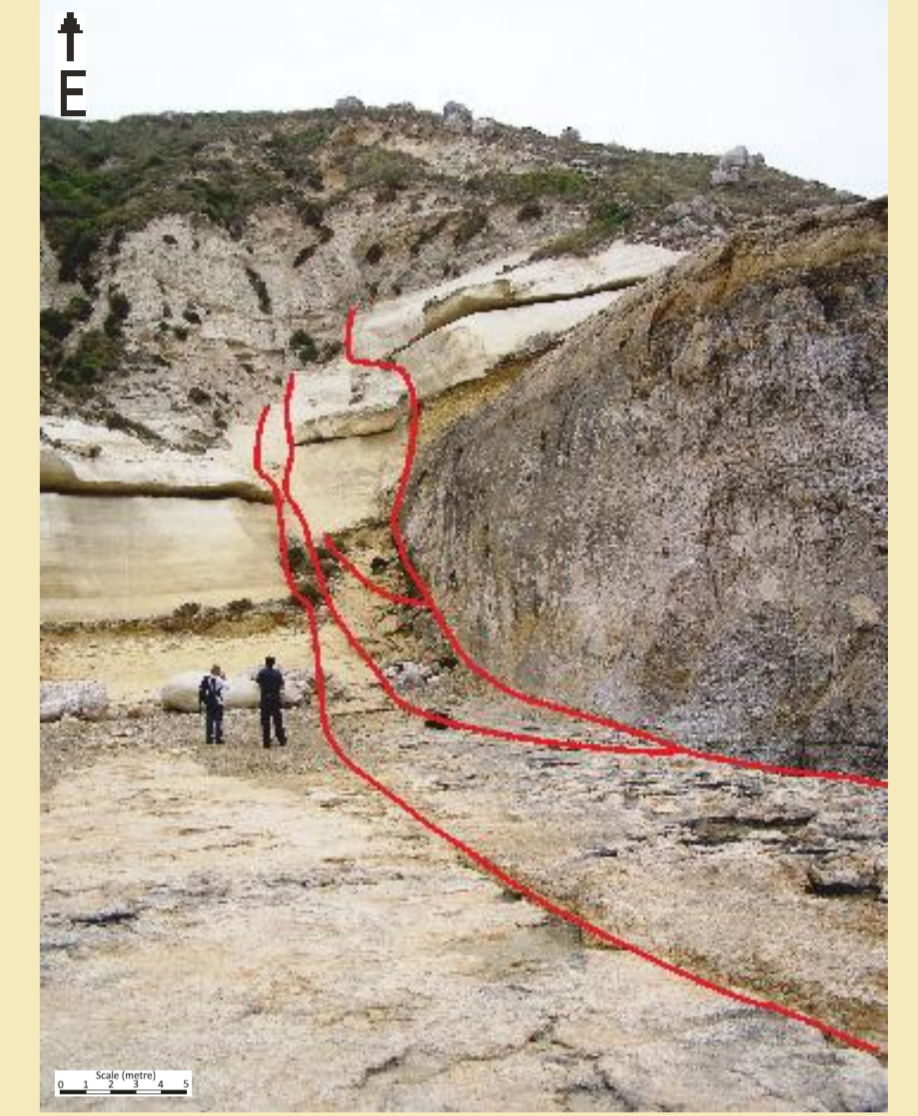
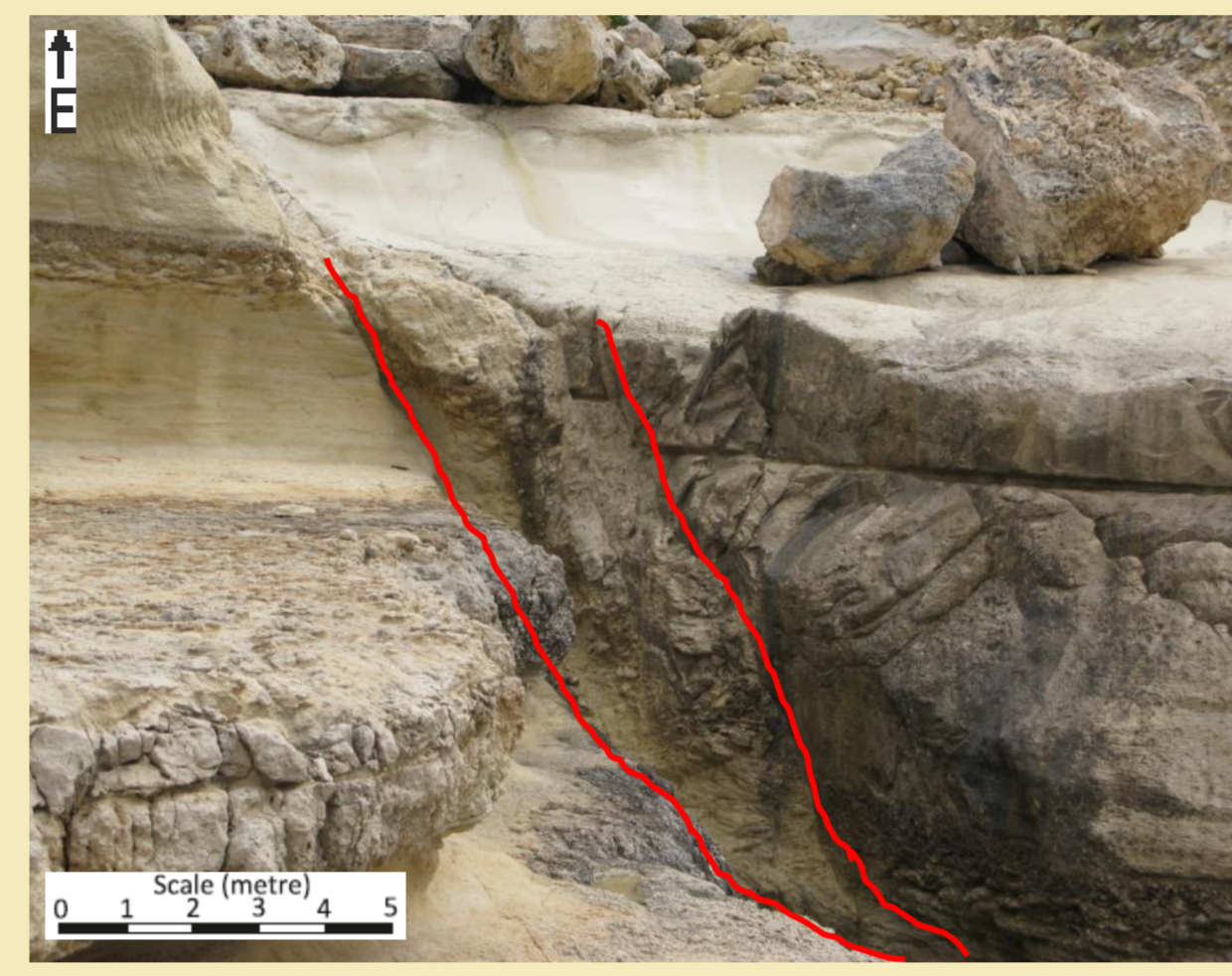
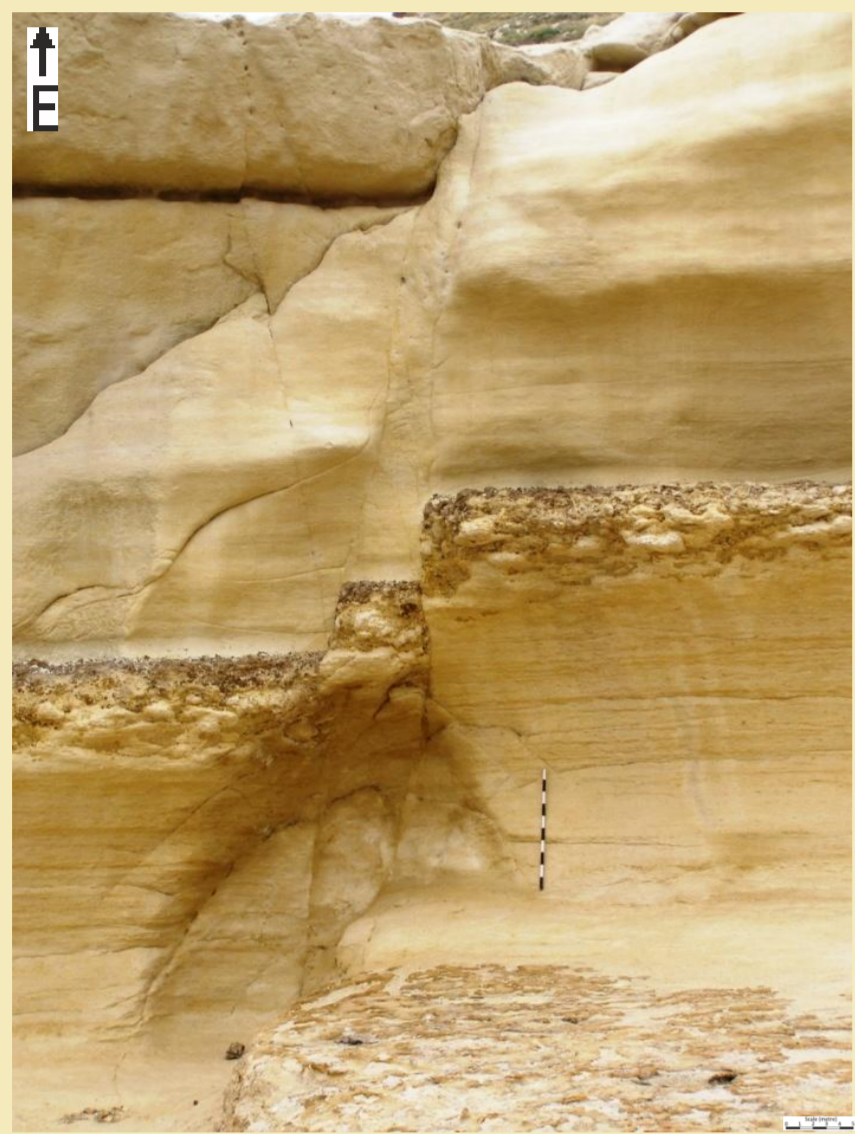
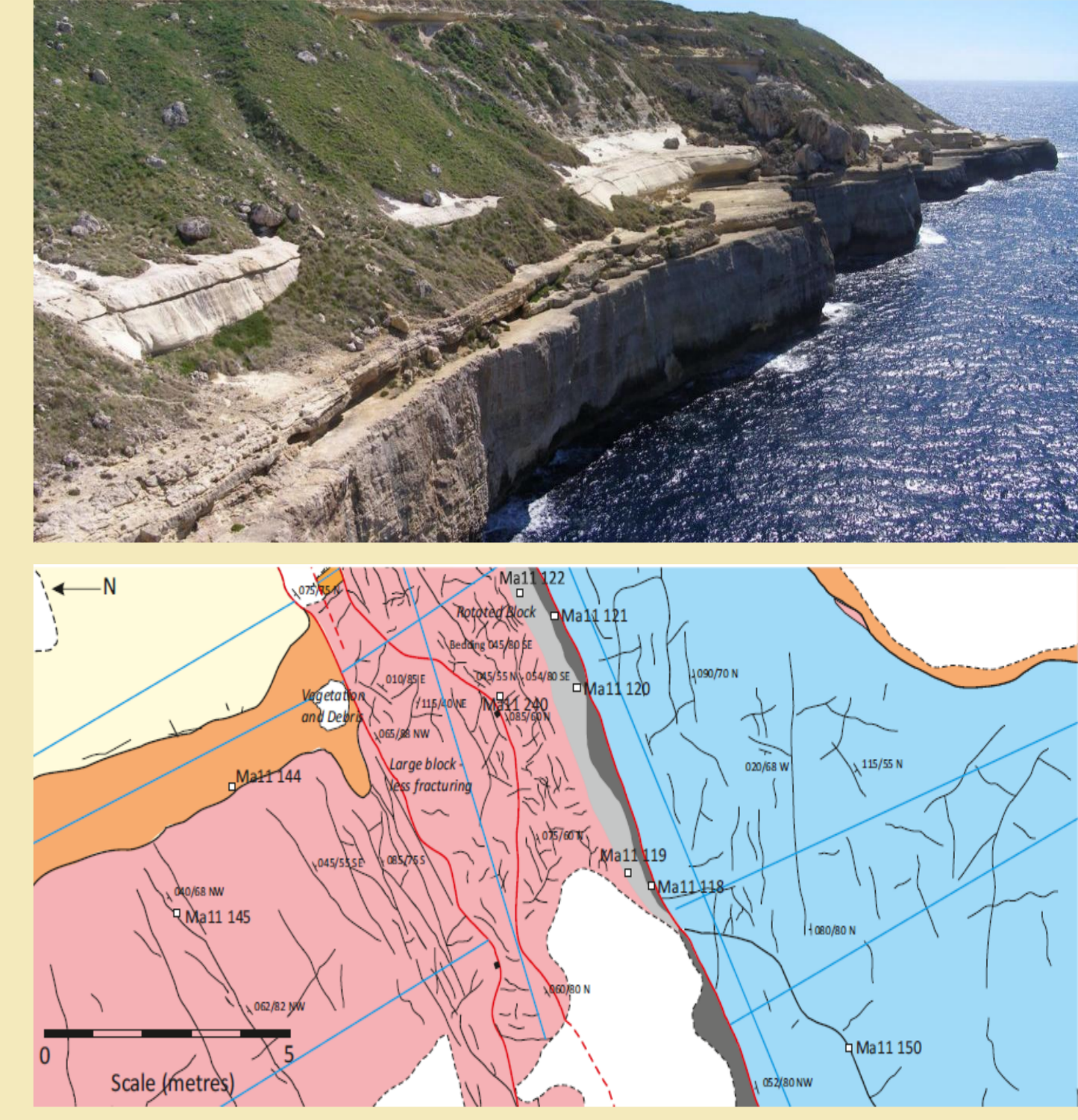
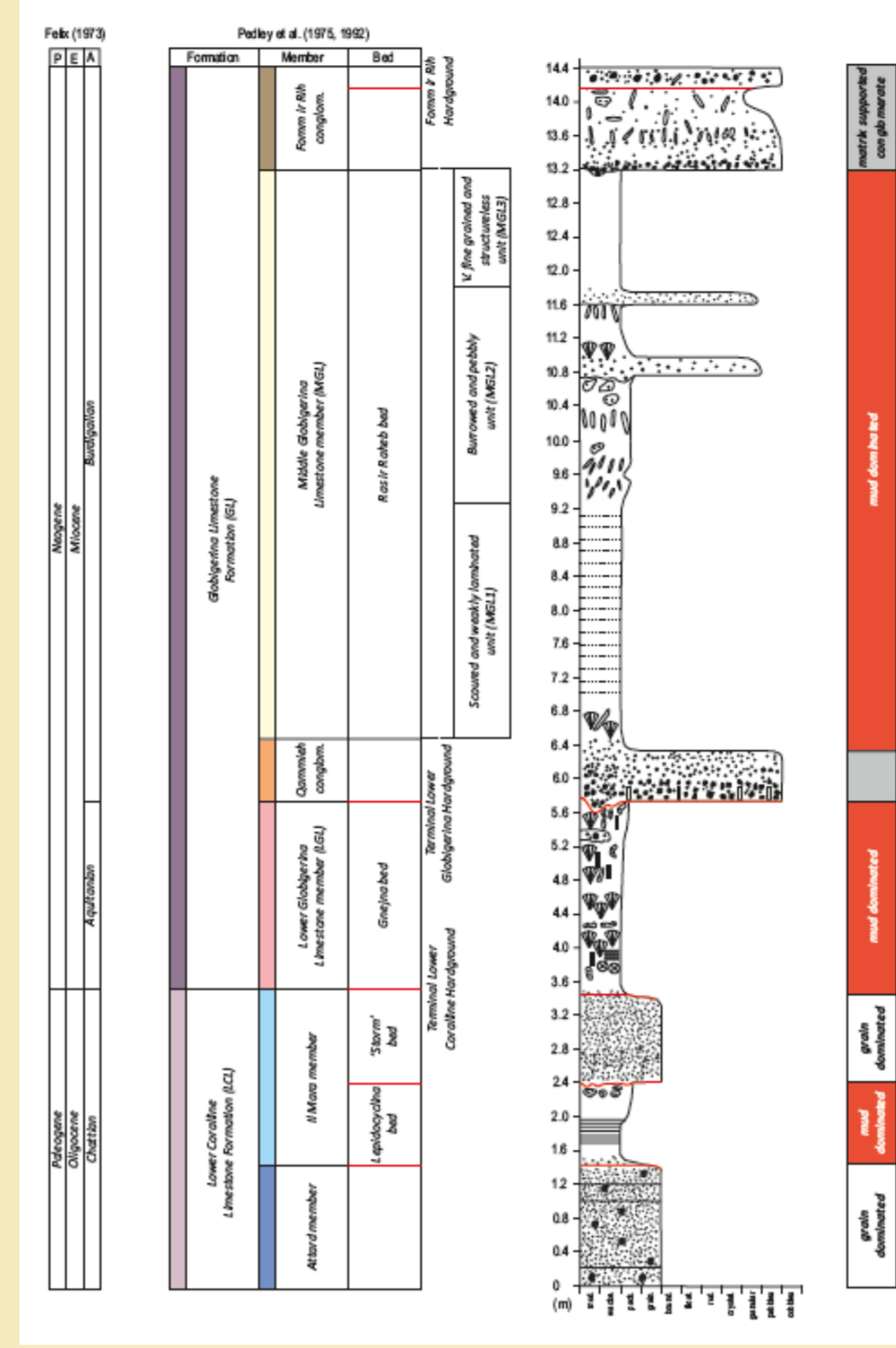


## Introduction

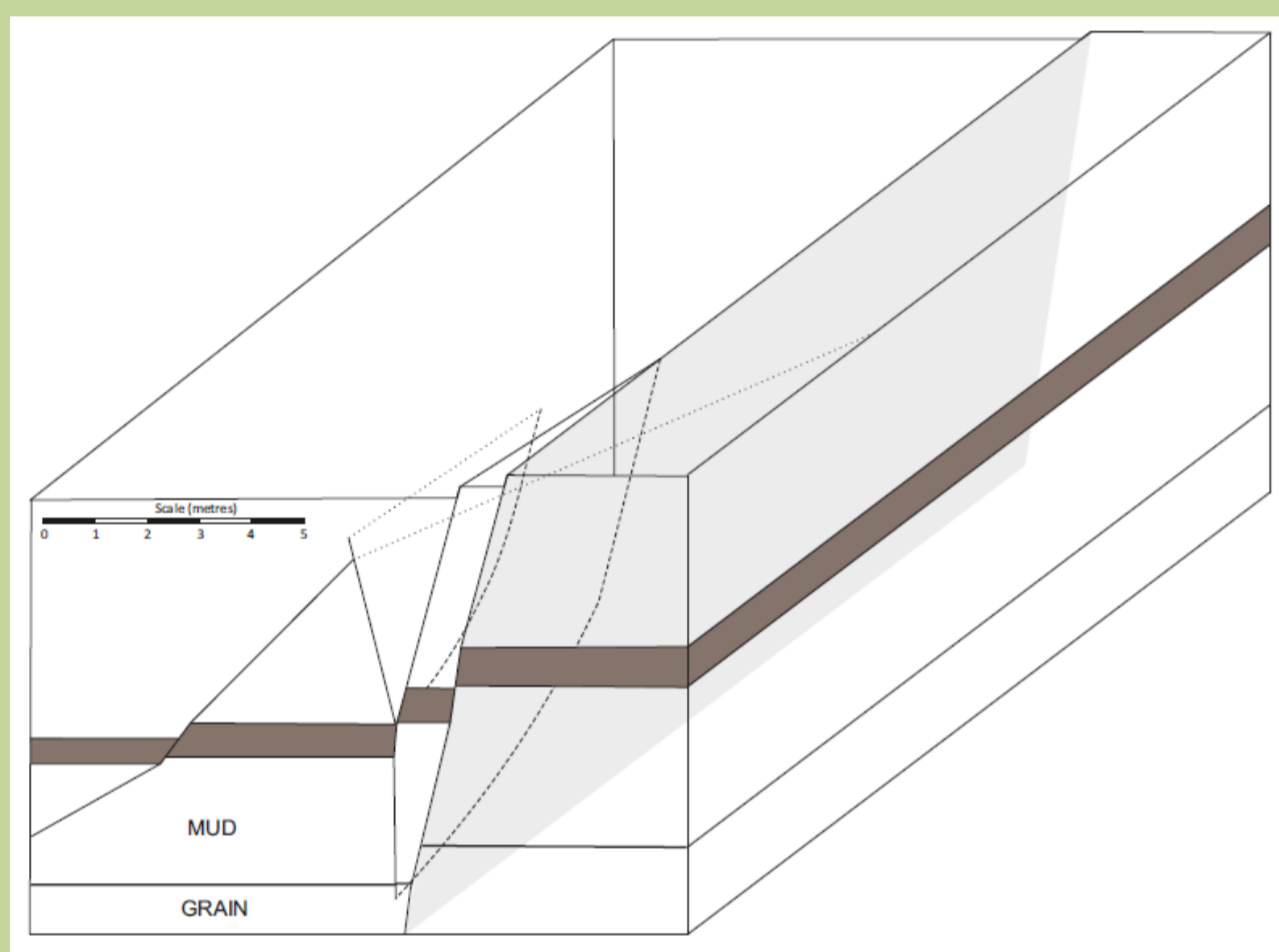
- Fault zone architectures are highly complex.
- A generalised model will not be applicable for every fault, due to variable external factors influencing faulting.
- The fault zone architecture of each individual fault therefore needs to be modelled separately.
- Maltese faults do not conform to the traditional fault core - damage zone - protolith model. They show a complex architecture with different intensities of damage within the fault zone.
- A new model for these Maltese faults is outlined in this poster.

## Geological Setting

Malta is located in an extensional basin created in the foreland of the Sicilian Apennine-Maghrebian fold and thrust belt, with a N-S stretching direction (Pedley et al., 1976; Dart et al., 1993). The carbonates on Malta range from chalky foram-rich 'mud' facies to packstone 'grain' facies, deposited on a homoclinal ramp. The faults have propagated and evolved differently in the two main carbonates (mud- and grain- dominated facies), primarily due to their different inherent properties.

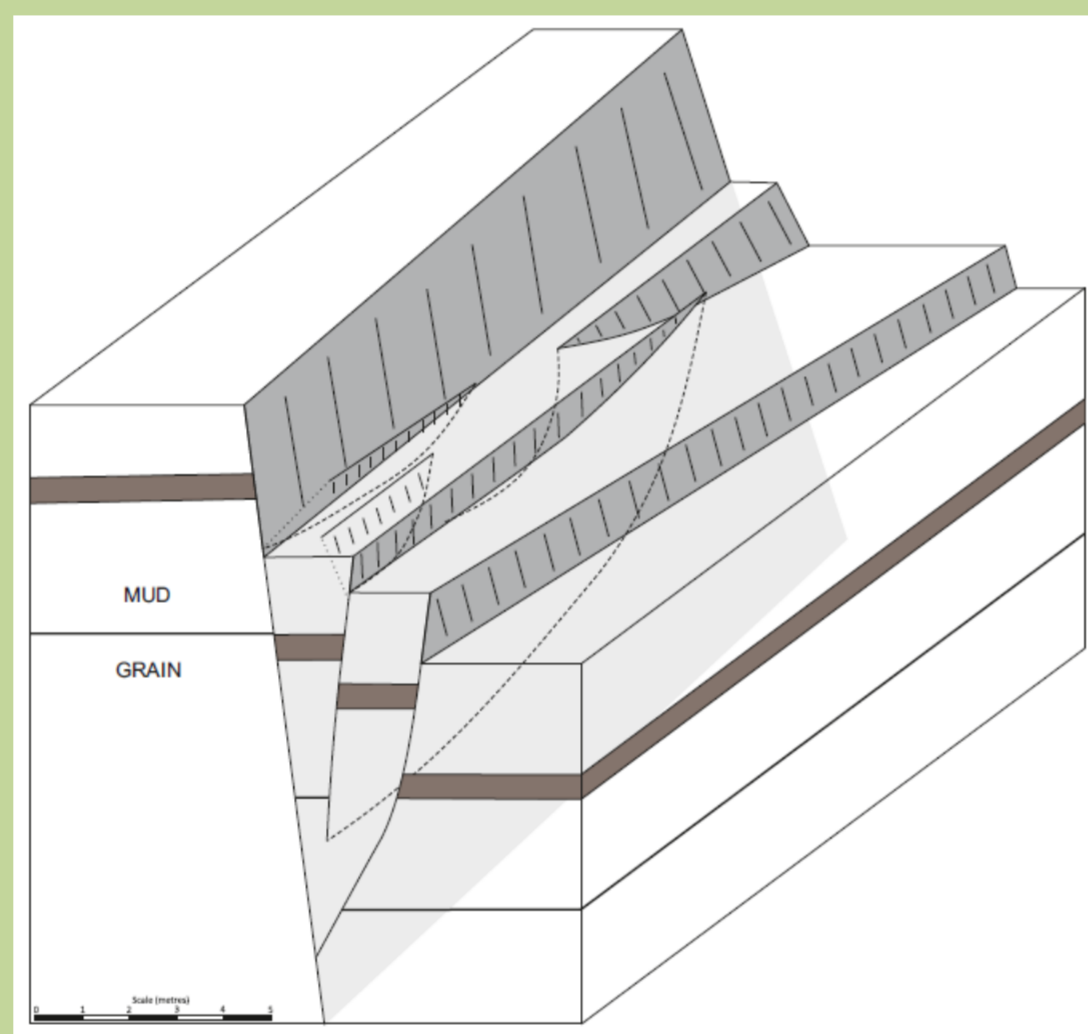


0.75 m Displacement



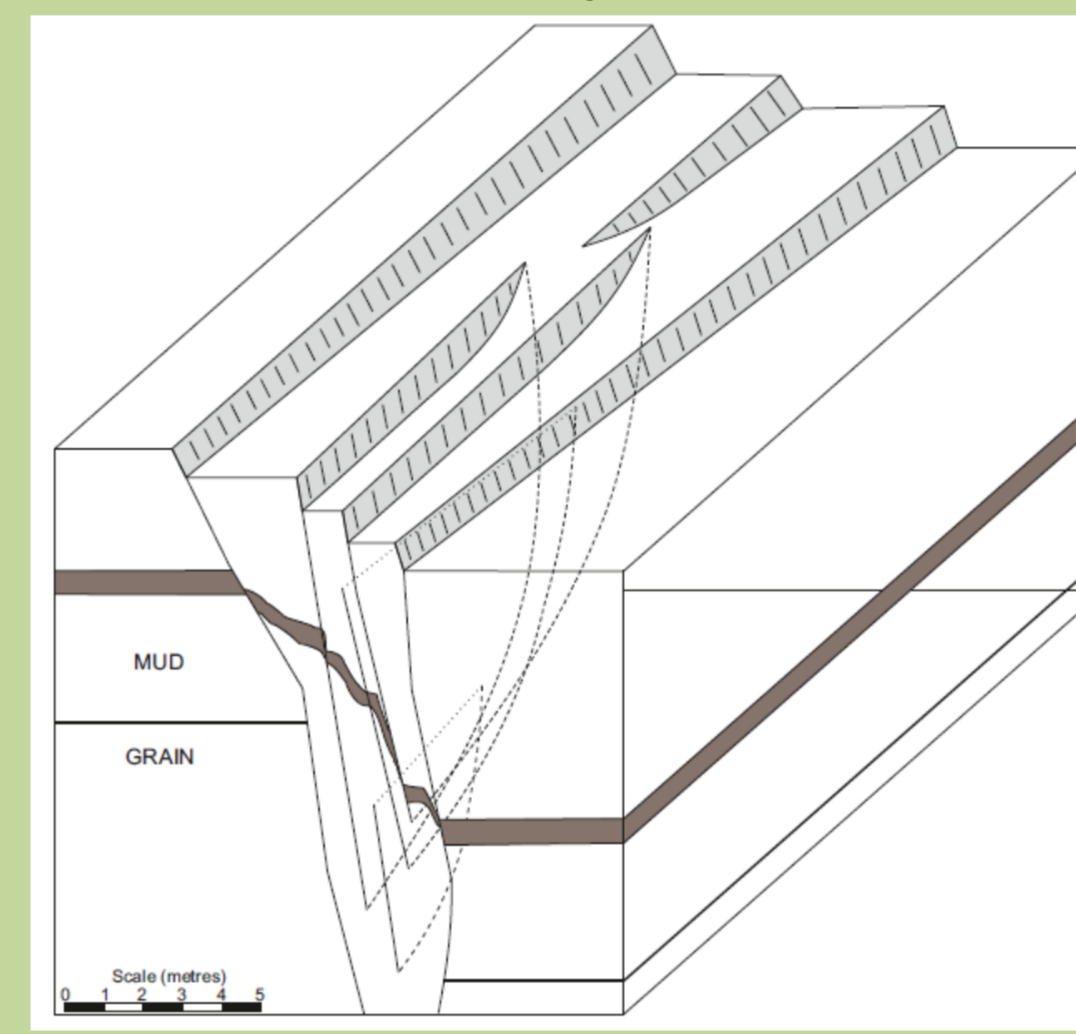
Segmentation of the fault at the grain- mud boundary. Could be due to bifurcation of the fault.

5.1 m Displacement



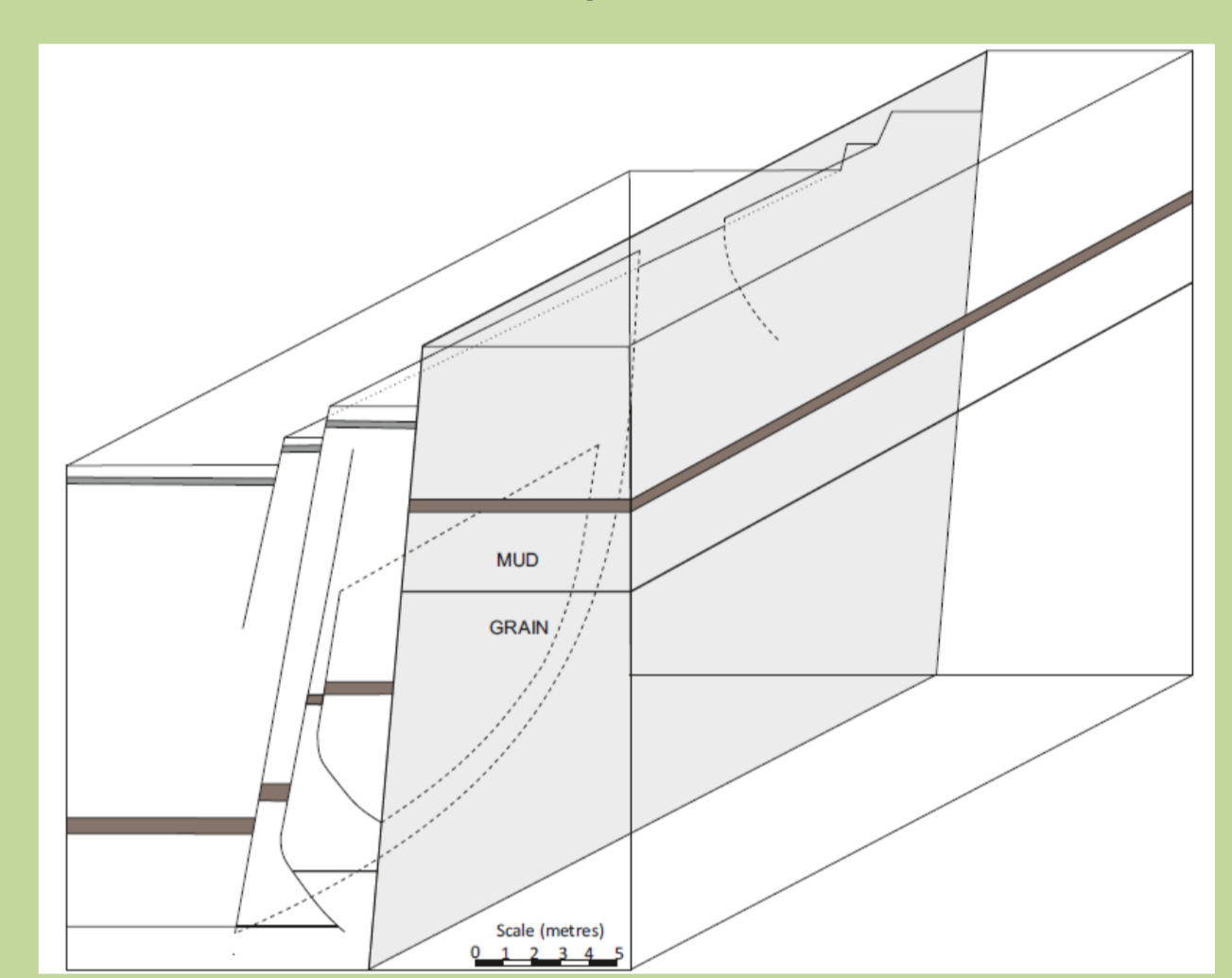
Splay of the fault at the grain-mud dominated boundary.

7 m Displacement



Bound fault zone with more slip surfaces accommodating the stress in the mud dominated carbonate facies.

11.7 m Displacement



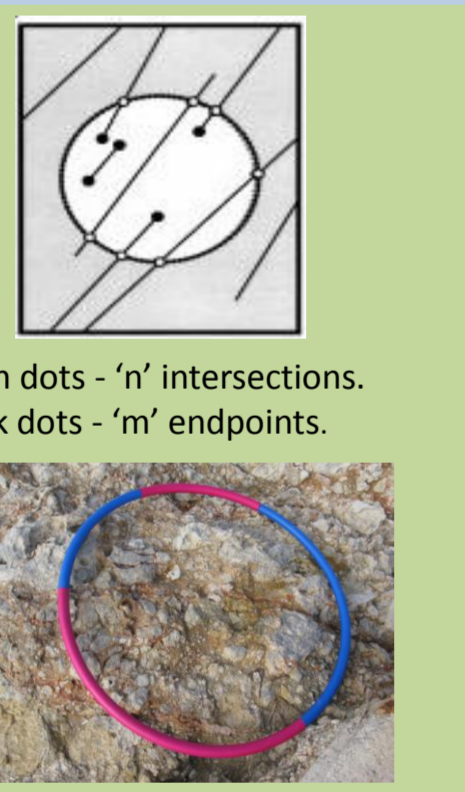
One slip surface in the grain dominated facies, splaying into several slip surfaces in the mud dominated carbonates.

## Circular Scan Lines across the faults

Intensity:  $n/4r$   
 Fracture area in a volume of rock. Mean total trace length of fractures per unit area.

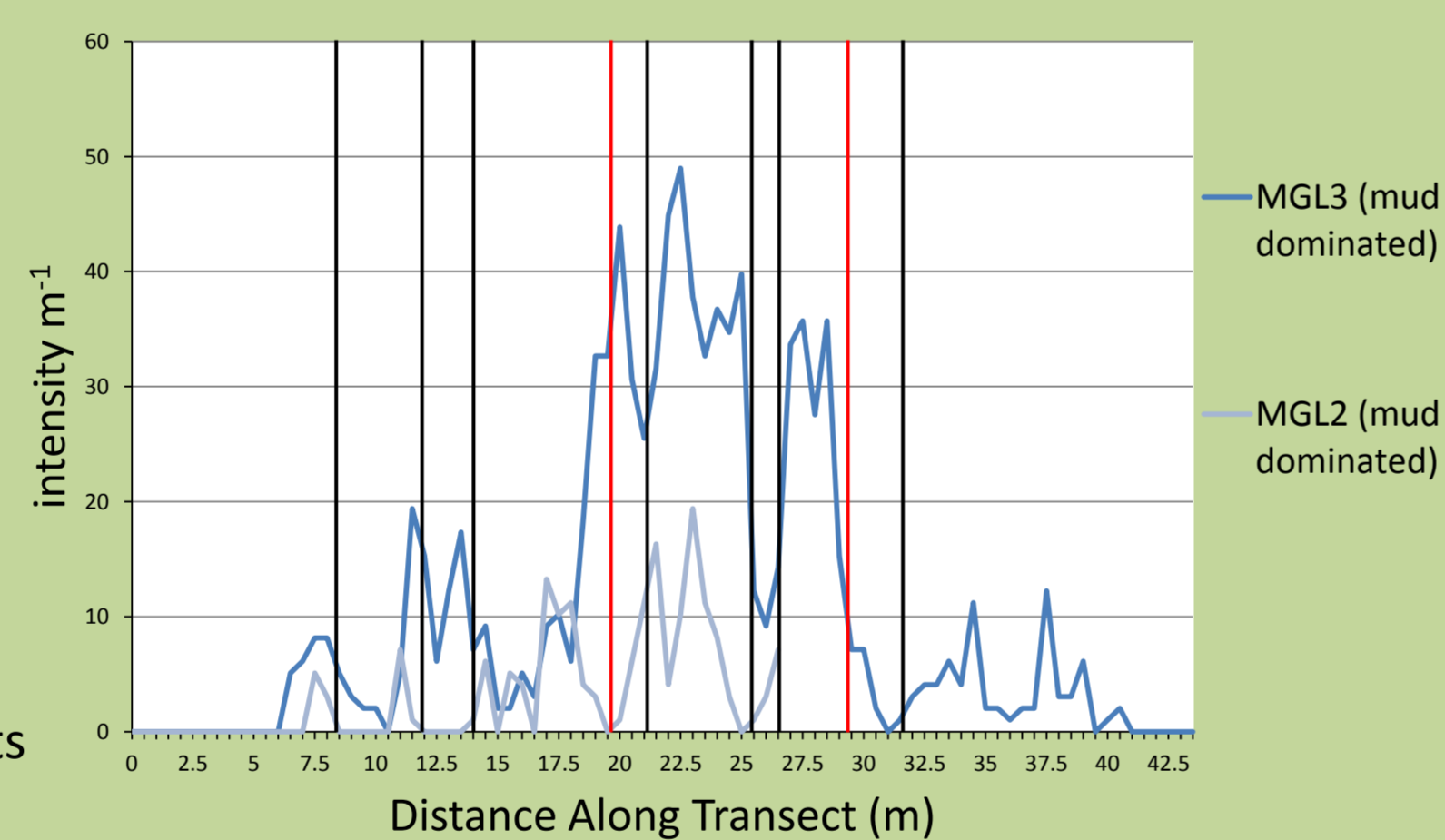
Density:  $m/2\pi r^2$   
 Fractures per unit area. Mean number of trace centres per unit area.

Mean Trace Length:  $(n/m)\pi r/2$   
 (Mauldon et al., 2001)

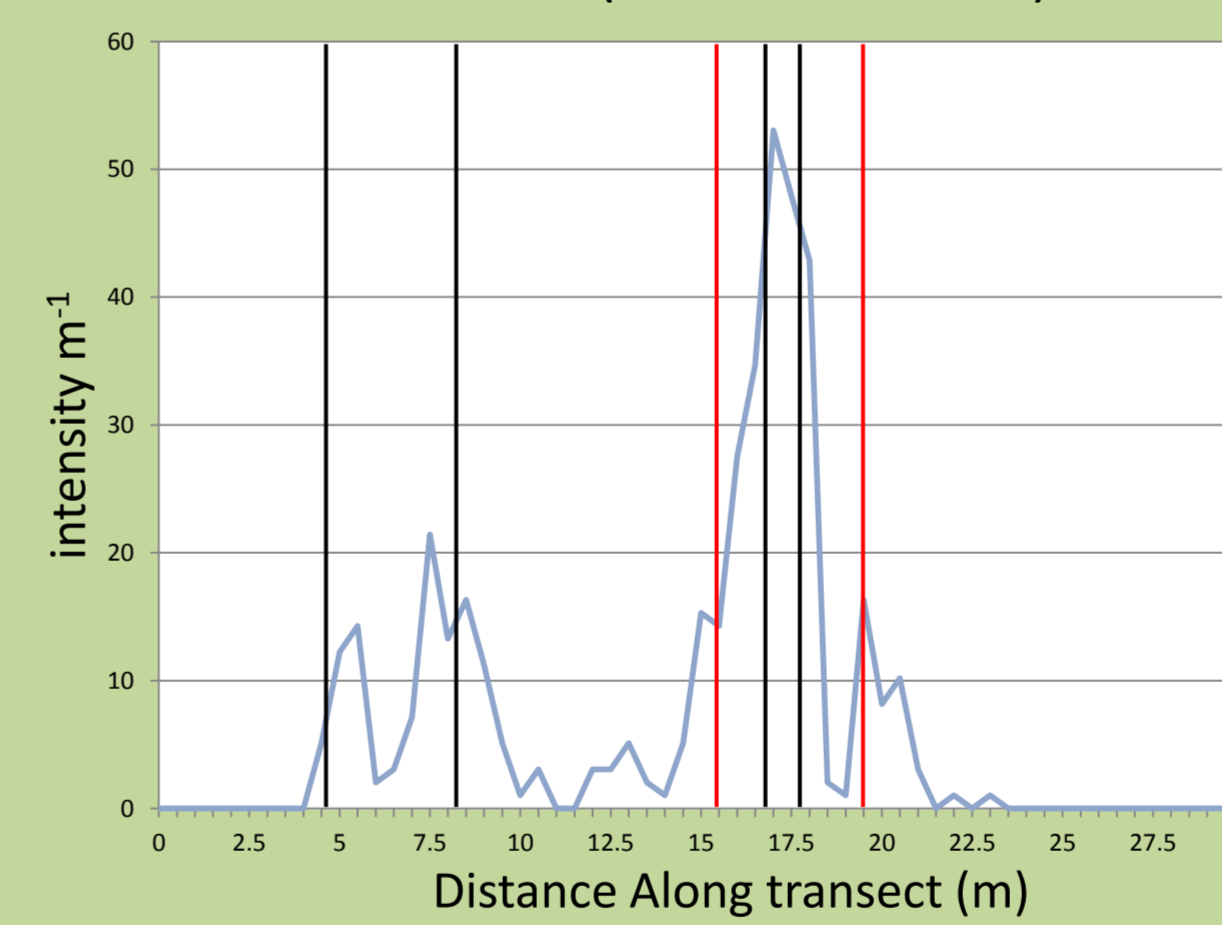


Red Lines: Main (bounding) faults. Black Lines: Subsidiary faults

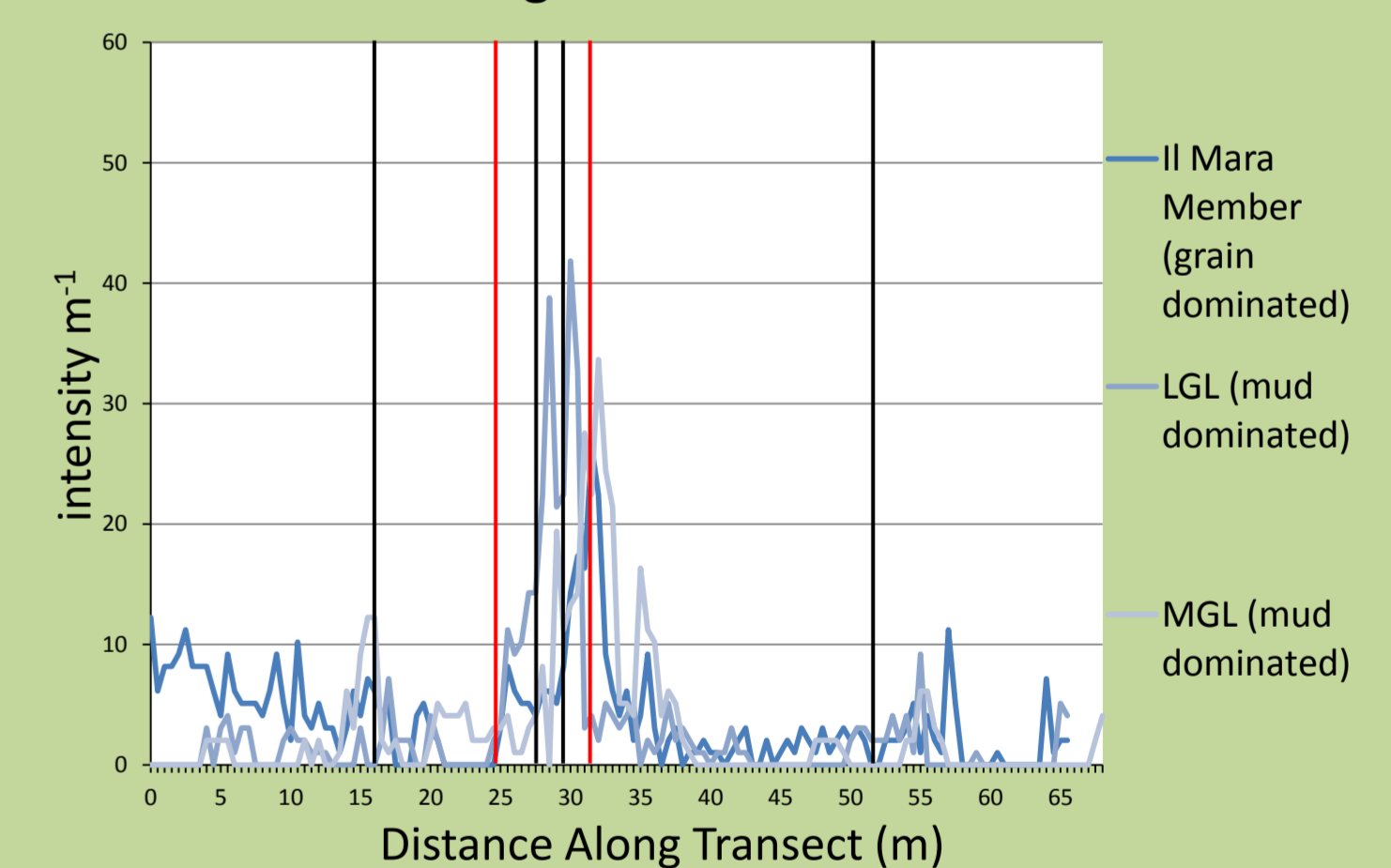
Intensity of fractures across the 5.1 m fault in 2 different mud- dominated facies



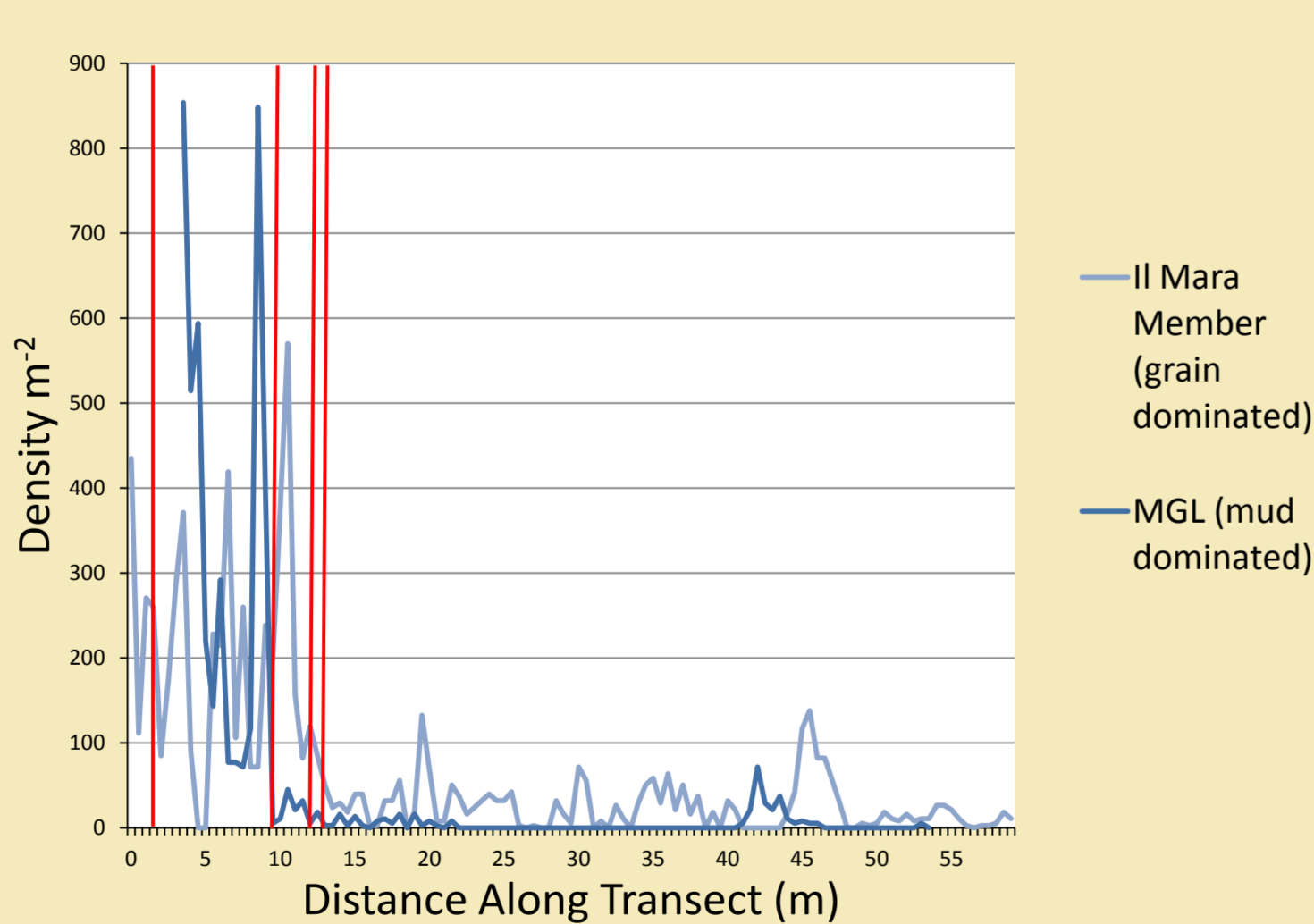
Intensity of fractures across the 7 m fault in the MGL2 (mud dominated)



Intensity of fractures across the 11.7 m fault in mud- and grain- dominated facies

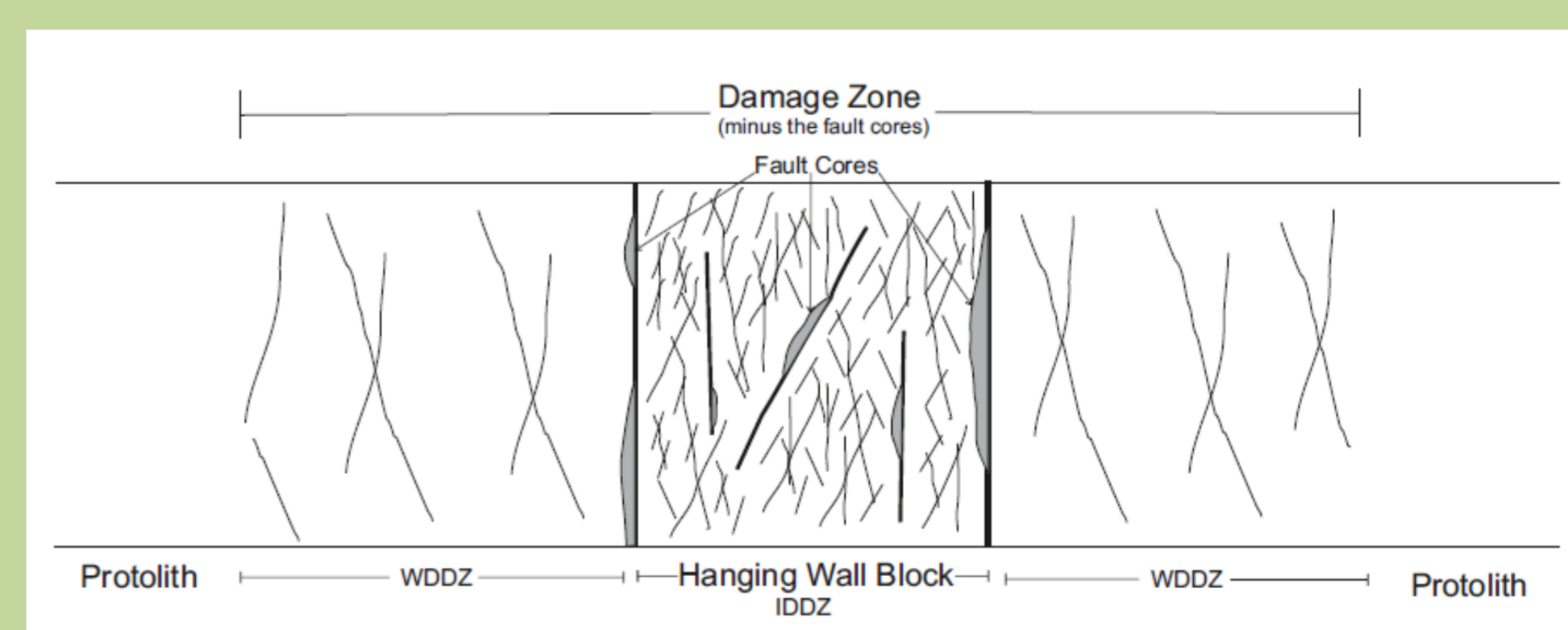


Density of fractures across the 25 m fault in mud- and grain- dominated facies



## Alterations to the model:

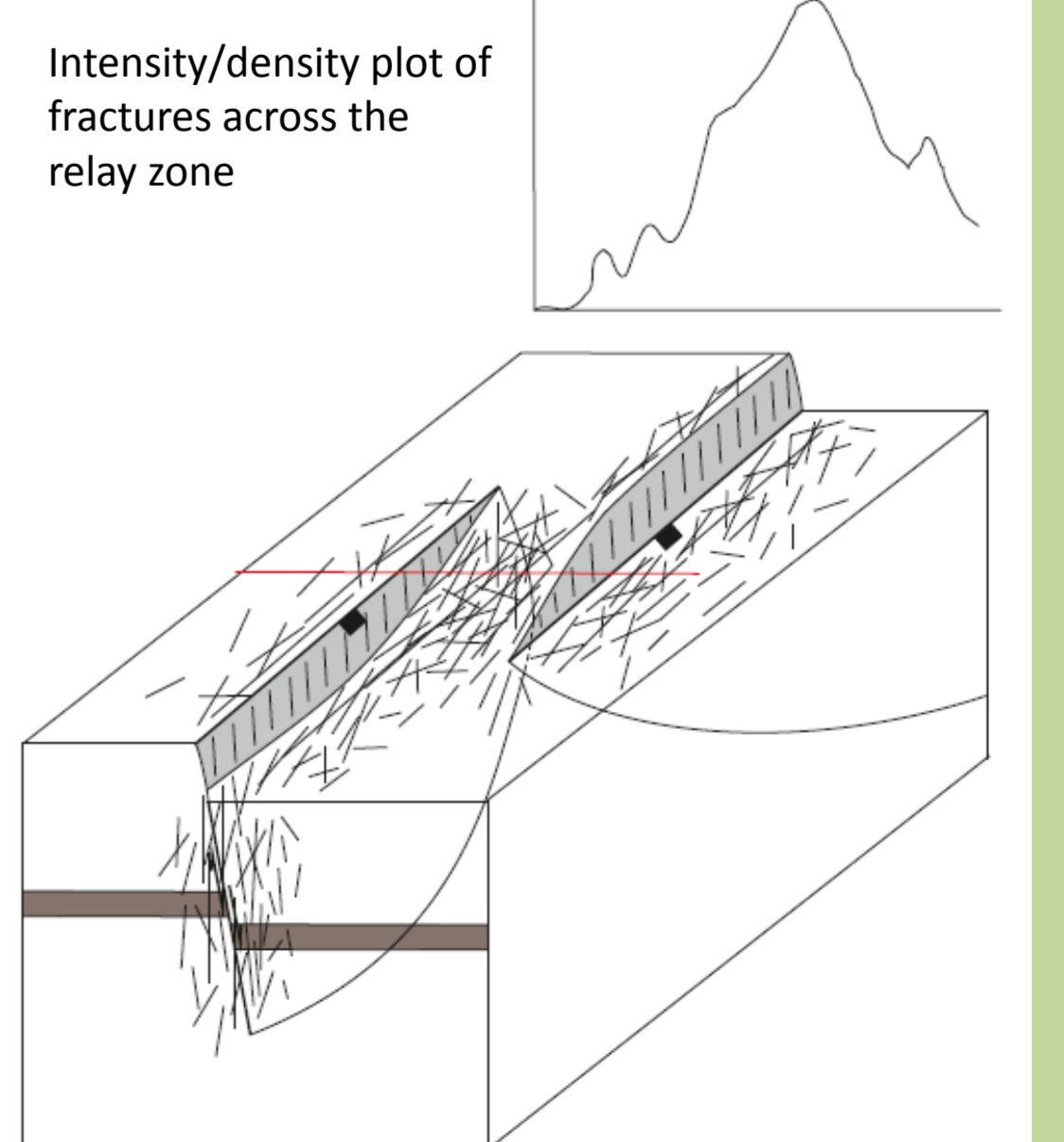
At higher displacements (figures to the left) more slip surfaces are created in grain dominated facies. A threshold therefore occurs between 11.7 m (one slip surface) and 25 m to critically introduce more slip surfaces to accommodate the increased displacement.



IDDDZ – intensely deformed damage zone.  
 WDDZ – weakly deformed damage zone.

## Summary

- A new model for the Maltese faults is proposed in this poster.
- The fault zones observed show a paired slip surface architecture.
- This cannot be thought of as a relay zone or bifurcation of the fault, due to the pattern of deformation within/surrounding the fault zone (see right).
- This bounded fault architectural model could have a significant influence on the petrophysical signature of the zone, controlling the sealing/conduit potential of the faults.



## References

- Dart, C. J., Bosence, D. W. J., McClay, K. R., 1993. Stratigraphy and structure of the Maltese Graben System. *Journal of the Geological Society*, Vol. 150, p. 1153-1166.
- Felix, R., 1973. Oligo-Miocene stratigraphy of Malta and Gozo. *Meded. Landbouwhogeschool Wageningen* 73-20, 1-103.
- Mauldon, M., Dunne, W. M., Rohrbach Jr, M. M., 2001. Circular scanlines and circular windows: new tools for characterizing the geometry of fracture traces. *Journal of Structural Geology*, Vol. 23, p. 247-258.
- Pedley, H. M., 1975. The Oligo-Miocene sediments of the Maltese islands. PhD thesis, University of Hull.
- Pedley, H.M., House, M. R., Waugh, B., 1976. The geology of Malta and Gozo. *Proceedings of the Geologists' Association*, Vol. 87, No. 3, p. 325-341.
- Pedley, H. M., 1992. Geological Map of the Maltese Islands, Oil Exploration Directorate Office of the Prime Minister Valletta, Malta.



Hanging Wall Block width in mud and grain dominated carbonates

