

*Present day tectonic regime in the frontal  
part of the Eastern Alps inferred through  
an integrated approach*

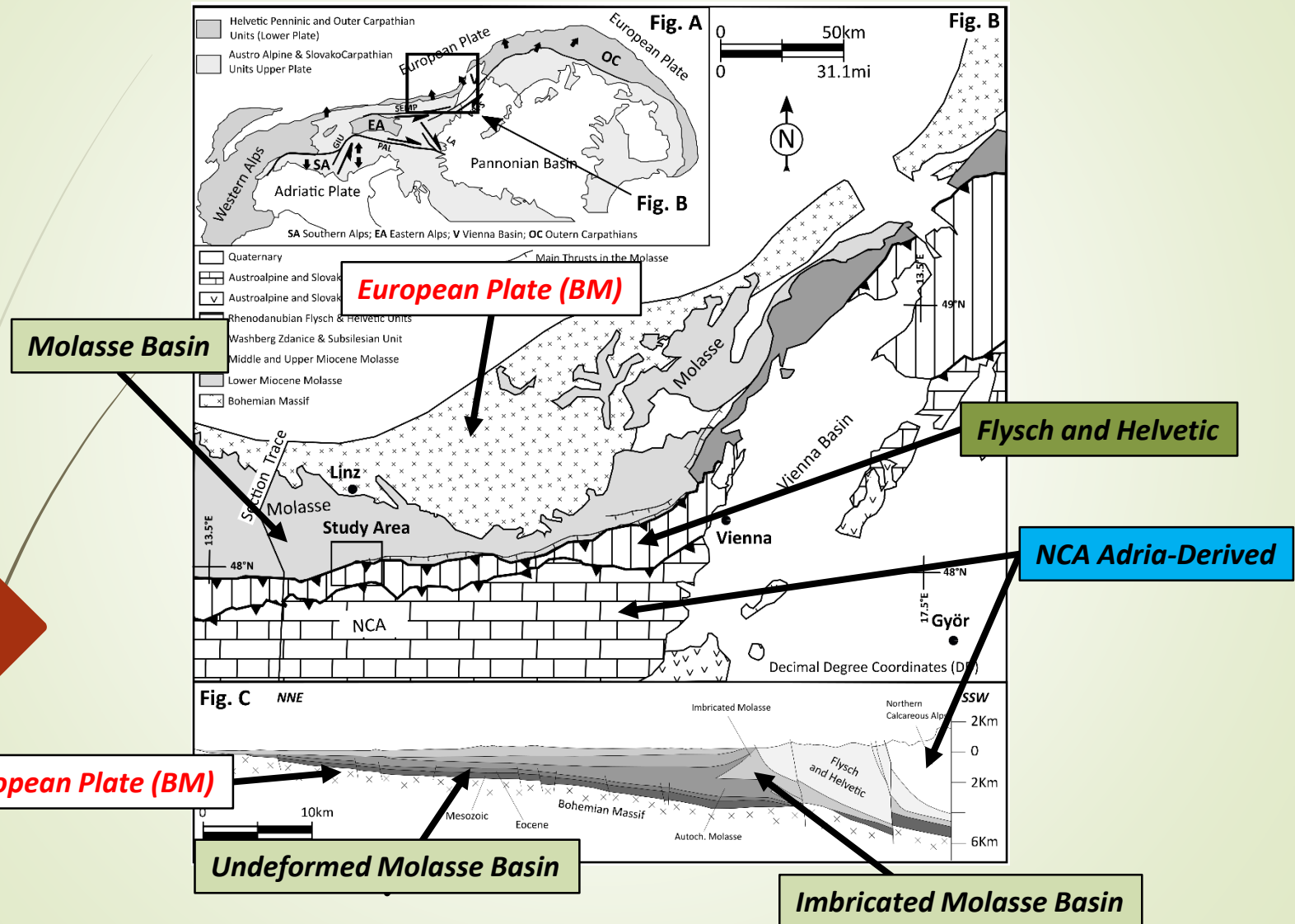
*Dr Nicola Levi*

*M. Habermueller  
Dr K. Decker  
Dr U. Exner  
E. Piani  
Dr G. Wiesmayr*

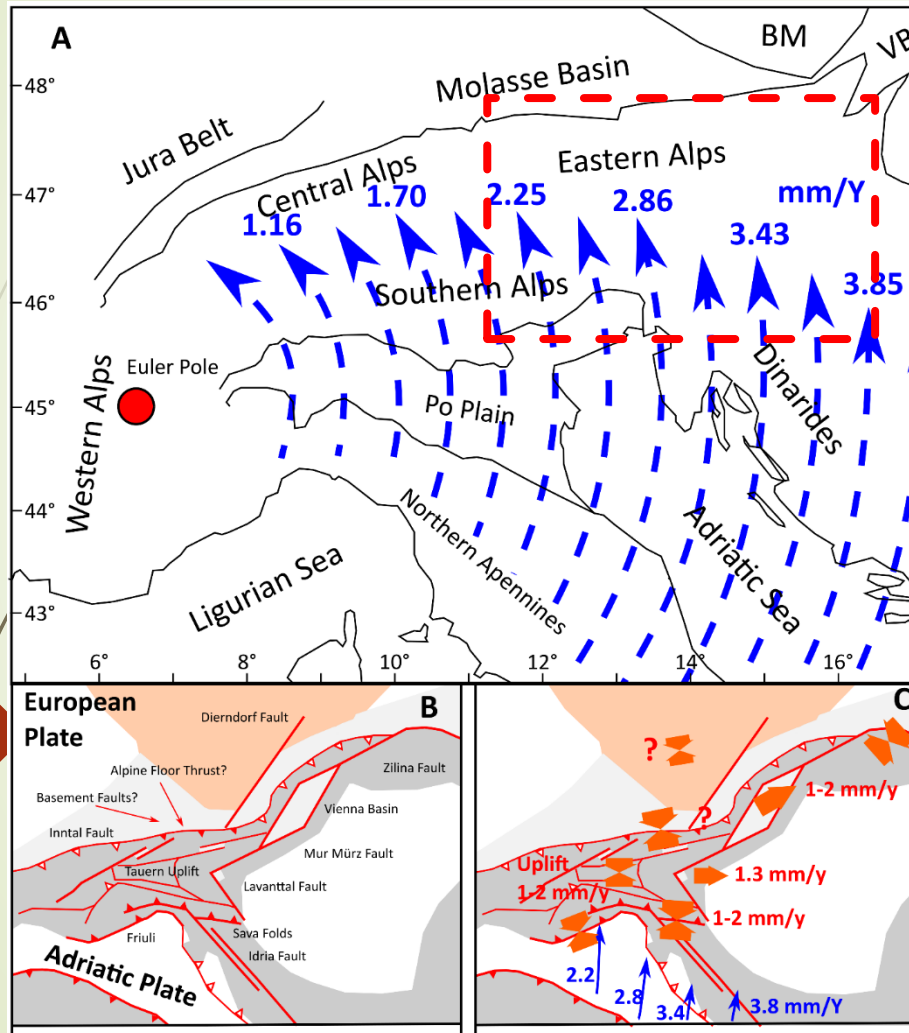


# Introduction: Geologic Setting

Map and Geologic Sections after  
Beidinger and Decker, 2014 and  
Krenmayr and Schnabel, 2006



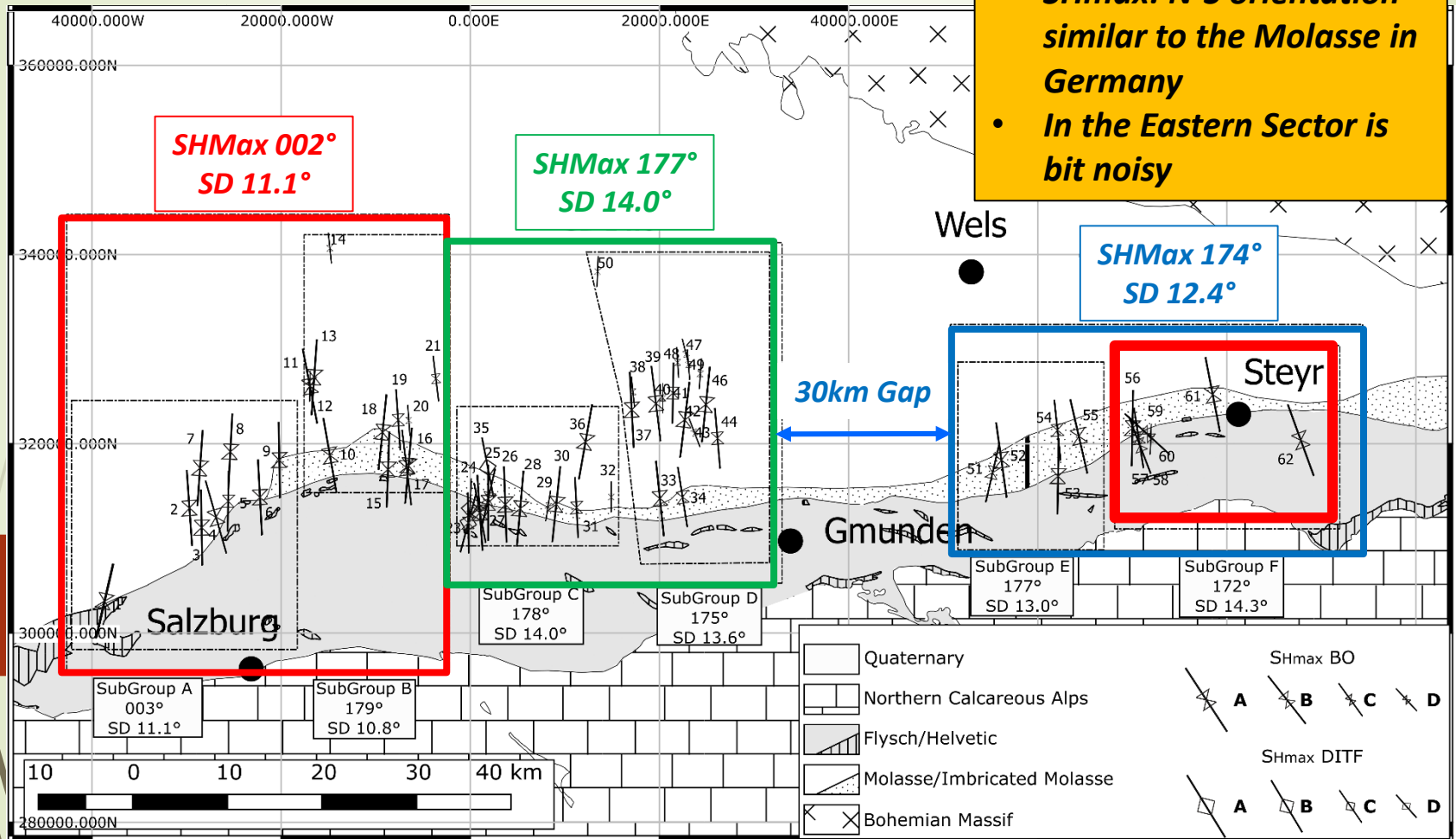
# Introduction: Active Plate Convergence between Adria and Europe



**Active convergence between Europe and Adria inferred from GPS data (modified after Weber et al., 2010)**

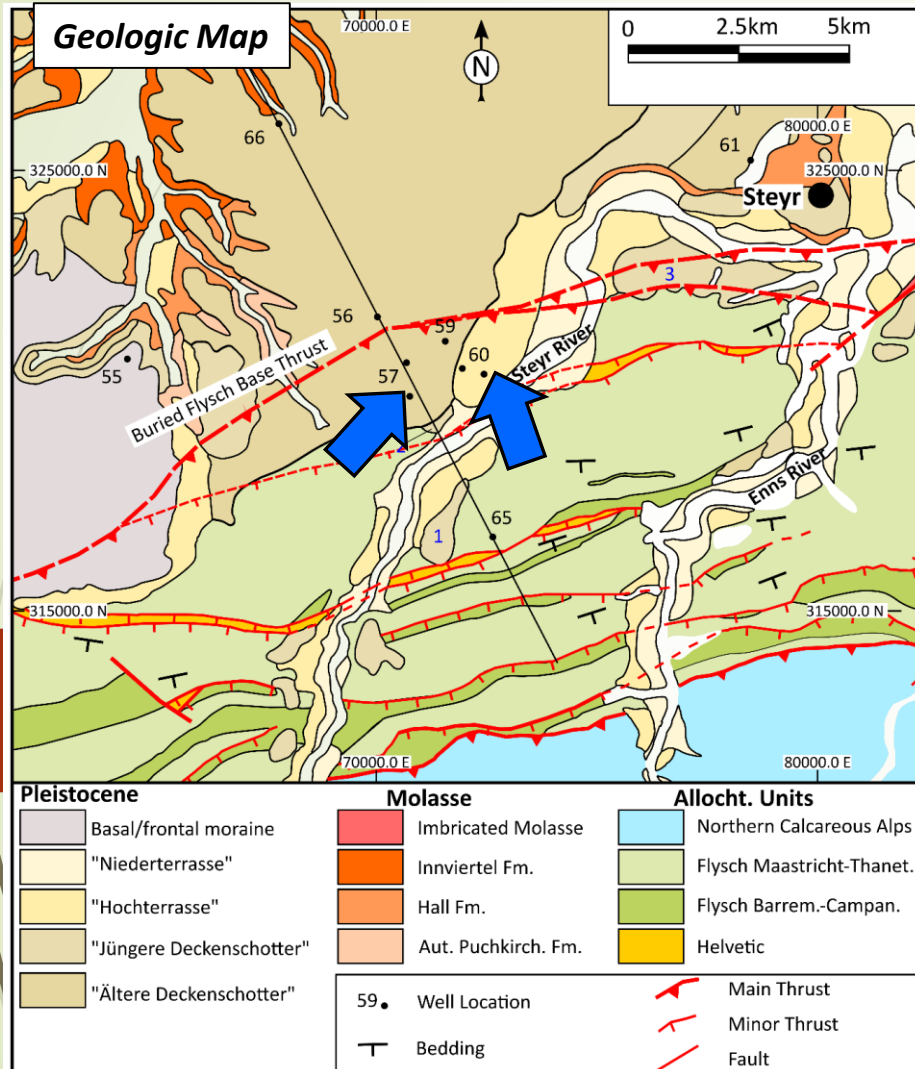
**Estimated convergence rates (data from Decker et al., 2005; Greneczy et al., 2005; Vrabec et al., 2006; Weber et al., 2010)**

## In Situ Stress Orientation from BHI Data



- **SHmax: N-S orientation similar to the Molasse in Germany**
- **In the Eastern Sector is bit noisy**

# Stress Anomalies In The Eastern Sector



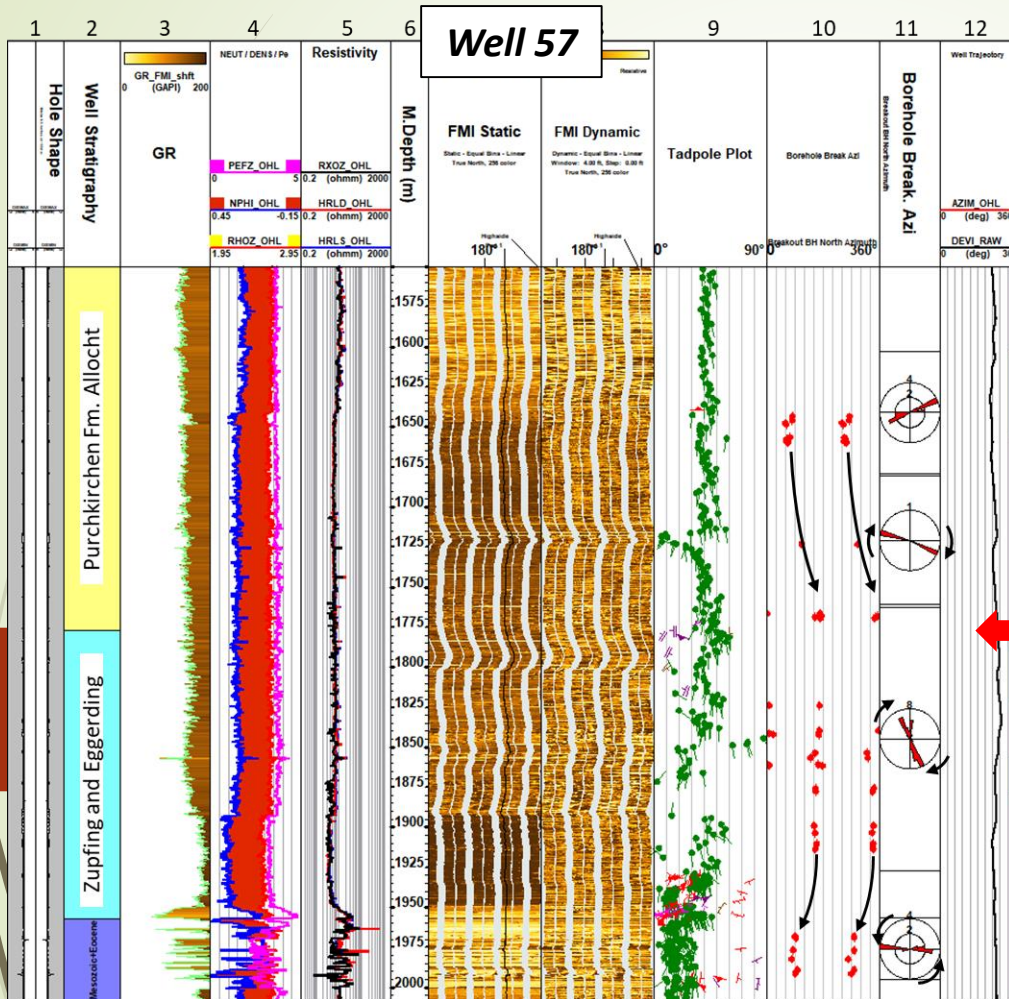
- *Stress anomalies are found only in two wells, both located in the Eastern Sector*
- *Wells 57 and 60 are located close to each other and were drilled through the frontal part of the belt*

Geologic map of the study area modified from the 1:50.000 and 1:200.000 maps of the Austrian Geological Survey (GBA) (Egger and Faupl, 1999; Krenmayr and Schnabel, 2006).

The maps of the Quaternary sediments of the Steyr and Enns rivers (Van Husen, 1971; 1975)



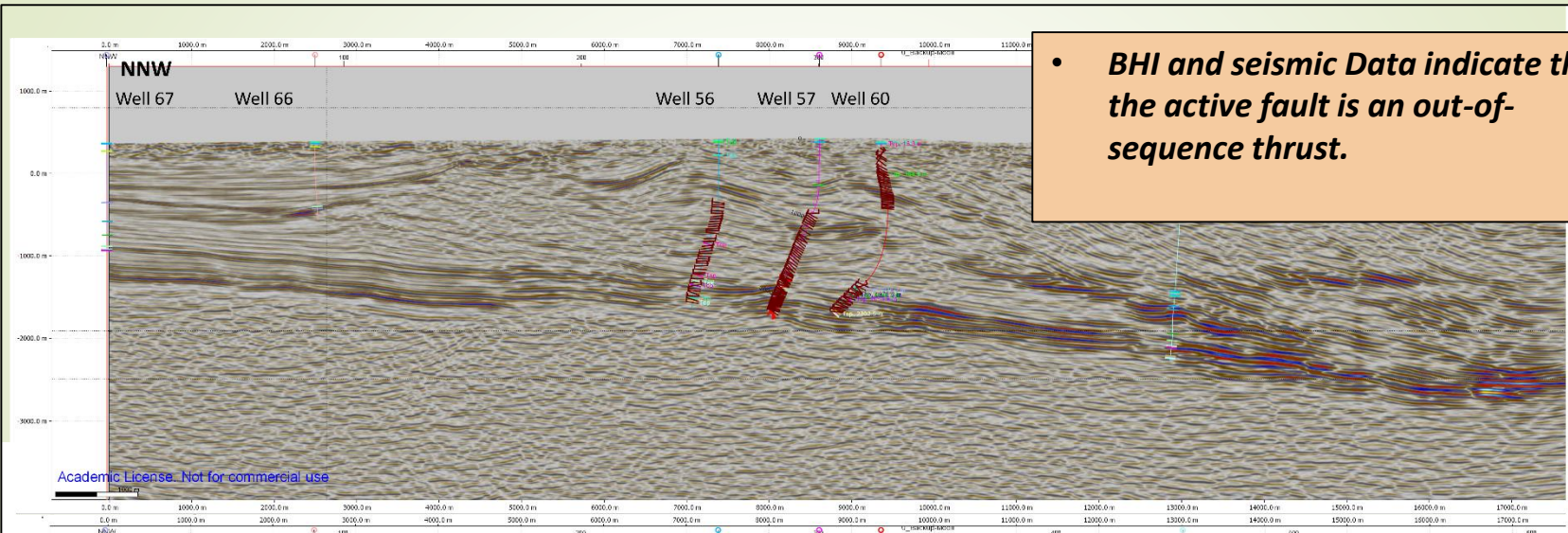
# Stress Anomalies In The Eastern Sector



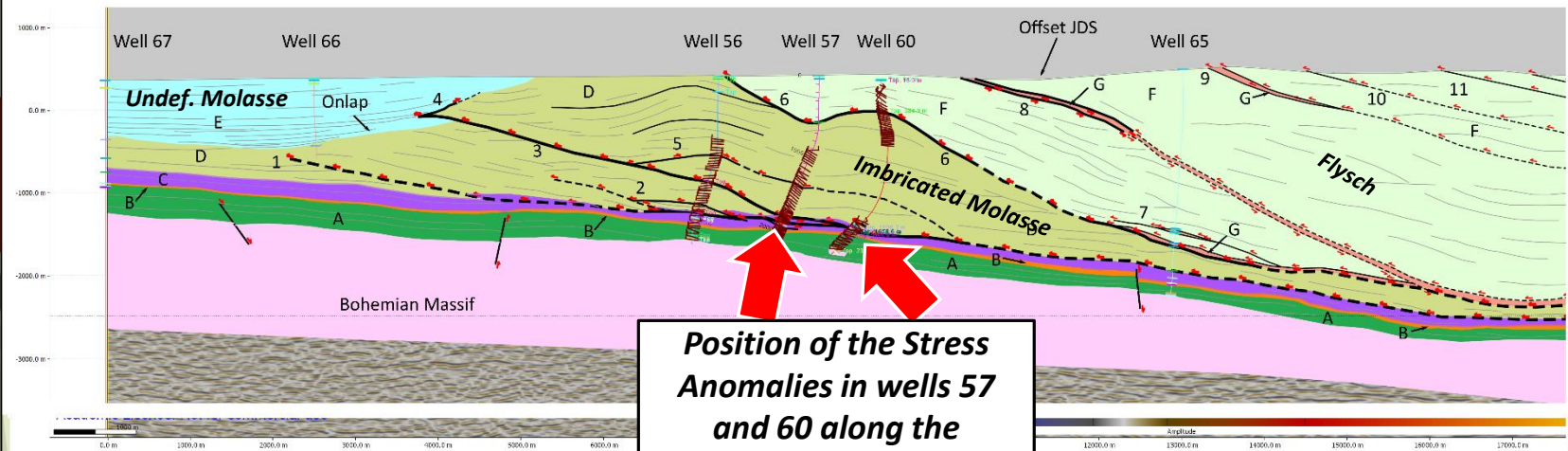
- *Rotation of the induced features close the main decollement of the Imbricated Molasse*
- *Indicating active faulting causing a stress perturbation*
- *A similar stress perturbation is observed in the same interval in well 60*

**Main Decollement of the Imbricated Molasse**

# Stress Anomalies In The Eastern Sector



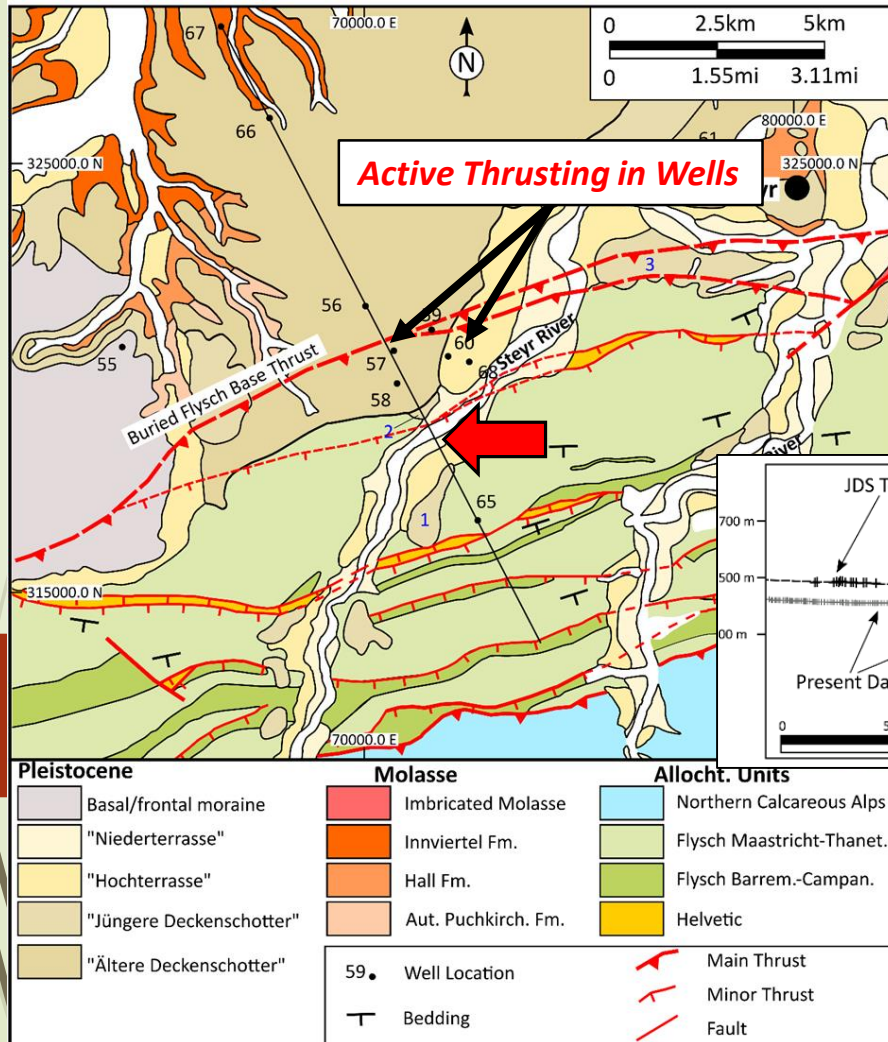
- BHI and seismic Data indicate that the active fault is an out-of-sequence thrust.**



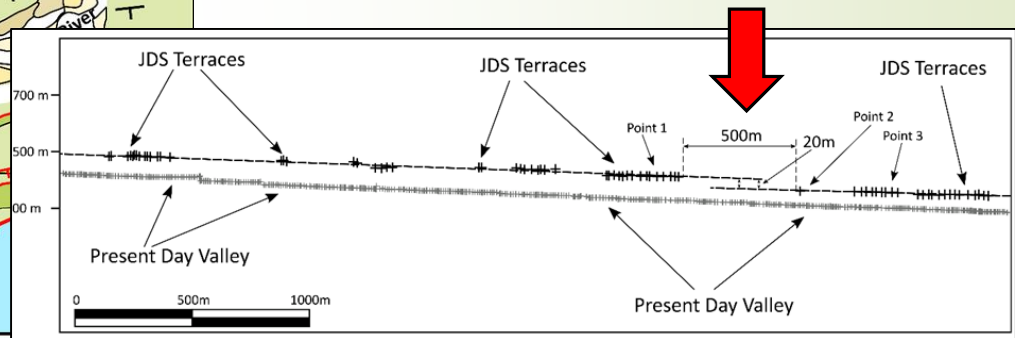
**Position of the Stress Anomalies in wells 57 and 60 along the Decollement**



# Stress Anomalies: Comparison With Quaternary Terraces



Quaternary	Magnetic Polarity	Age ka	$\delta_{18}O$	Age ka	Glacial Stage	ALPS	FORELAND
Bühnes Normal	Normal		3% 4% 5%				
		I	2	Würm	Piedmont Gl.	Niederterrasse	
		II	6	Riss	Piedmont Gl.	Hochterrasse	
		III	8	Large Interglacial			
		IV	10	Mindel	Piedmont Gl.	Jüngere Deckenschotter	
		V	12				
		VI	14				
Krems Schnees	Hundsheim D. Alenb. 28	VII	16	Günz	Piedmont Gl.	Ältere Deckenschotter	



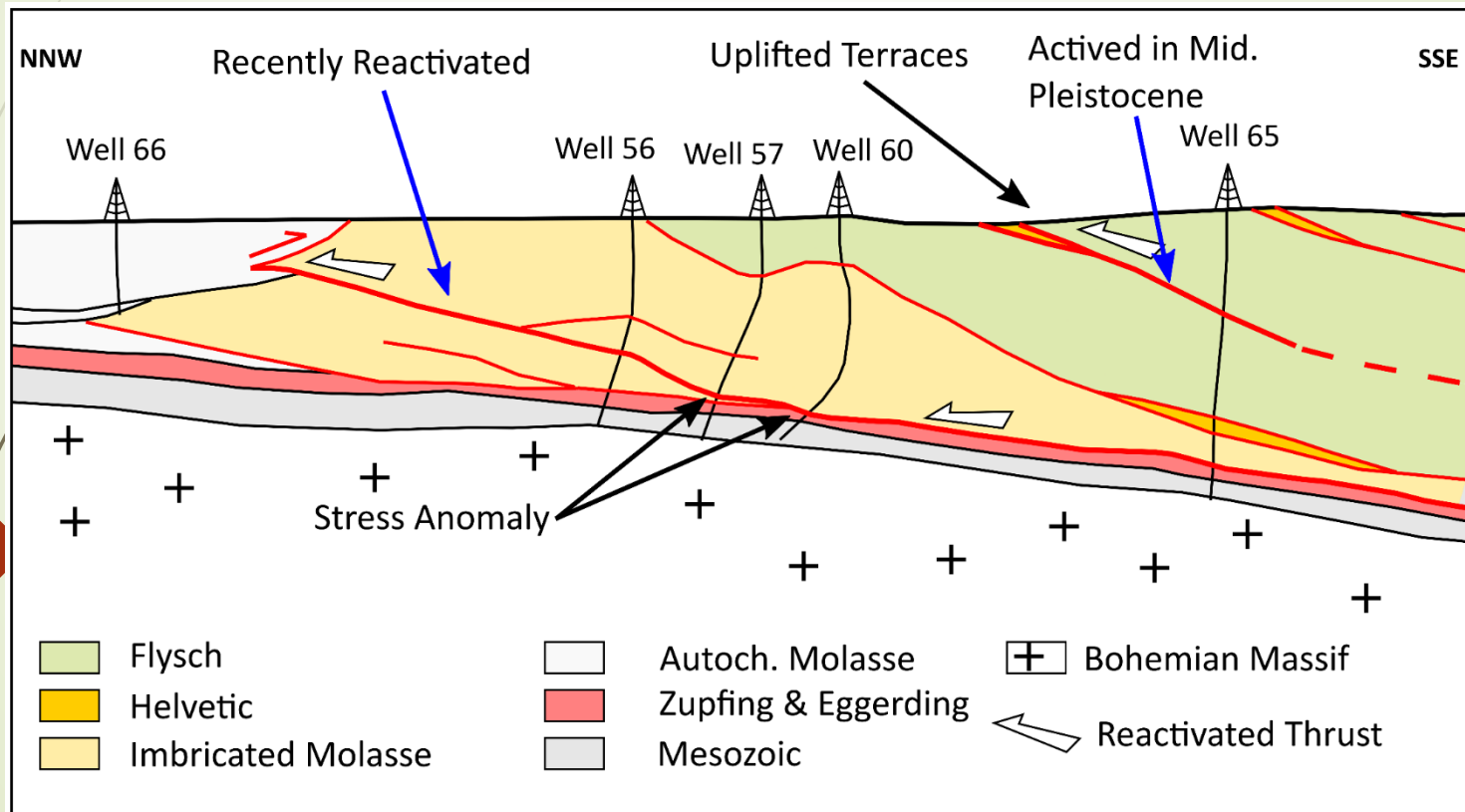
*Redrawn with data from Van Husen (1971, 1975, 1999)*

- In the same area mid Pleistocene Conglomerates are reported offset along another out of sequence thrust (red arrow).*



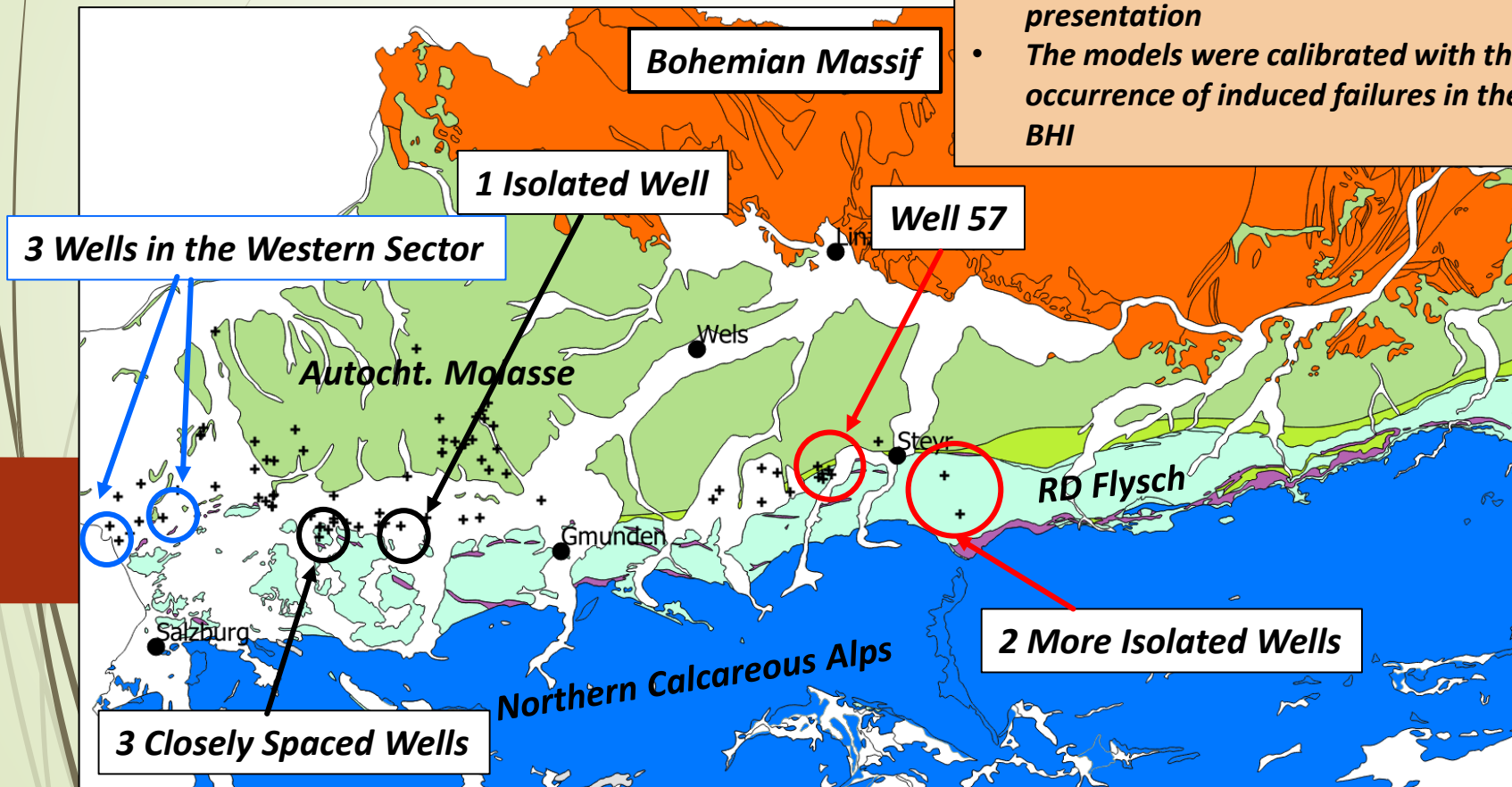
## Stress Anomalies: Final Remarks

Quaternary shortening jumped across different pre-existing structures or alternatively occurred in spaced steps.



## Location of the Geomechanical Models

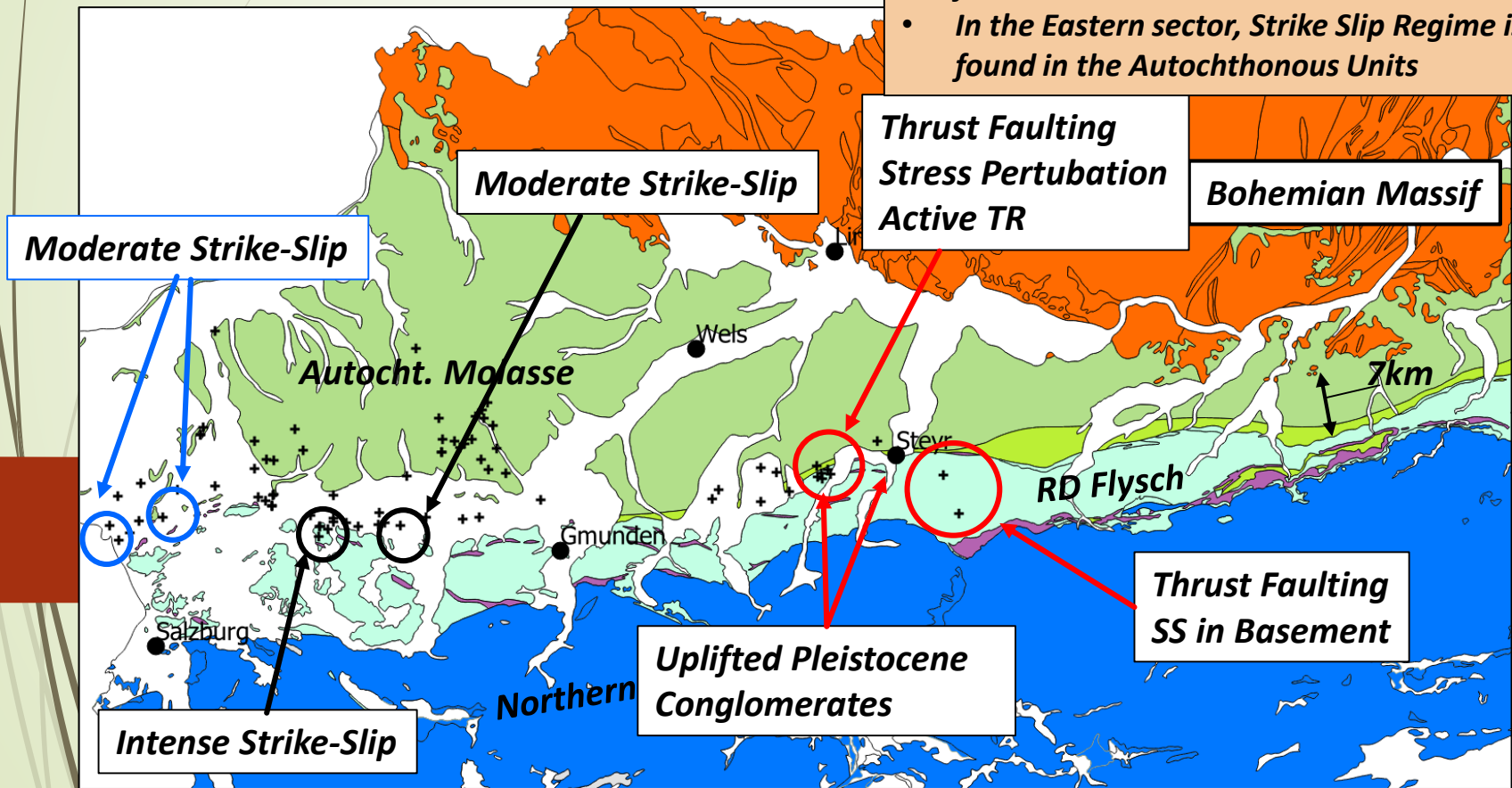
- Geomechanical Models were developed in 10 wells to evaluate stress magnitudes and regime
- The results are still unpublished thus I can not include them in this presentation
- The models were calibrated with the occurrence of induced failures in the BHI





## Distribution of Geomechanical Models

- *Strike-Slip is found in both Western and Central Sectors, even with some differences*
- *In the Eastern sector, Thrust Faulting is found in all the allochthonous units*
- *In the Eastern sector, Strike Slip Regime is found in the Autochthonous Units*



## ***Final Remarks***

- ***SHmax oriented +/- N-S, low Standard Deviations (11° to 14°)***
- ***Similar orientations in all tectonic positions***
- ***Indications for active tectonics detected only in few wells in the Eastern Sector***
- ***Active thrusting at the frontal part of the Eastern Alps (at least in the Eastern Sector) is confirmed for the first time***
- ***Stress perturbations associated to recent thrusting, confirmed also by the seismic and surface geology (Offset Pleistocene Conglomerates)***
- ***1D stress models confirm TF regime in the Eastern sector's Allochthonous Units***
- ***Central sectors: TR/SS in Flysch; SS in both imbricated Molasse and autochthonous units***
- ***Western Sector SS in both autochthonous and allochthonous units***
- ***East of the study area the Molasse is just 7km wide, squeezed between the BM and the frontal part of the Alps.***
- ***The active thrusting limited to the Eastern Sector could suggest that this is related to the subduction of the Bohemian Massif spur below the Alps.***



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