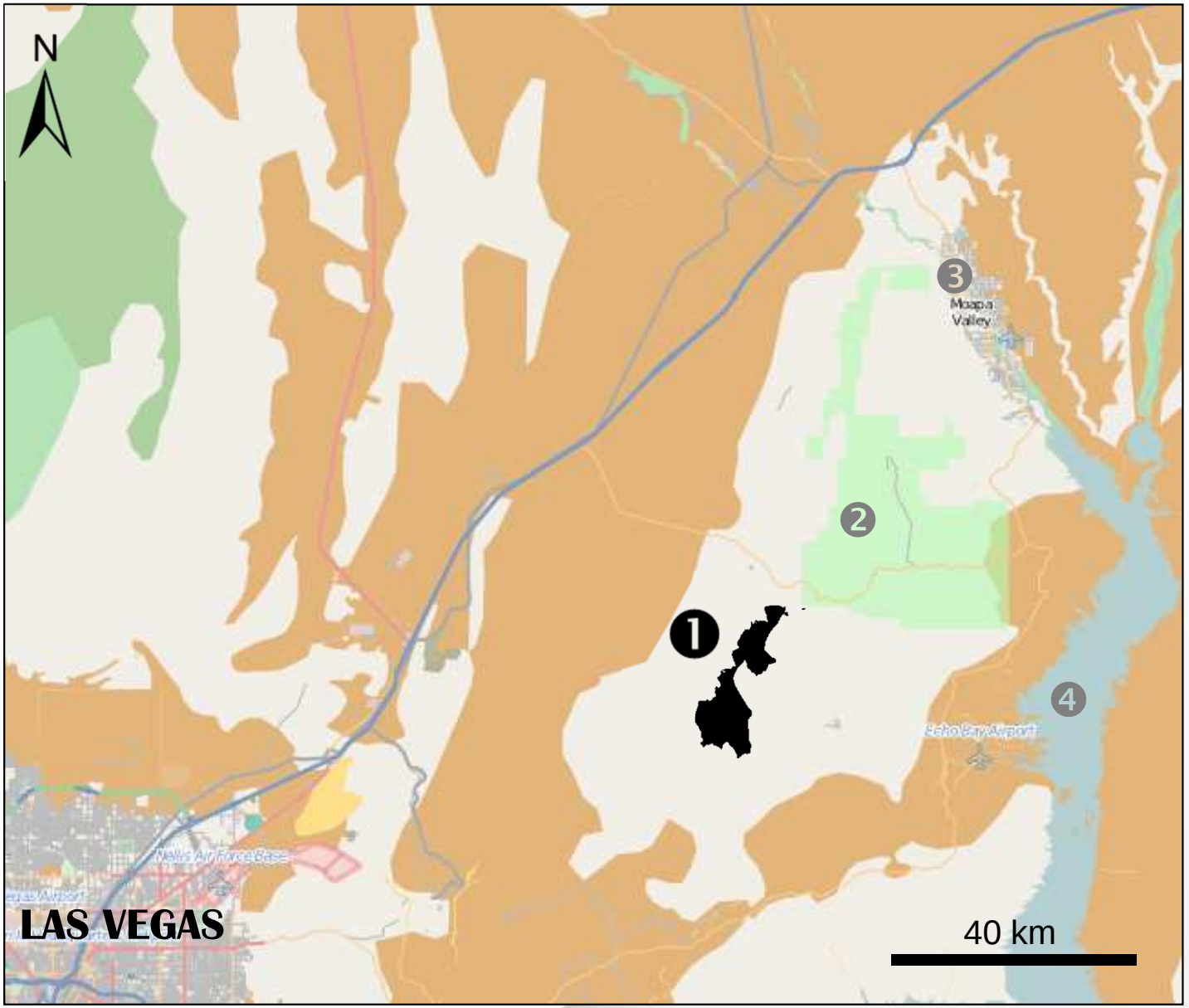
T208. Hinterland, Retroarc Fold-Thrust Belt, and Foreland Systems - Session 293

Study Area





❶ **Buffington Window**

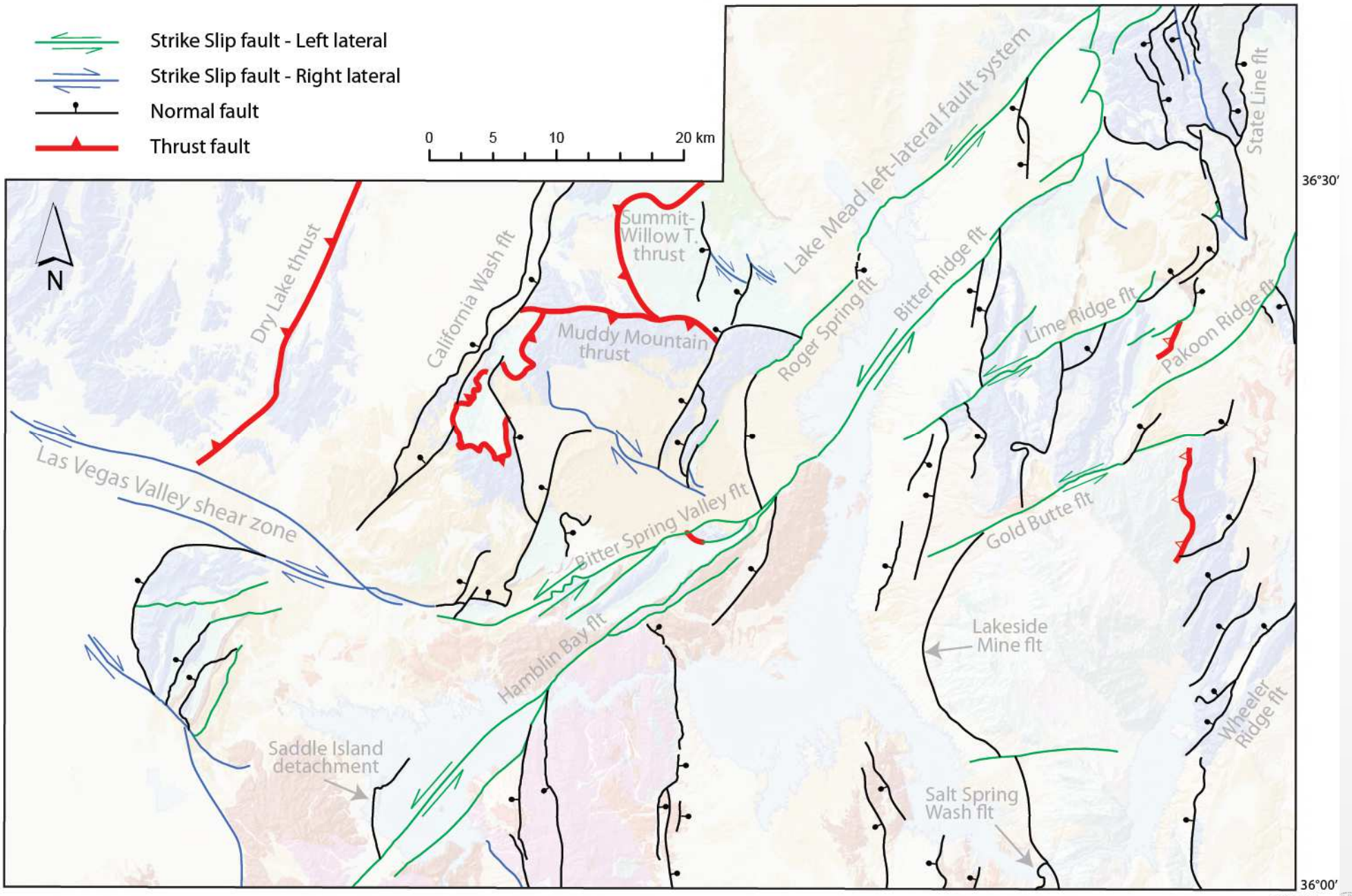
❷ Valley of Fire St. Park

❸ Moapa Valley

❹ Lake Mead

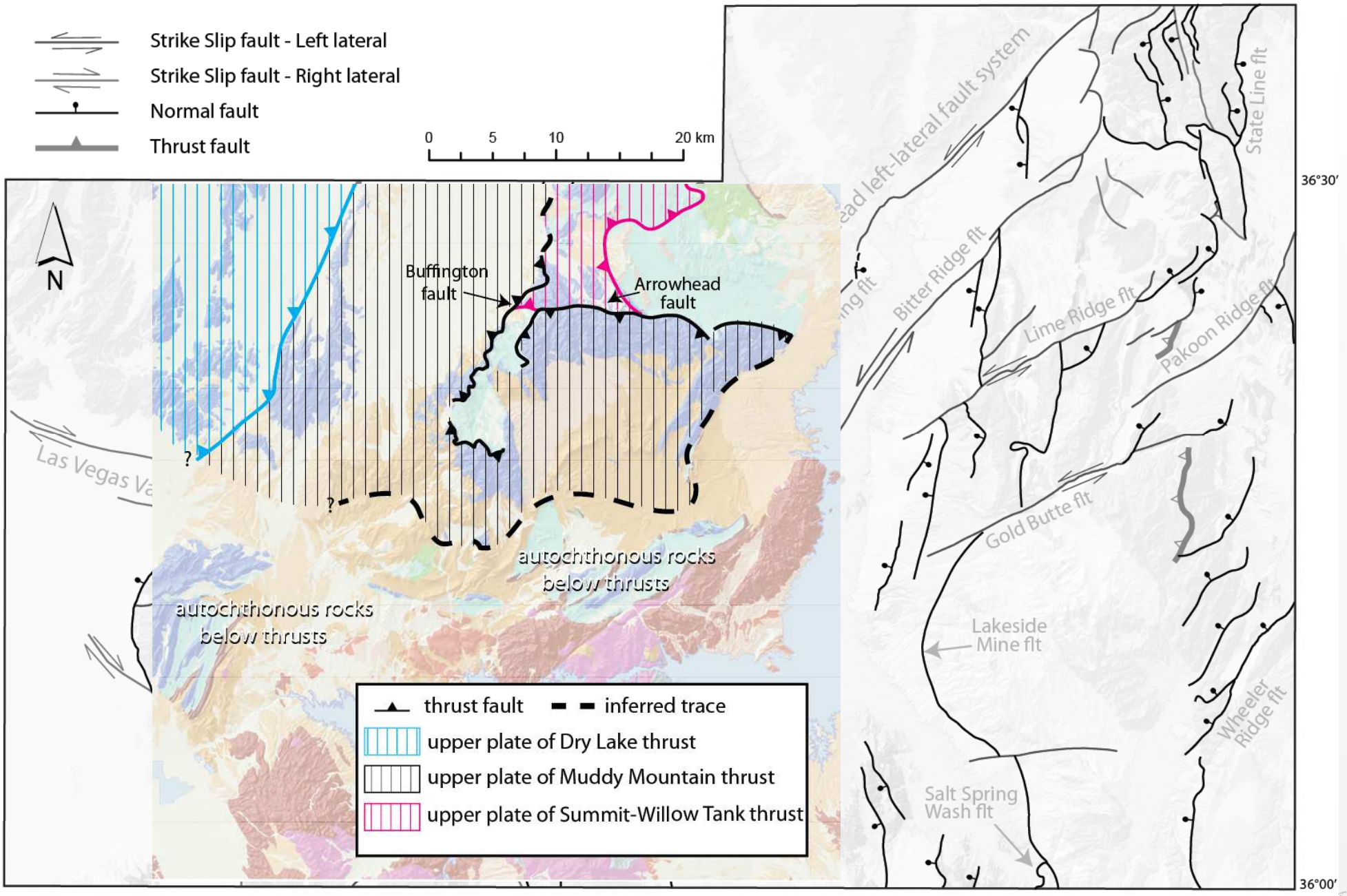
Sources: left, Modified from Brock and Engelder ,1977; right, OpenStreetMap Data

Geological Framework



Source: modified after Beard et al. (2007) Preliminary Geologic map of the Lake Mead 30'x60' quadrangle USGS

Geological Framework



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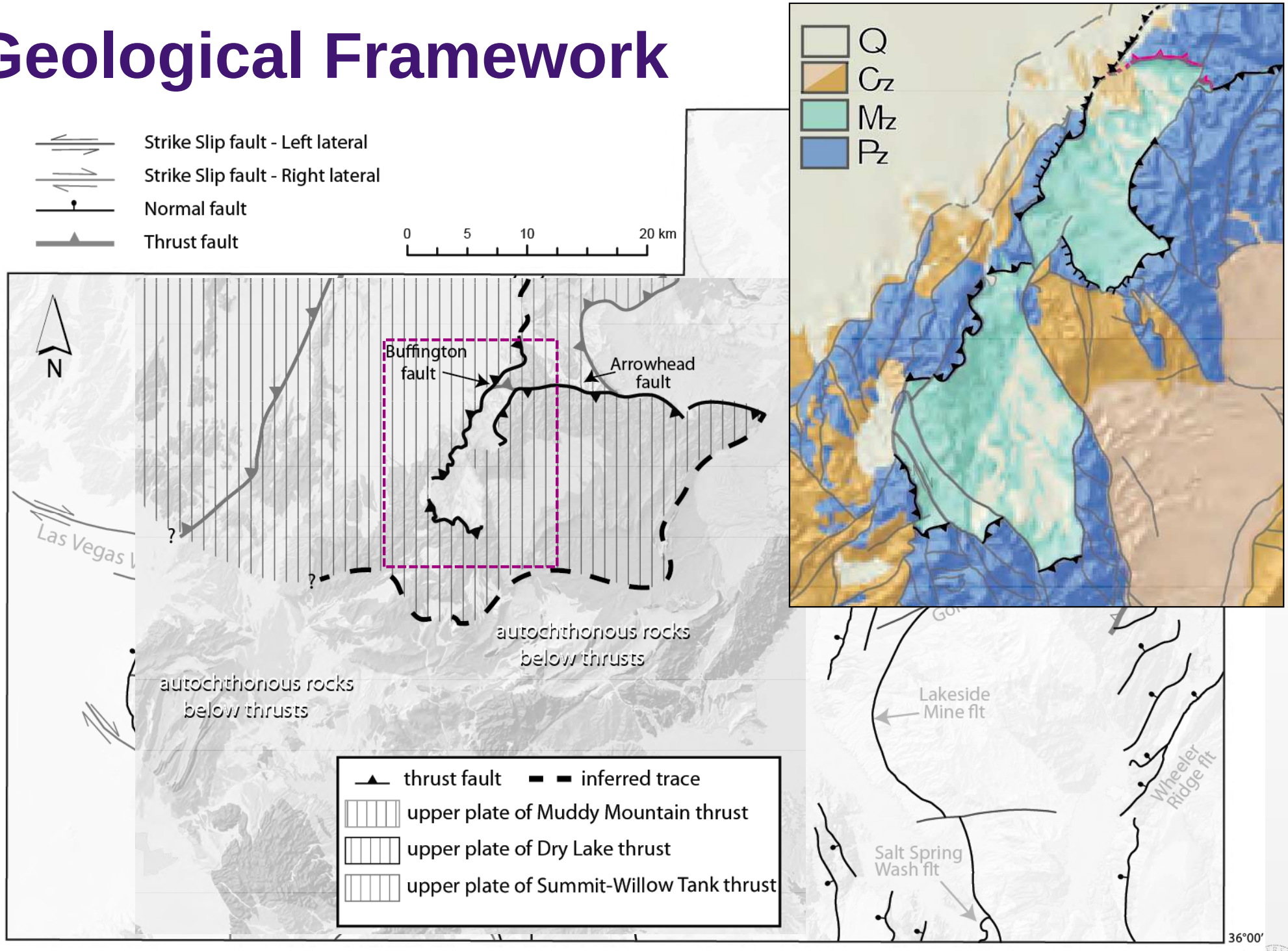
Geological Framework



Source: modified after Beard et al. (2007) Preliminary Geologic map of the Lake Mead 30'x60' quadrangle USGS

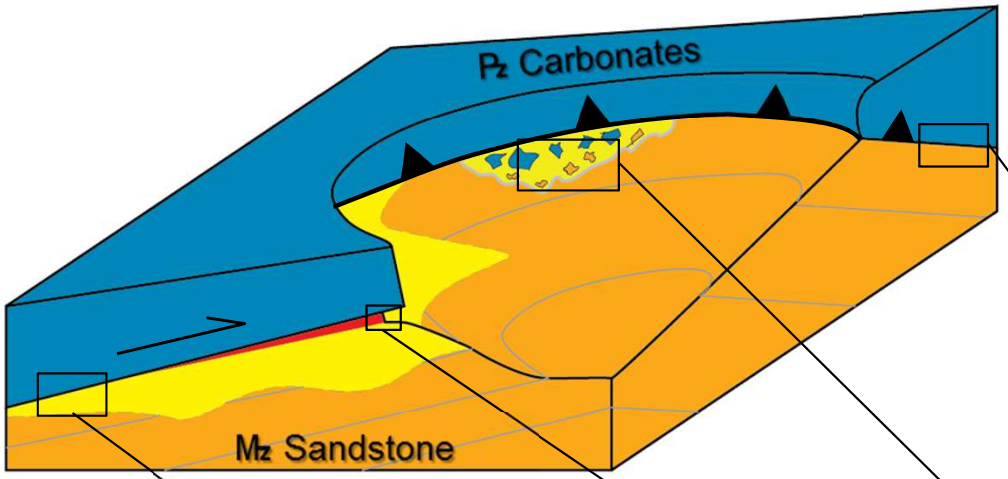
Previous Work

- Longwell 1949
- **Brock and Engelder 1977**
- Johnson 1981
- Price and Johnson 1982
- Burchfield et al. 1982
- Willemin 1984

40 - 100 km transport

What is the extent and character of deformation of porous sandstones below long transport overthrusts?

Muddy Mountain Thrust



Deformation bands

Types and orientations

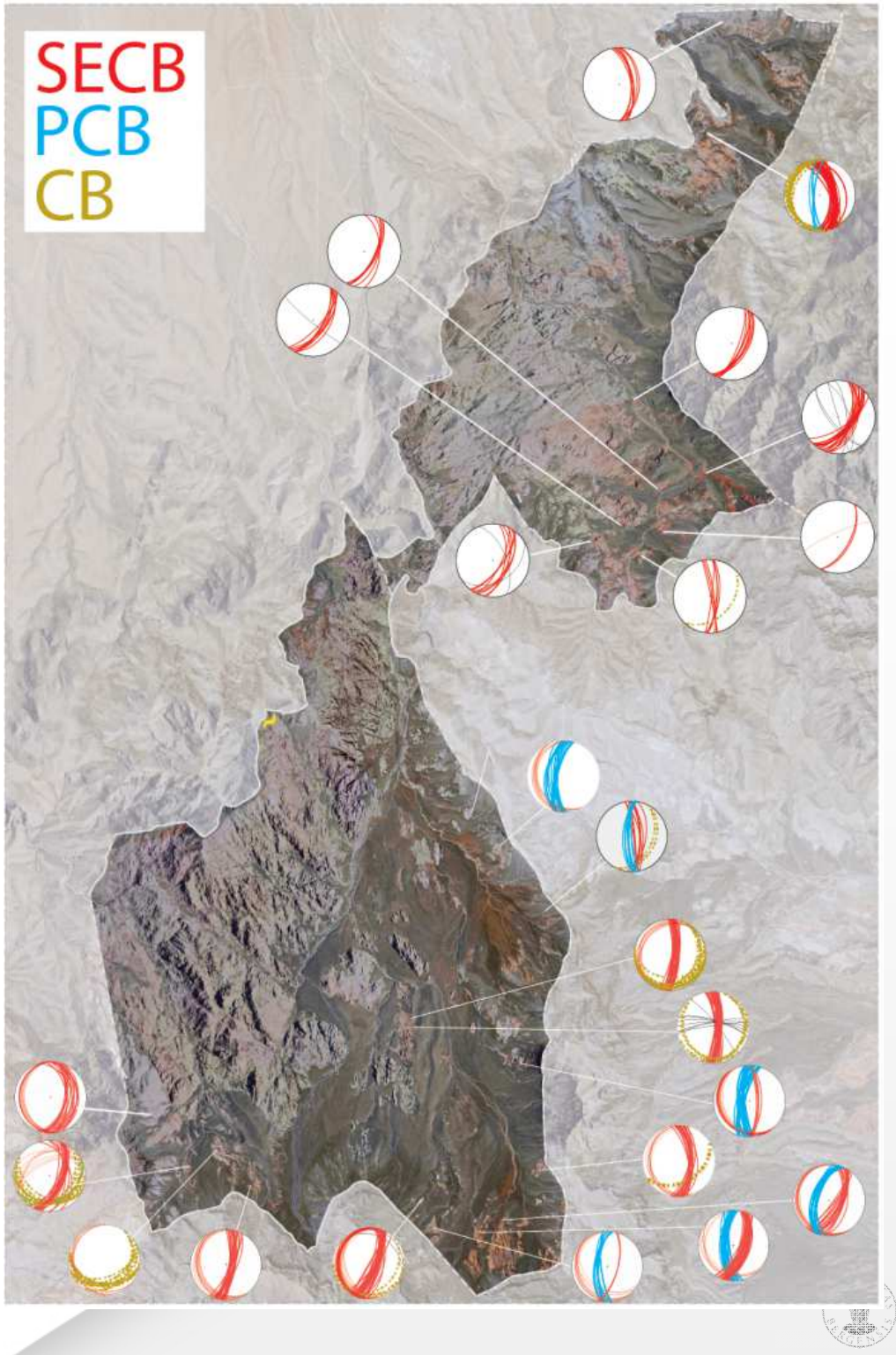
Pure Compaction bands PCB

Shear-Enhanced Compaction bands SECB

Set 1

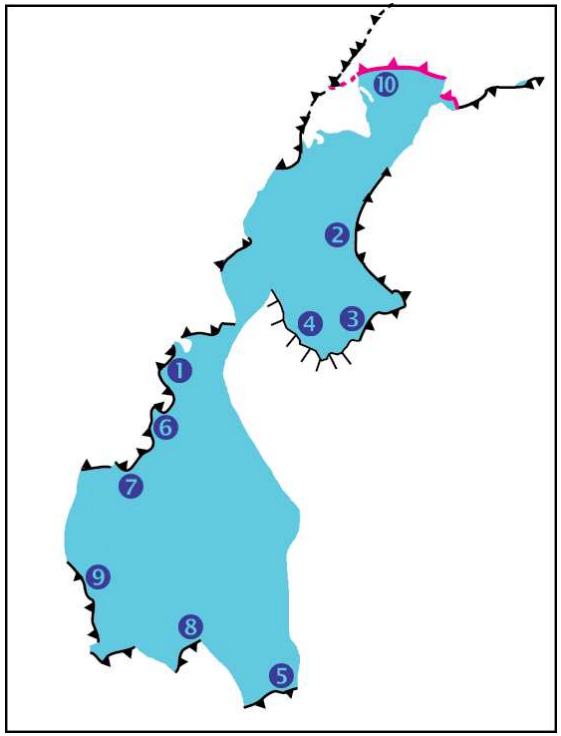
Set 2

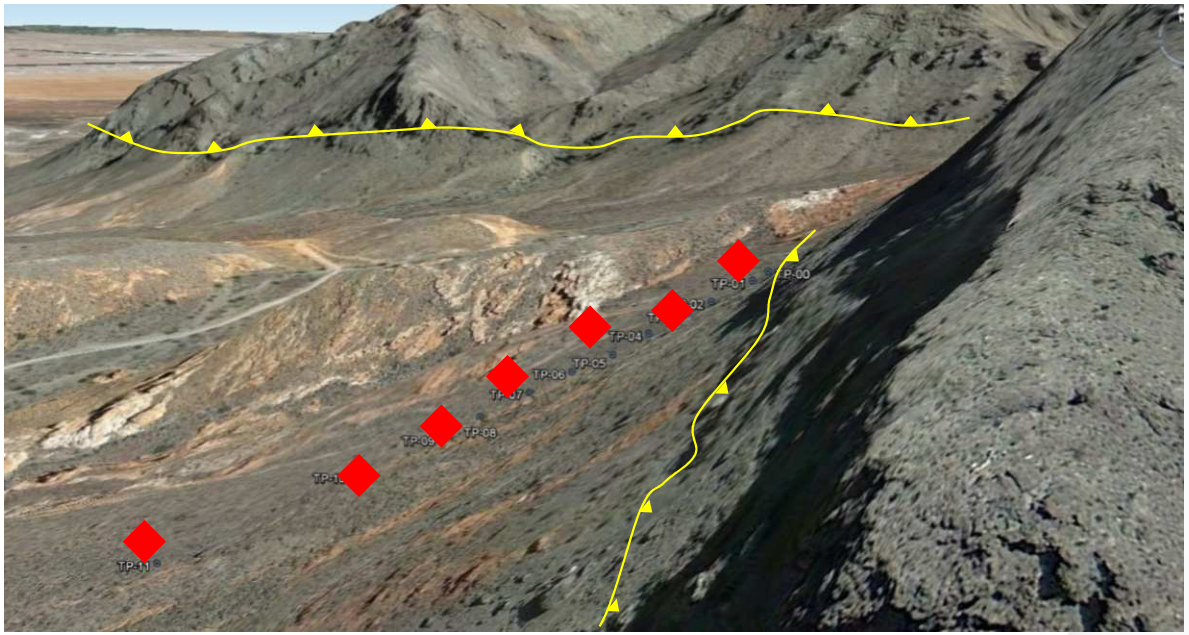
Cataclastic Bands CB



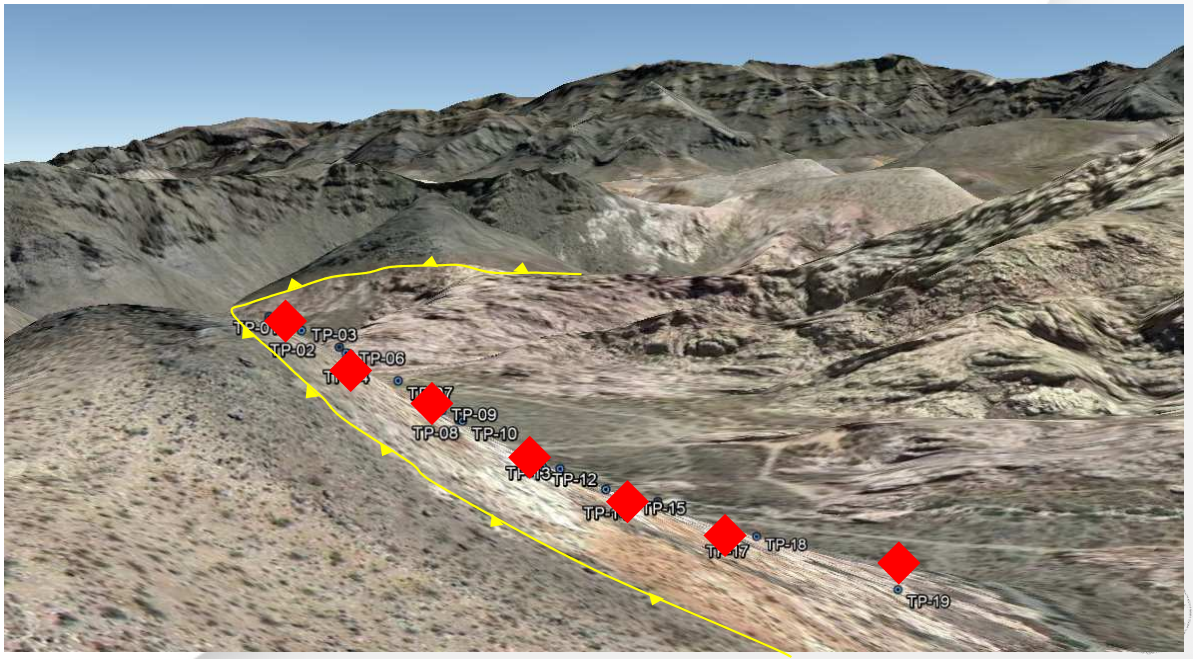
Petrophysical properties

- Permeability profiles
- Thin section analysis (microstucture and porosity ϕ)



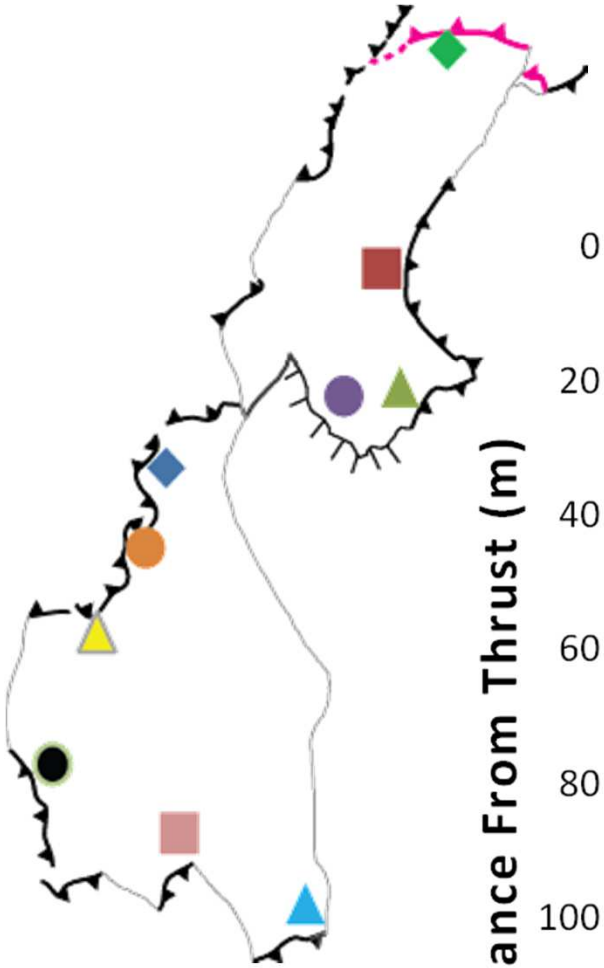


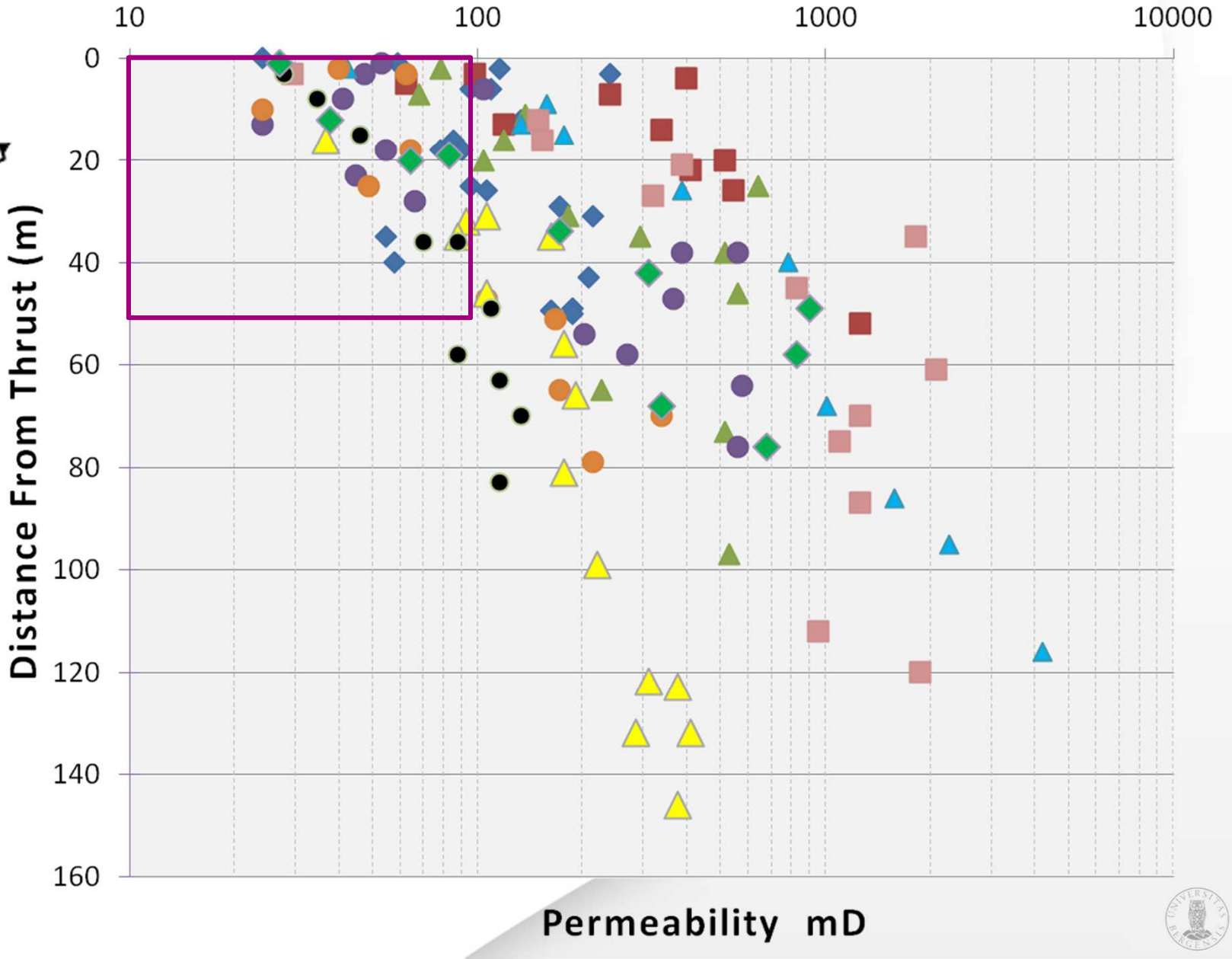
Source: Google Earth



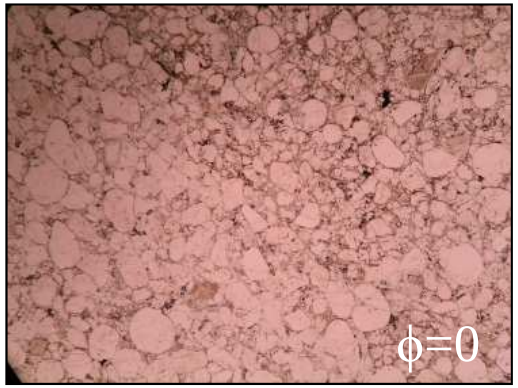
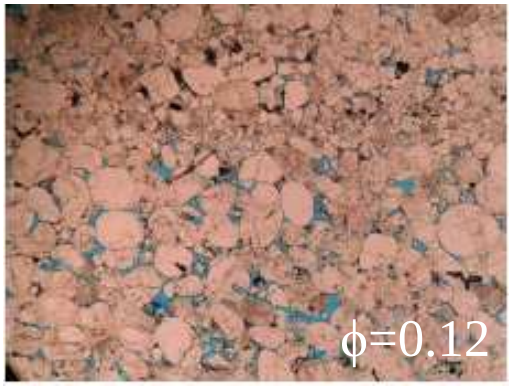
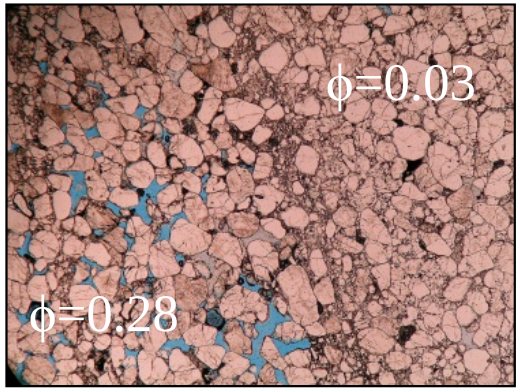
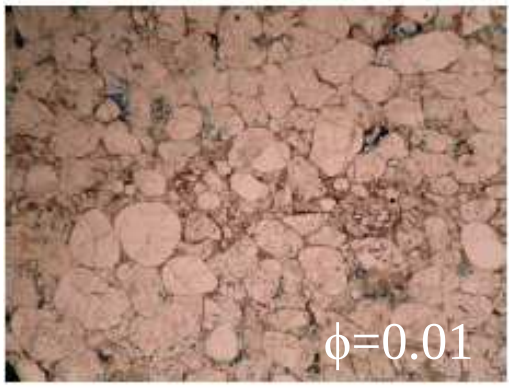
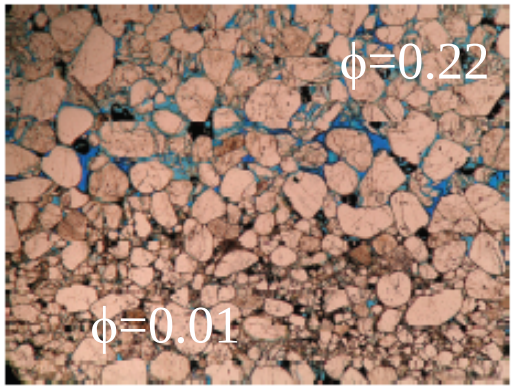
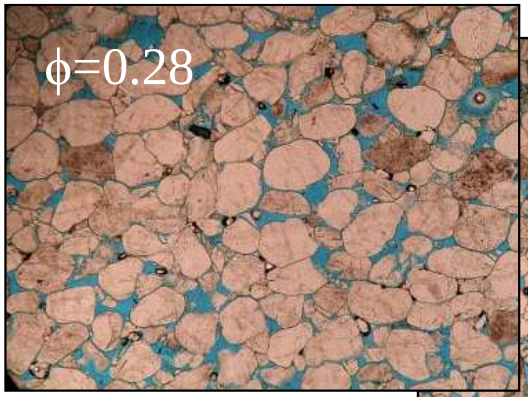
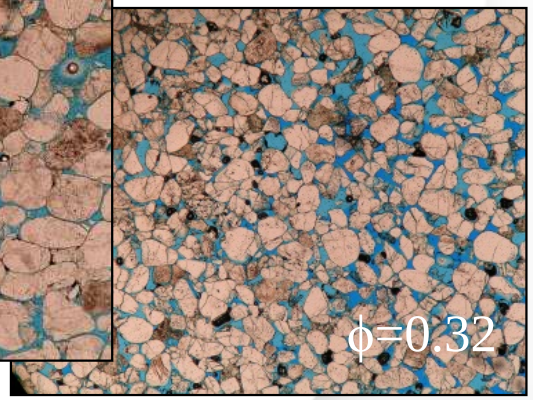
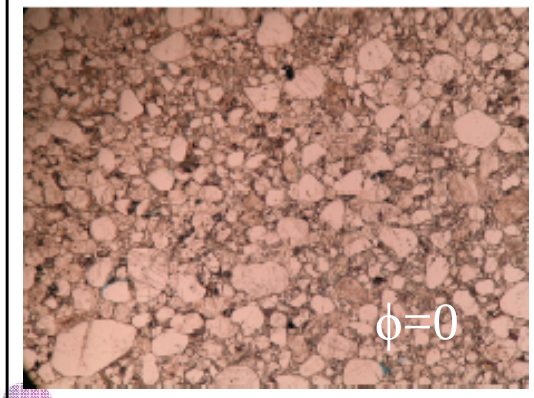
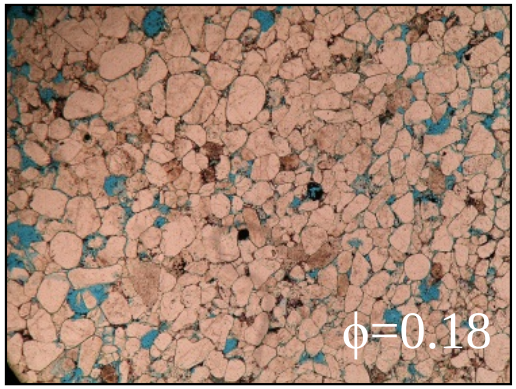
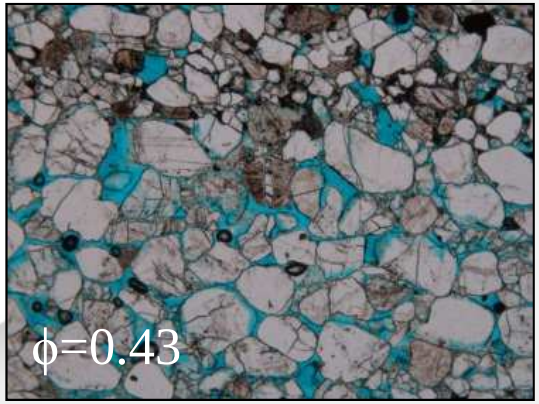
Results

Permeability Profiles





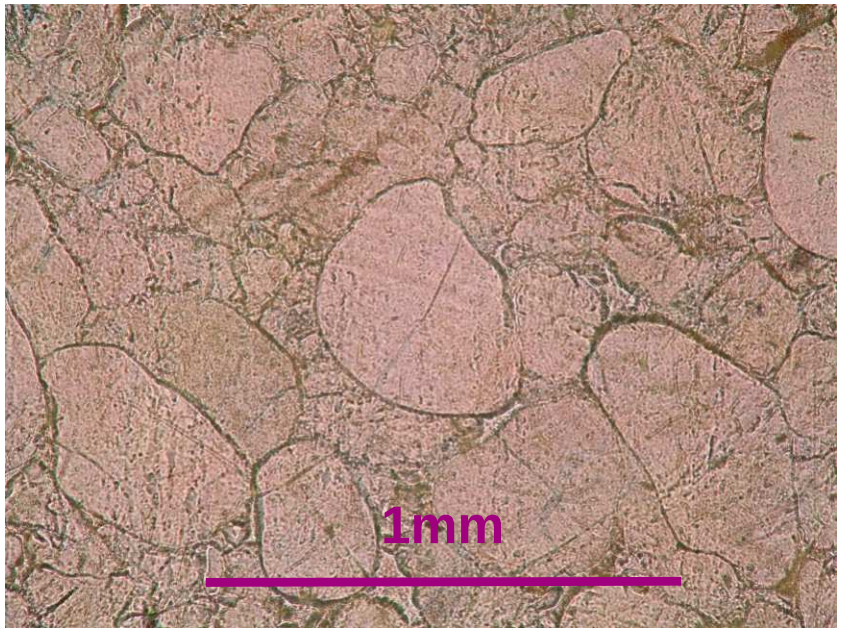
Porosity

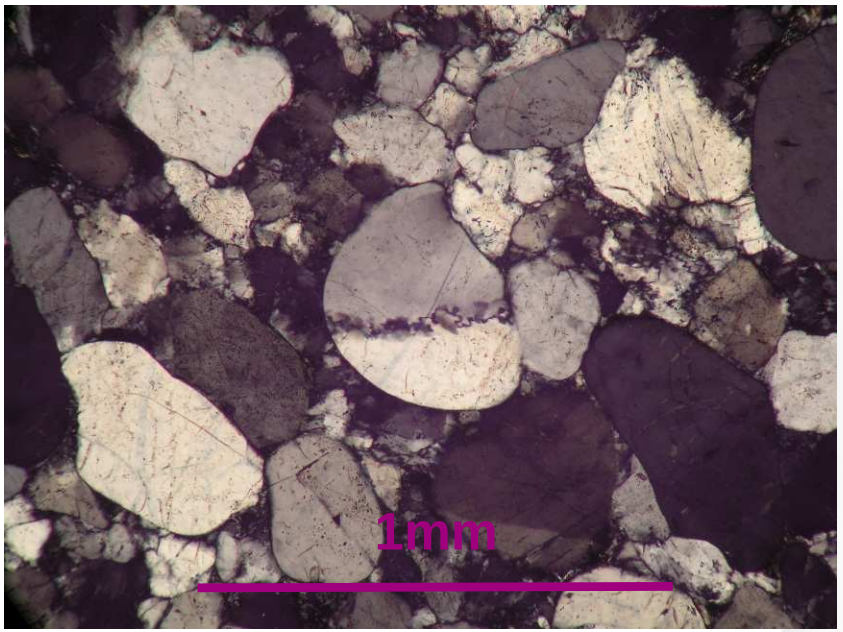
0-25 m	25-50 m	≥50 m
		
		 
		

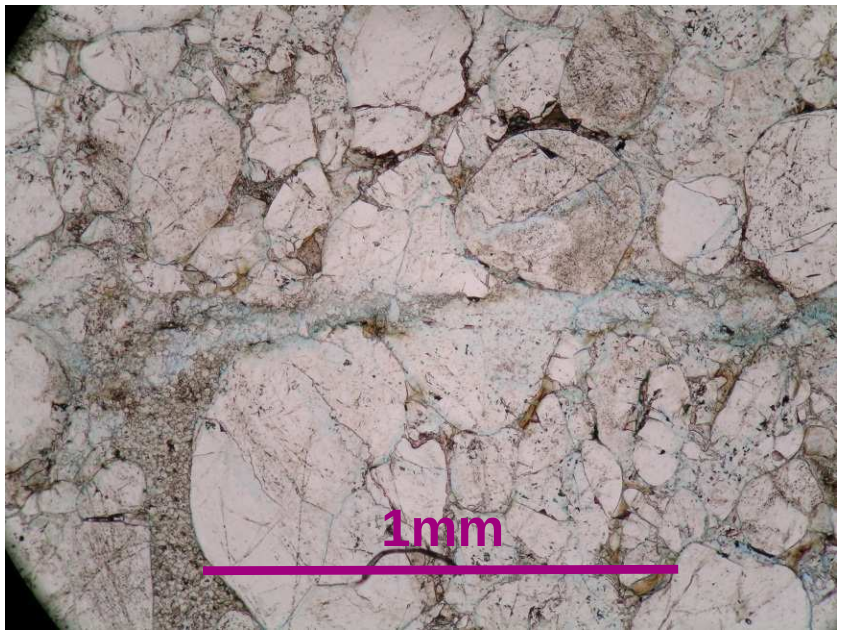
4x magnification – width of photos is 4.3mm

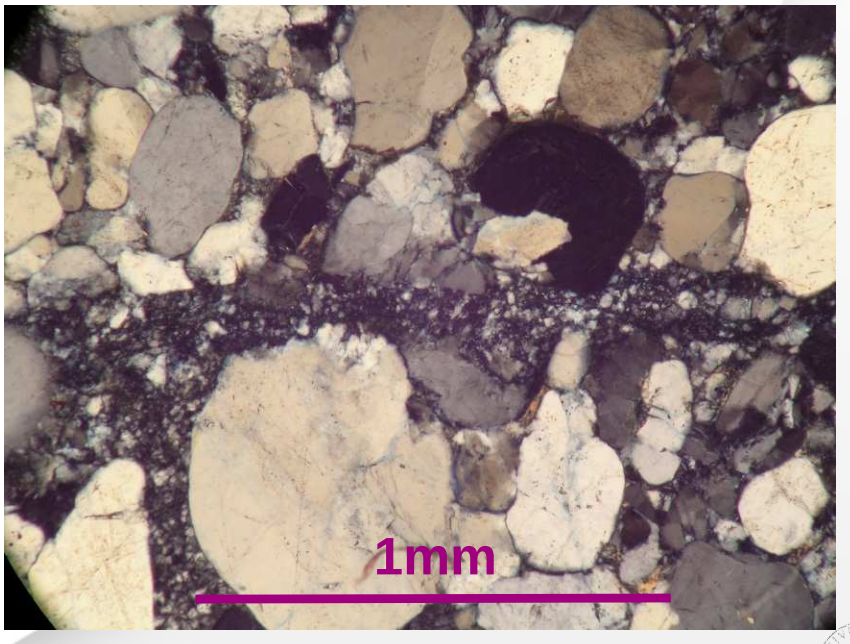
Microstructures - Examples

- Pressure solution
- Cataclasis
- Local Calcareous cementation (Post)



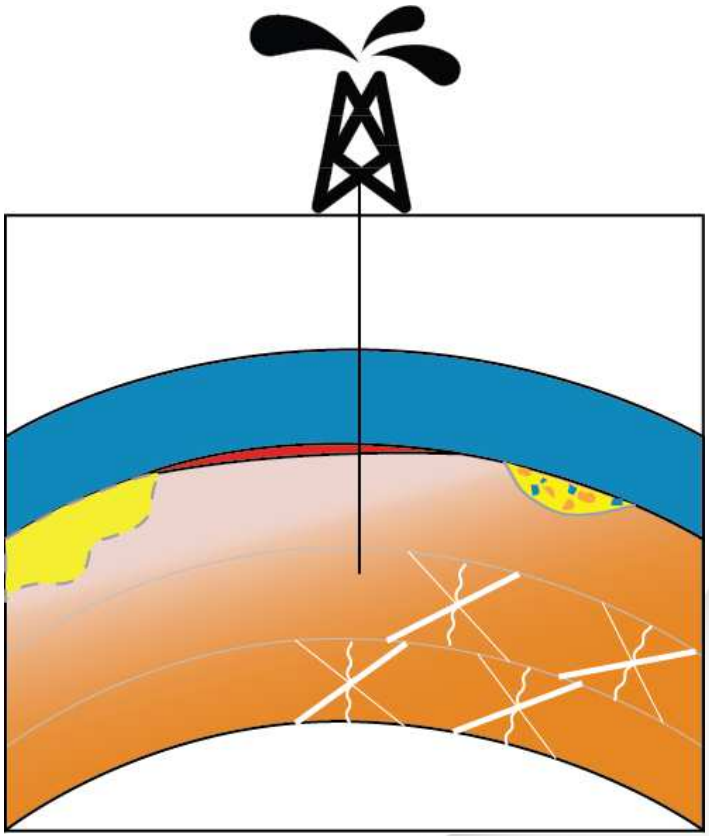






Implication for reservoir properties

- The non-effective top seal from the trust can be compensated by the low permeable zone in the sandstone due to the thrust movement
- Additional compartmentalization effects exist due to deformation bands
- Hydrocarbons - Underground water - CO_2 storage



Conclusions

- Permeability and total porosity loss due to thrusting is restricted to a few decameters zone below the thrust plane
- The main porosity and permeability reduction mechanisms are pressure solution and cataclasis, cementation playing a minor role
- The orientations of pure compaction bands PCB are consistent with an East verging direction of maximum horizontal stress σ_1
- The molasses and channels at the top of the Aztec Sst. correlate with a more gradual increase in permeability and porosity for the profiles nearby (higher induration).

Further work

- Quantification of pressure solution and cataclasis (strain analysis)
- SEM / RAMAN analyses
- Dominance of West verging set of SECB is still not fully understood

THANK YOU

Acknowledgements

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http://folk.uib.no/nglhe/COPS.html
http://www.cipr.uni.no/person.aspx?person=1221

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