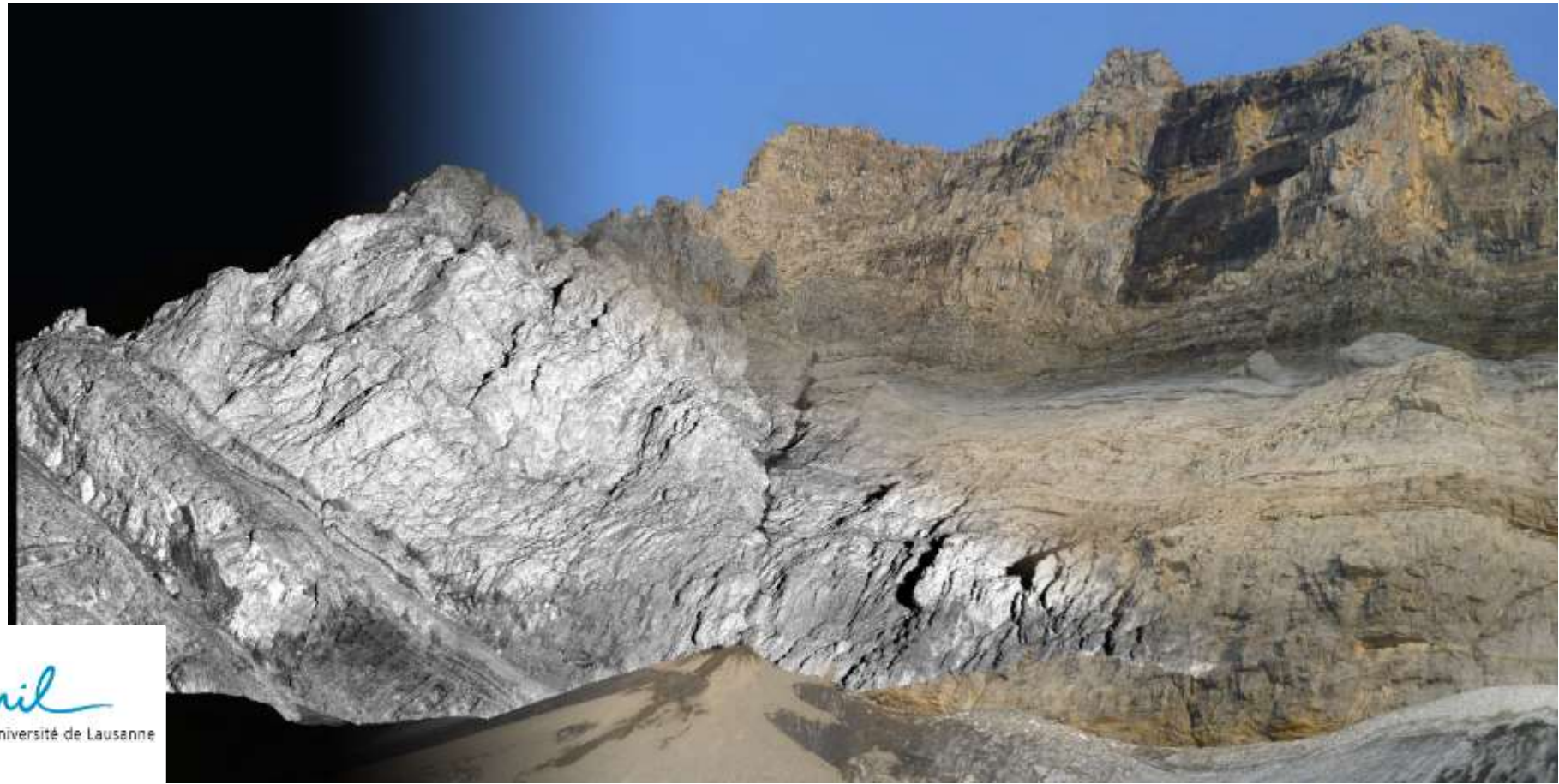
Geological mapping on TLS point cloud and fold modelling: The Dents-du-Midi massif (Switzerland)

Battista Matasci, Dario Carrea, Michel Jaboyedoff, Richard Metzger, Florian Humair, Antonio Abellan, Pierrick Nicolet

Institute of Earth Sciences, University of Lausanne

Terr@num, 35 bis rue de l'Industrie, 1030 Bussigny, Switzerland

First Vertical Geology Conference - 2014



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Objectives

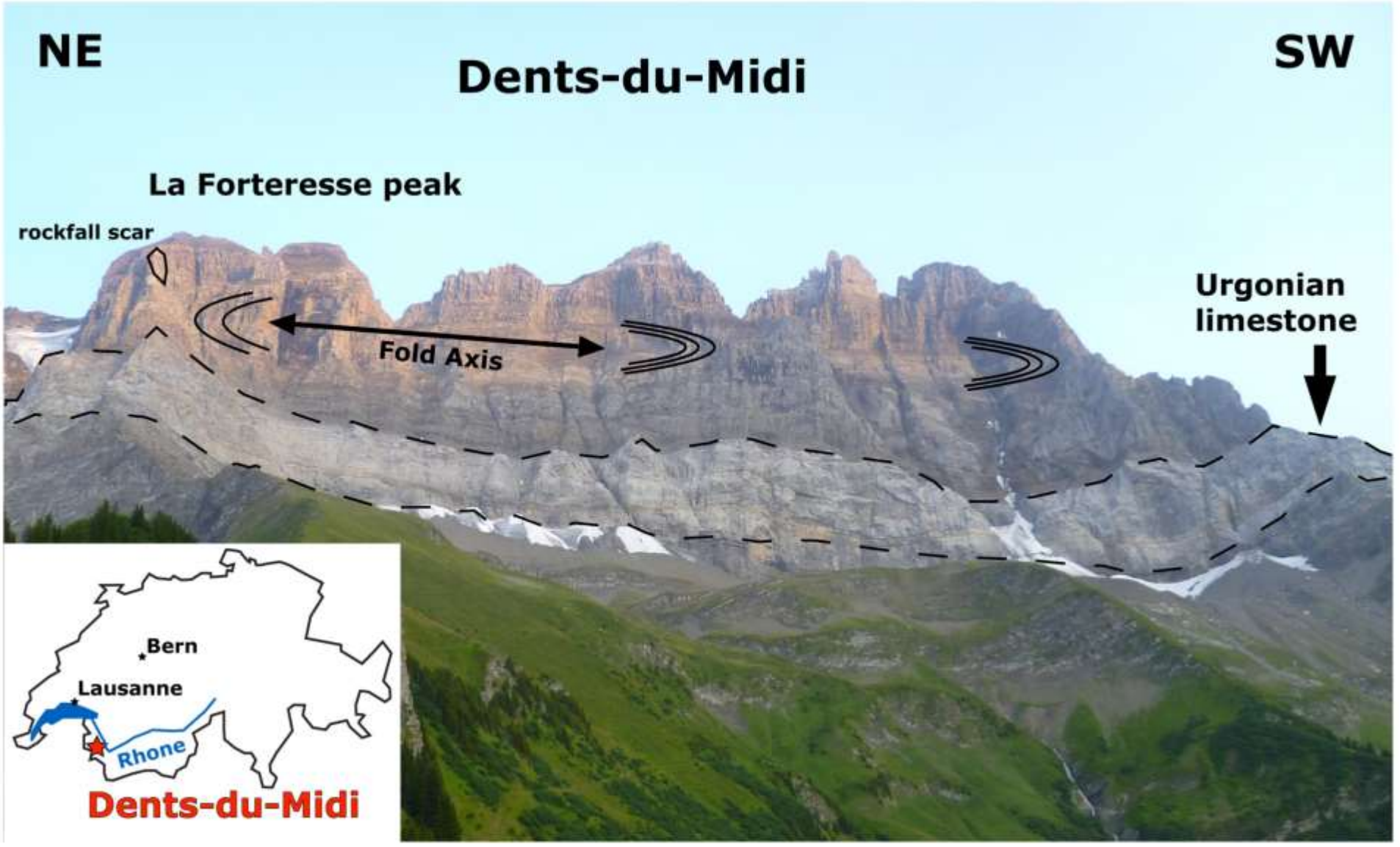
First part: *remote geological mapping*

- The Dents-du-Midi massif
- Terrestrial Laser Scanning point clouds Intensity
- A method to remotely map lithologies and geologic contacts in 3D using Coltop3D software

Second part: *fold modelling*

- Fold axis characterization based on TLS data
- Fold surface reconstruction with Matlab

The Dents-du-Midi massif



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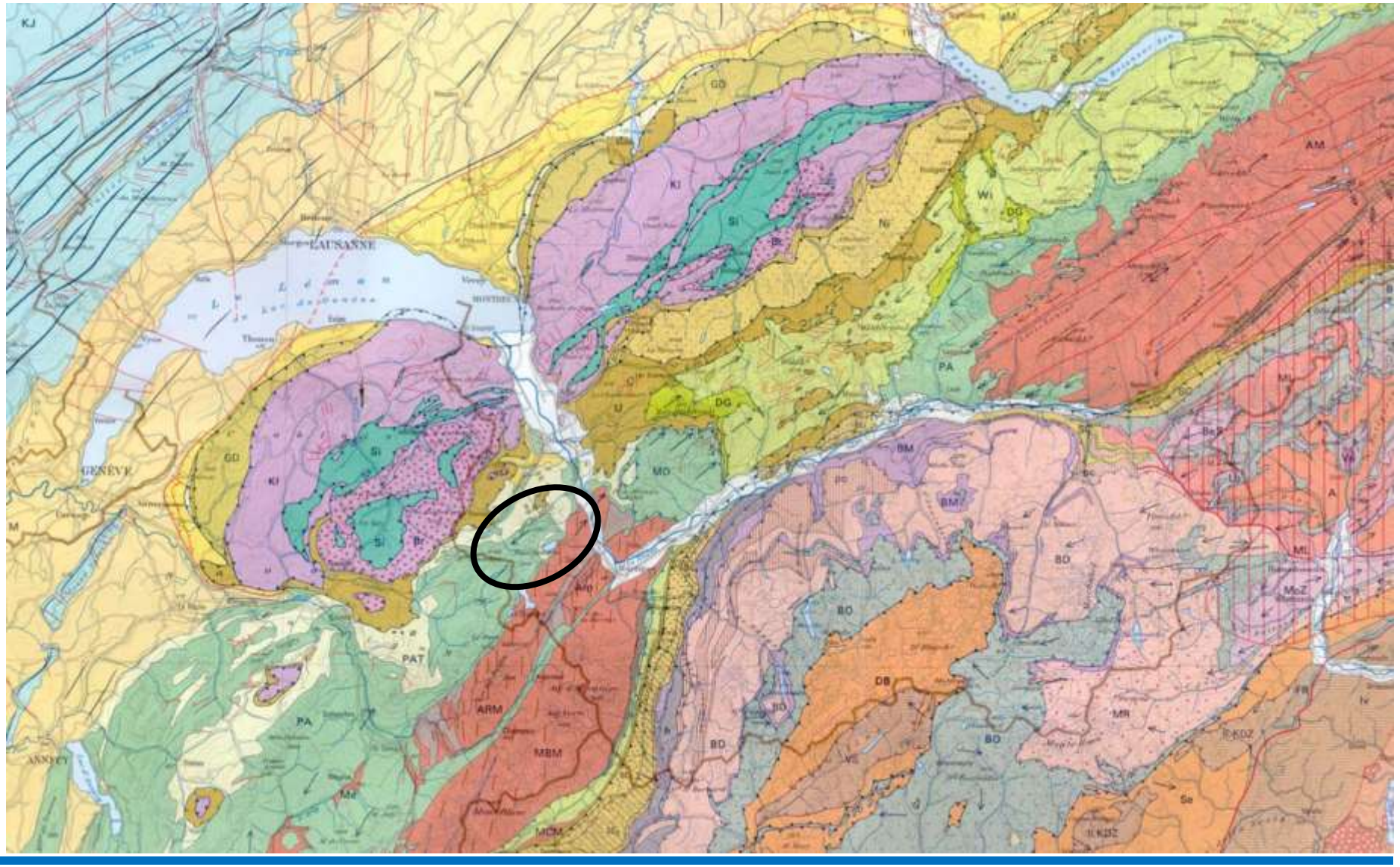
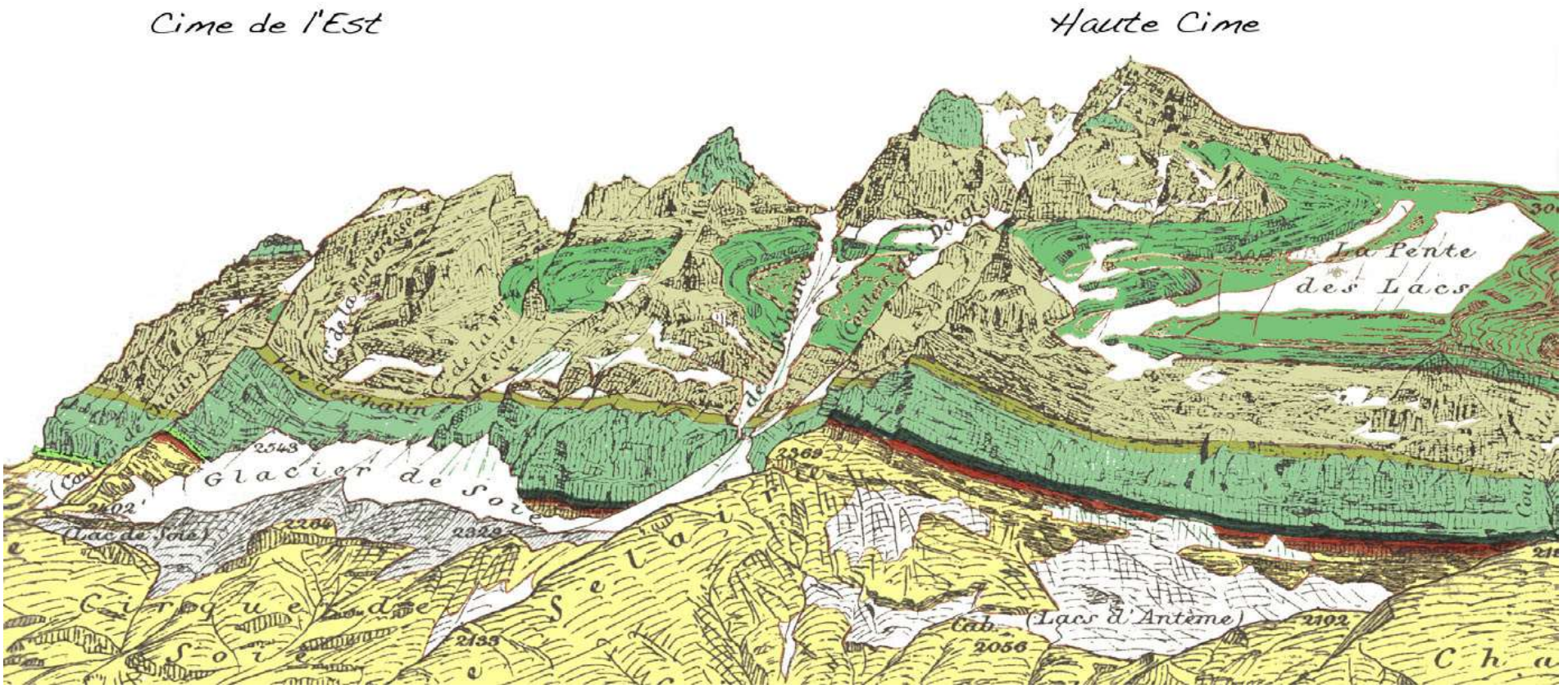


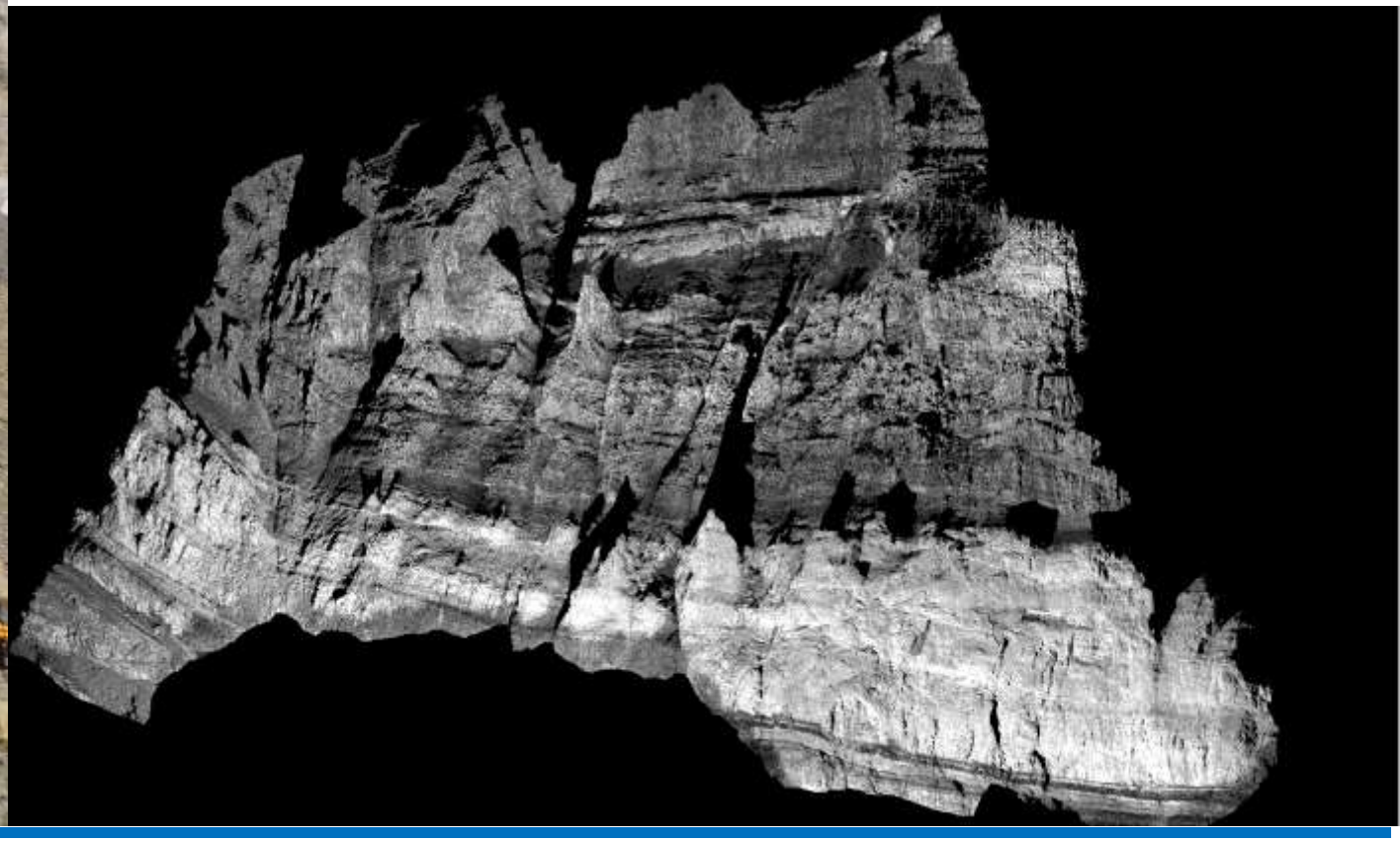
The Dents-du-Midi massif

- Geology mapped by Elie Gagnebin in 1928
- Frontal part of the sedimentary Morcles Nappe of the Helvetic alpine realm
- Lower Cretaceous to Oligocene limestones



Terrestrial Laser Scanning point clouds Intensity

- Terrestrial Laser Scanning with an Optech Ilris Long range
- 9 cm point spacing scan
- Polyworks
- Alignment on HRDEM (Swisstopo)



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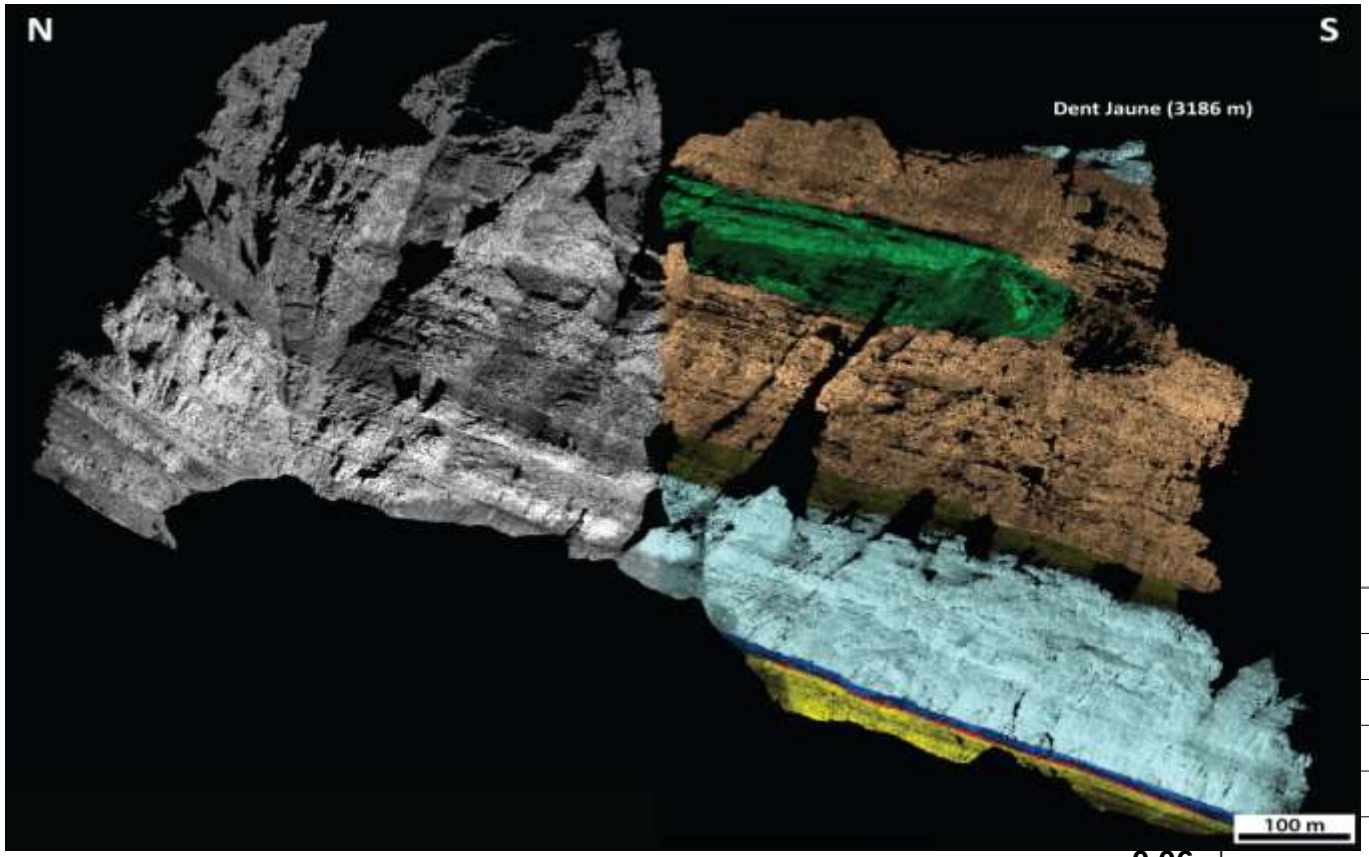


Limestone and shales with Nummulites (Priabonien)

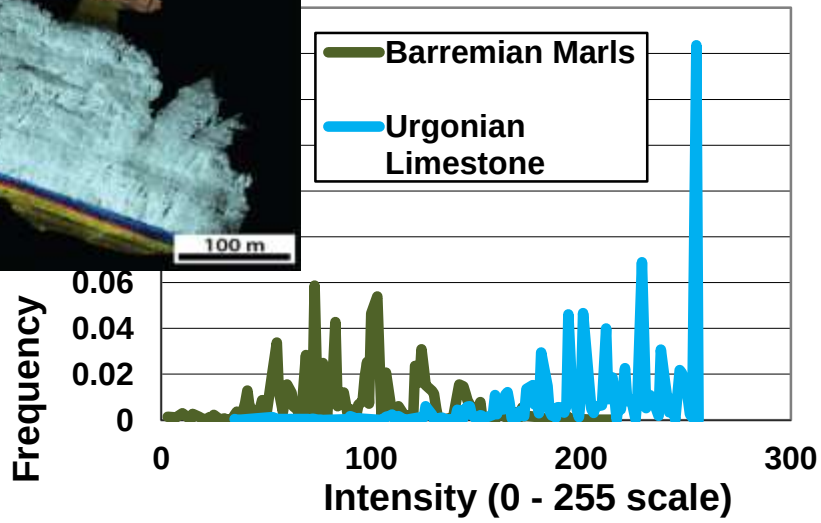
Red clays (Eocene)

Marly limestone (Turonien)

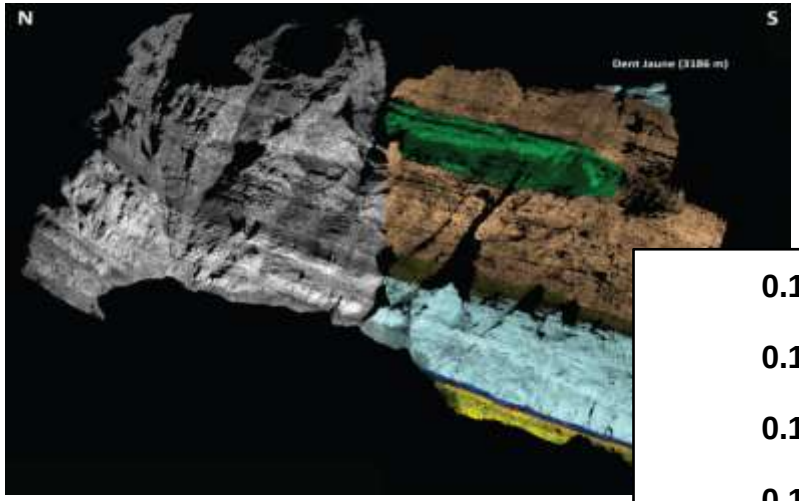
White limestone (Urgonien)

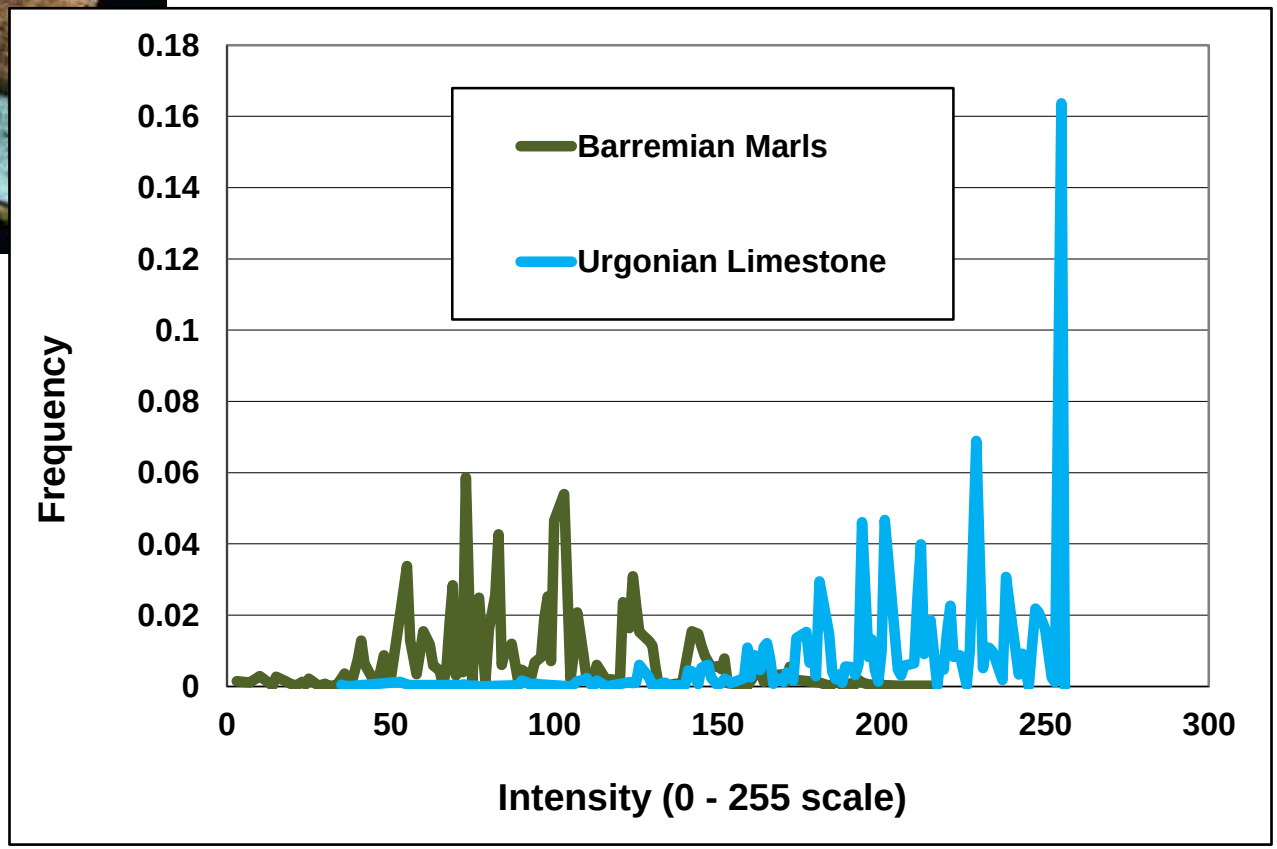
Marls with dark limestone intercalations (Barremien)

Siliceous brown limestone (Hauterivien)

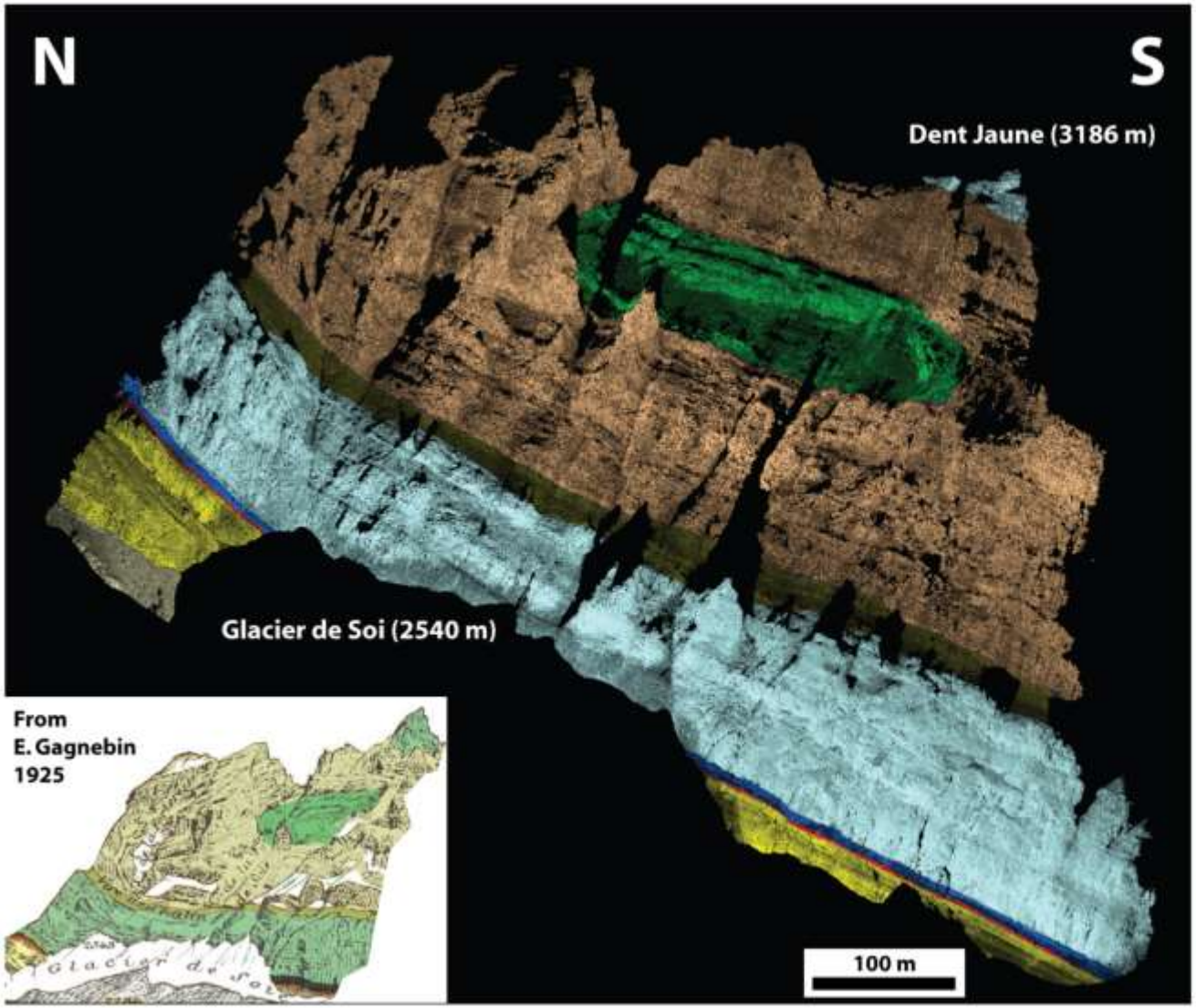


Terrestrial Laser Scanning point clouds Intensity





A method to remotely map lithologies and geologic contacts in 3D using Coltop3D software



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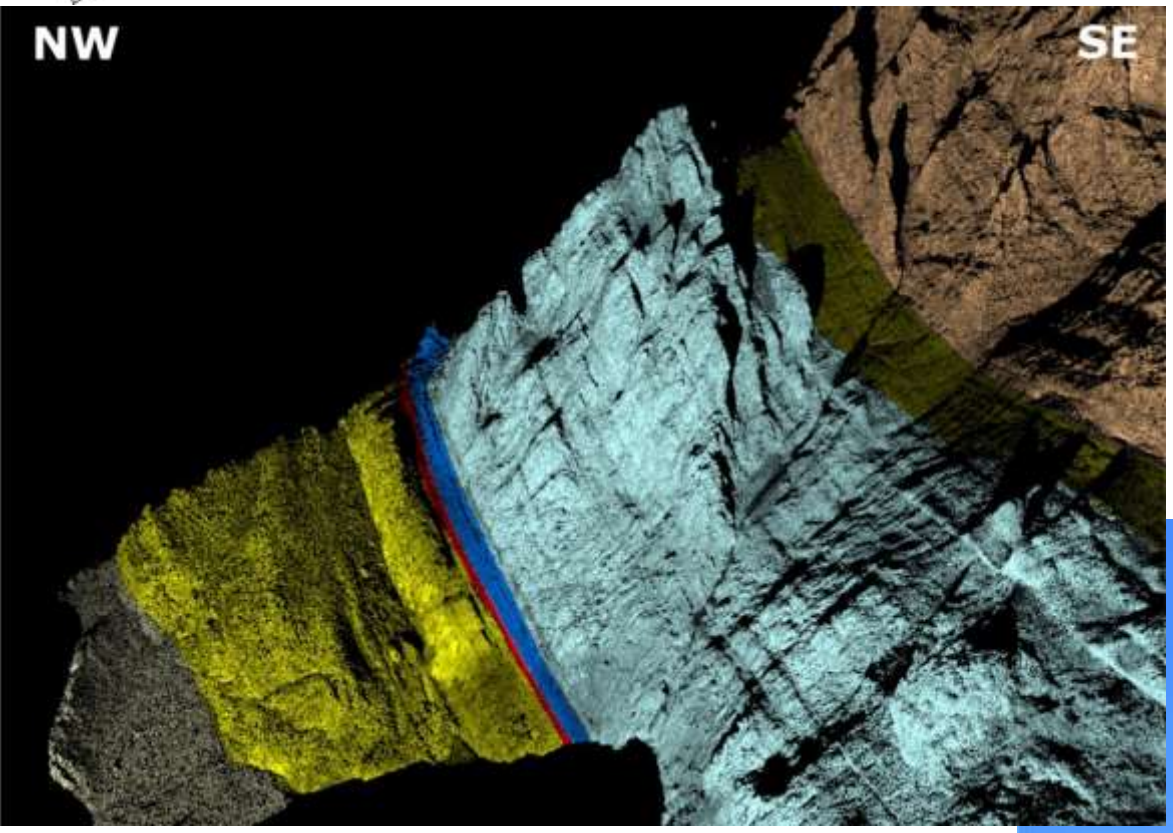

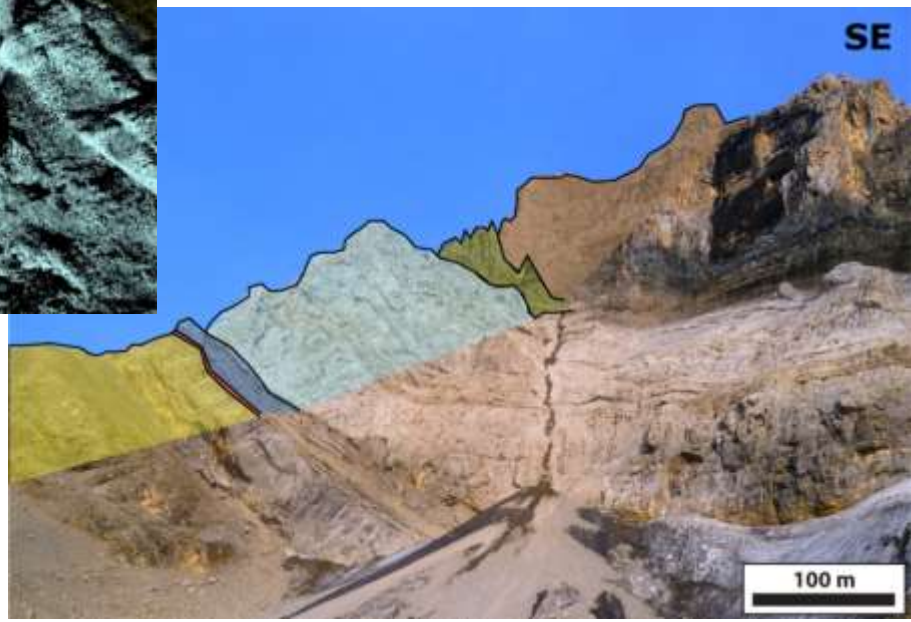

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- Red clays (Eocene)
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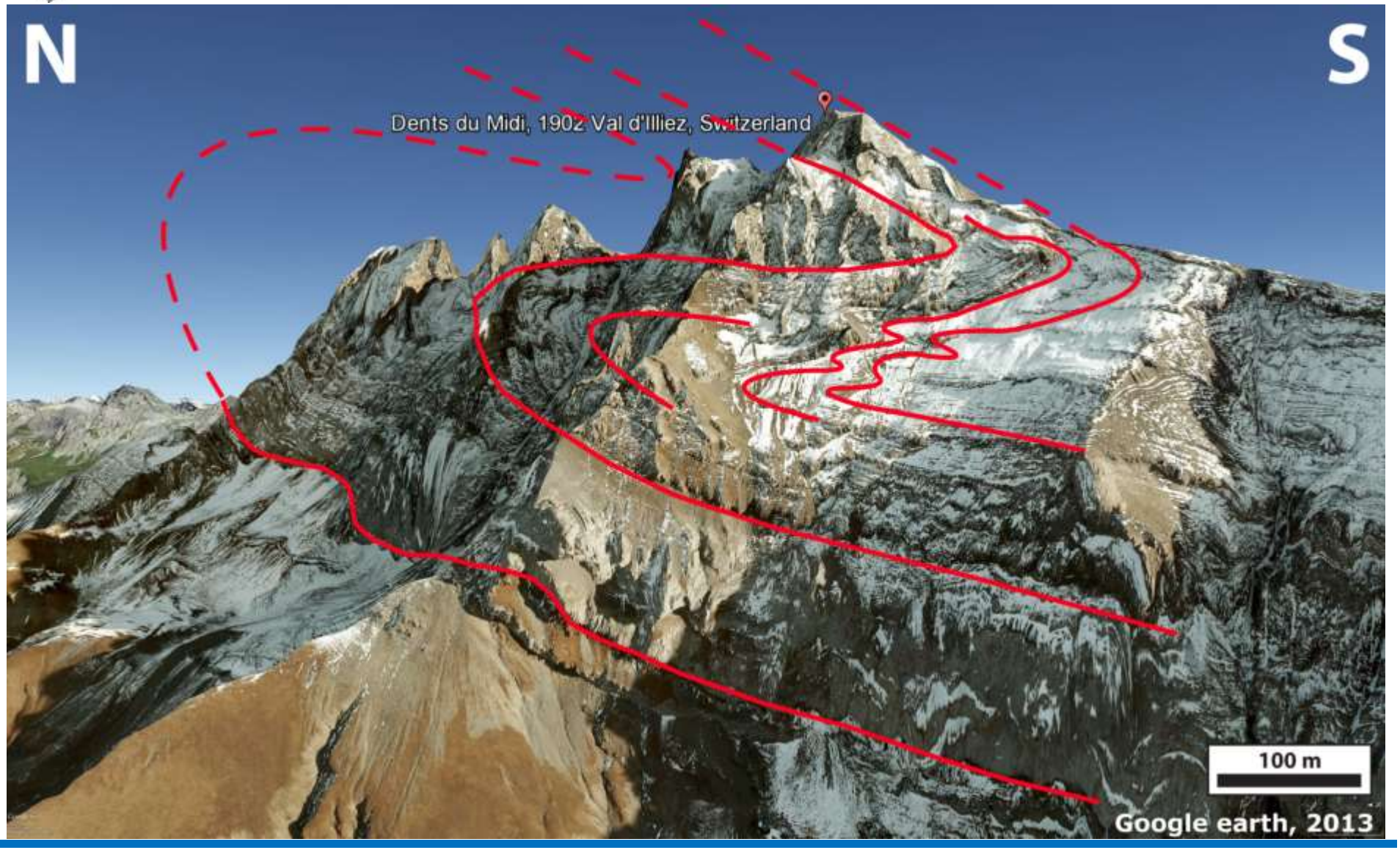
Fold axis characterization based on TLS data



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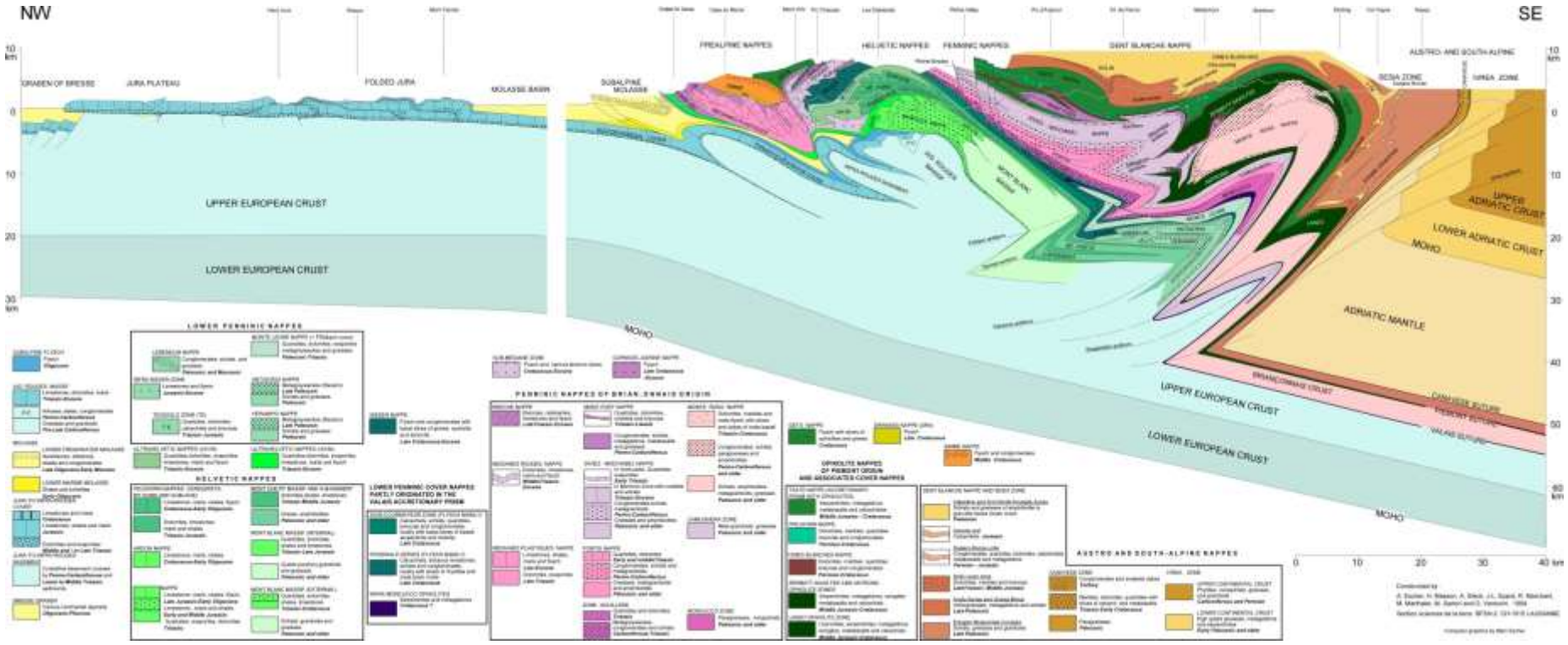
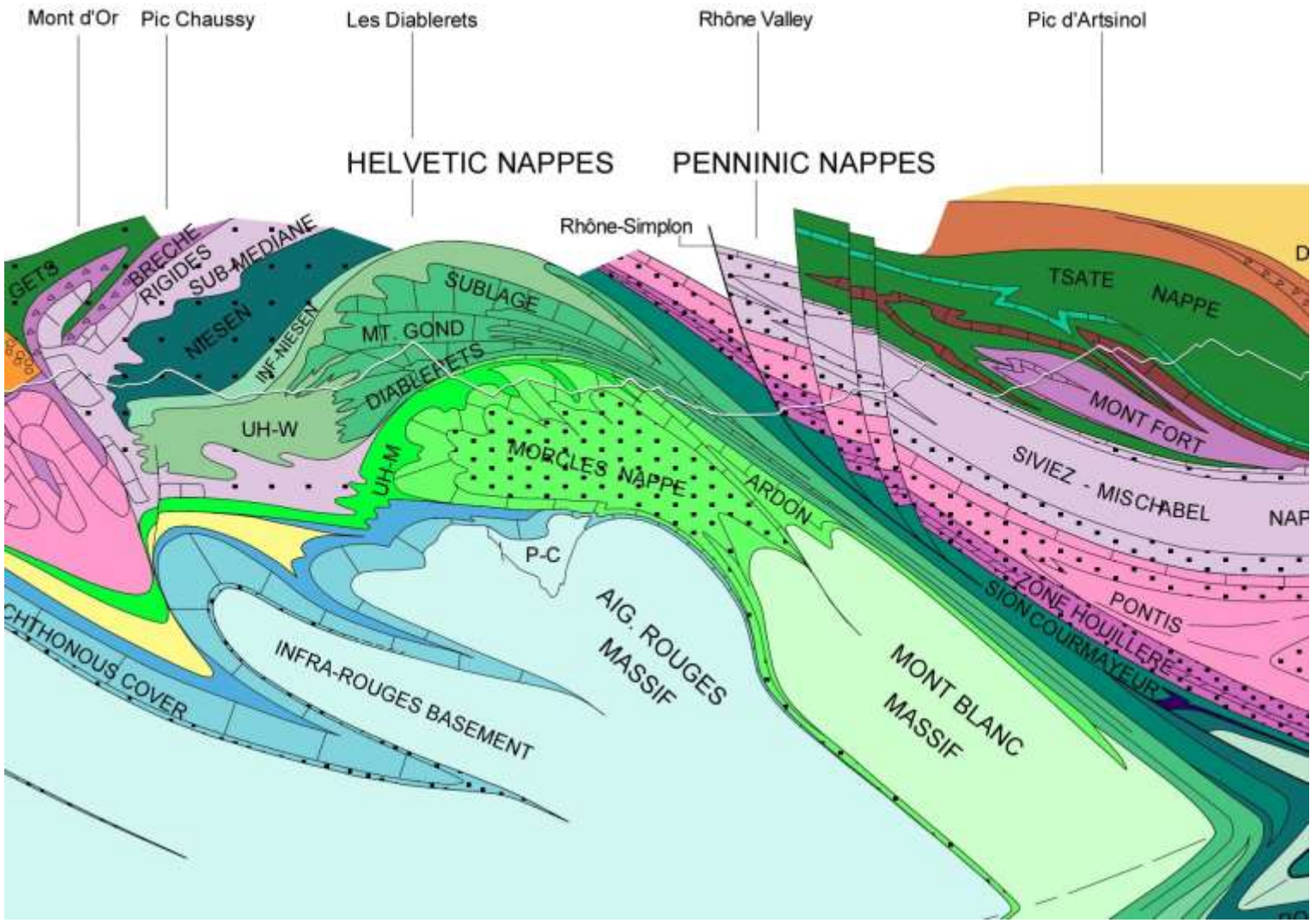


Escher et al. 1994

Fold axis characterization based on TLS data



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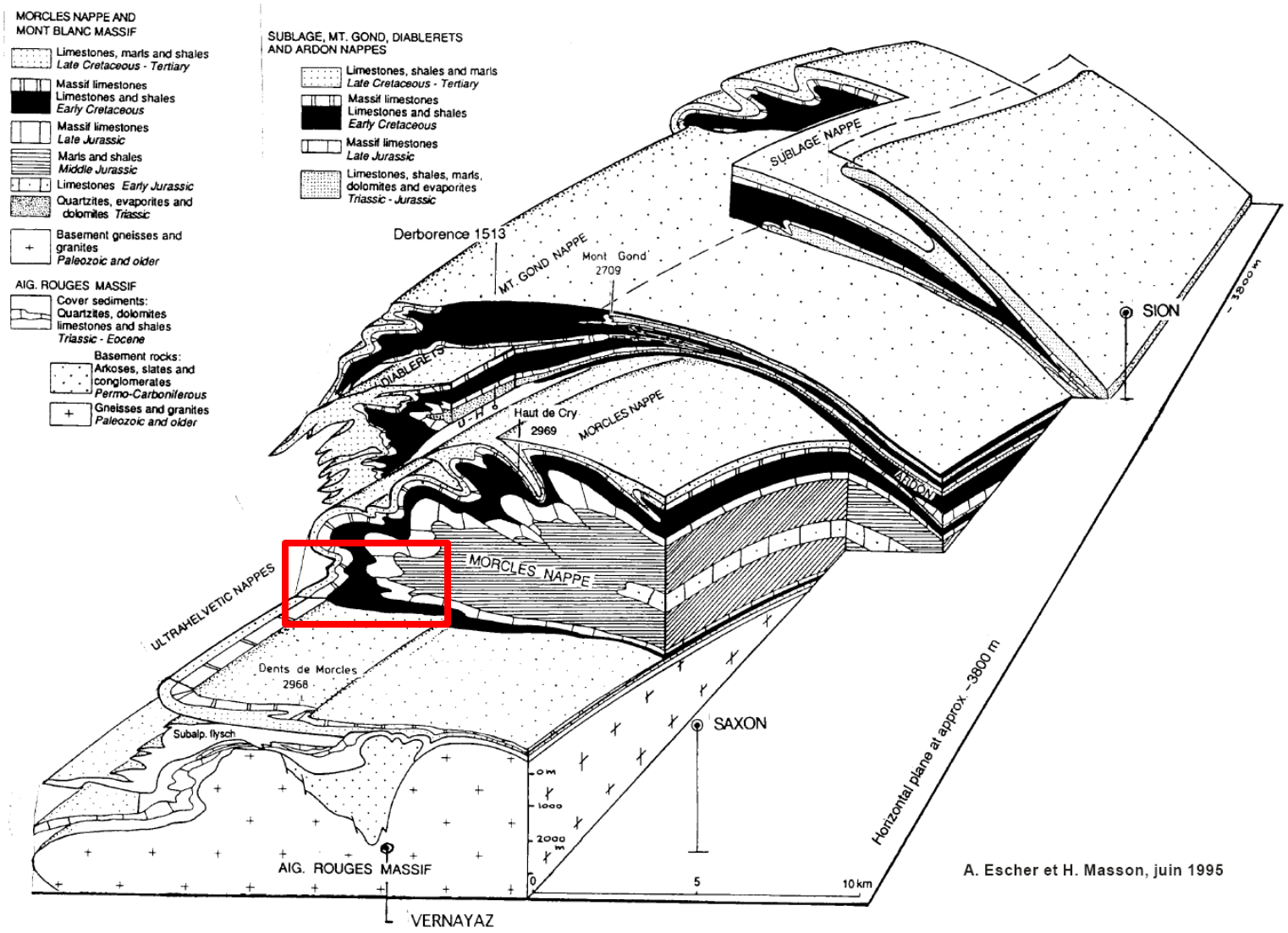

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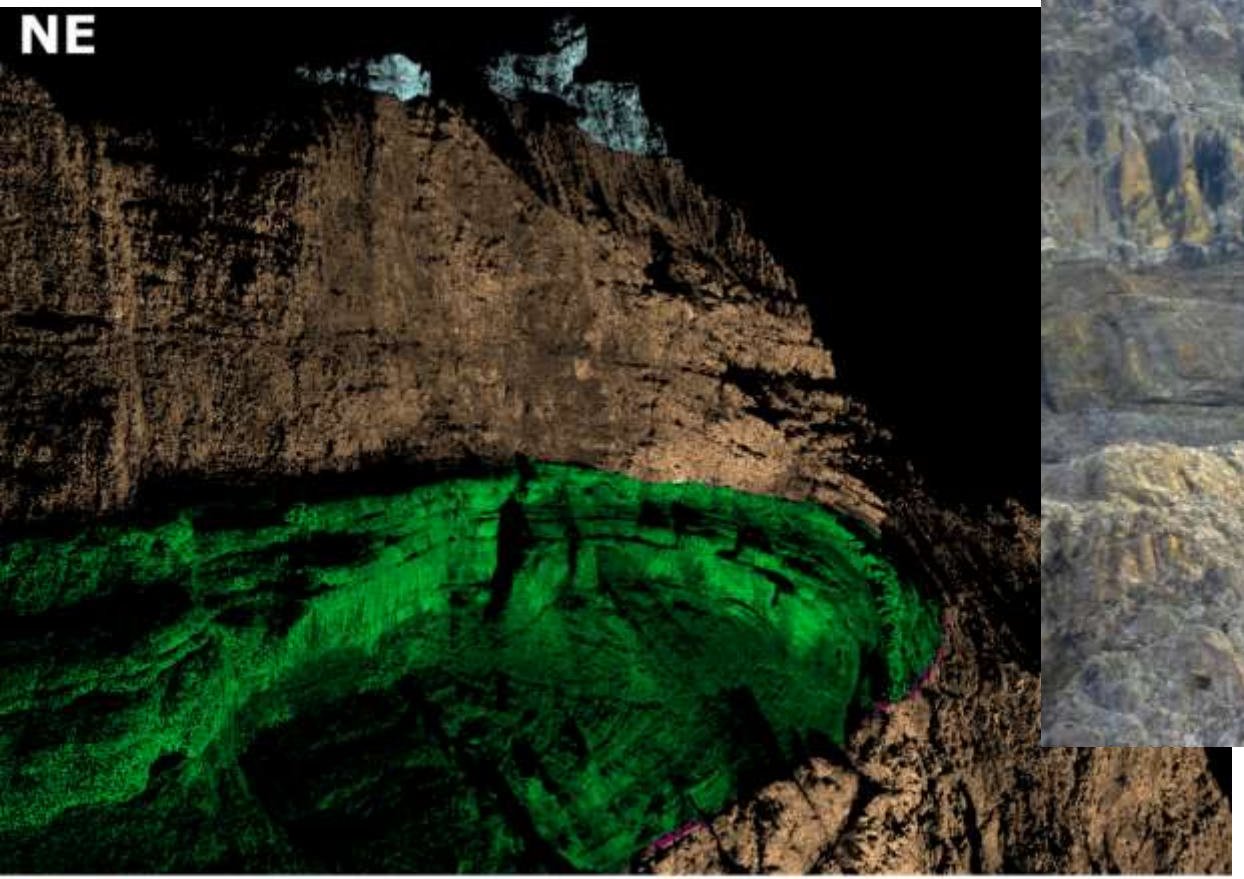
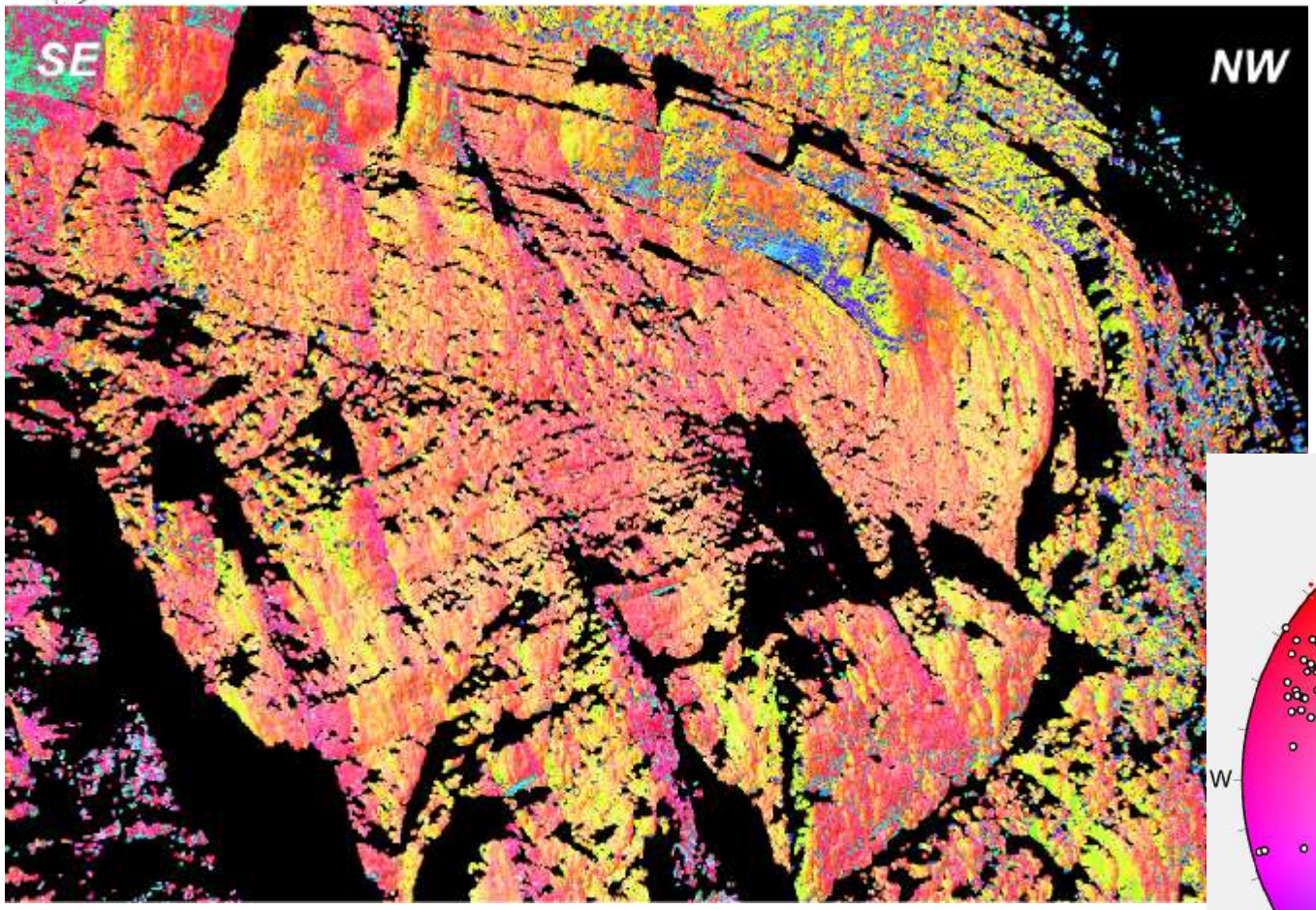


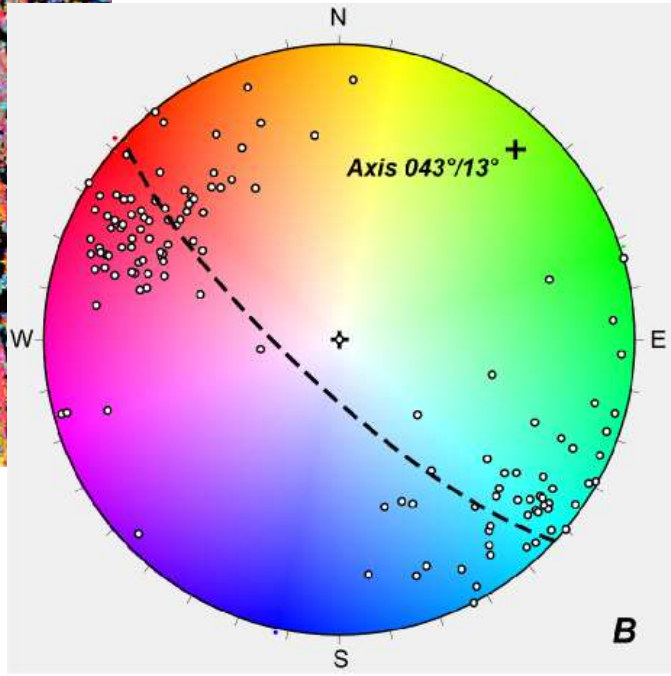
Siliceous brown limestone (Hauterivien)

Limestone (Valanginien)

Fold axis characterization based on TLS data



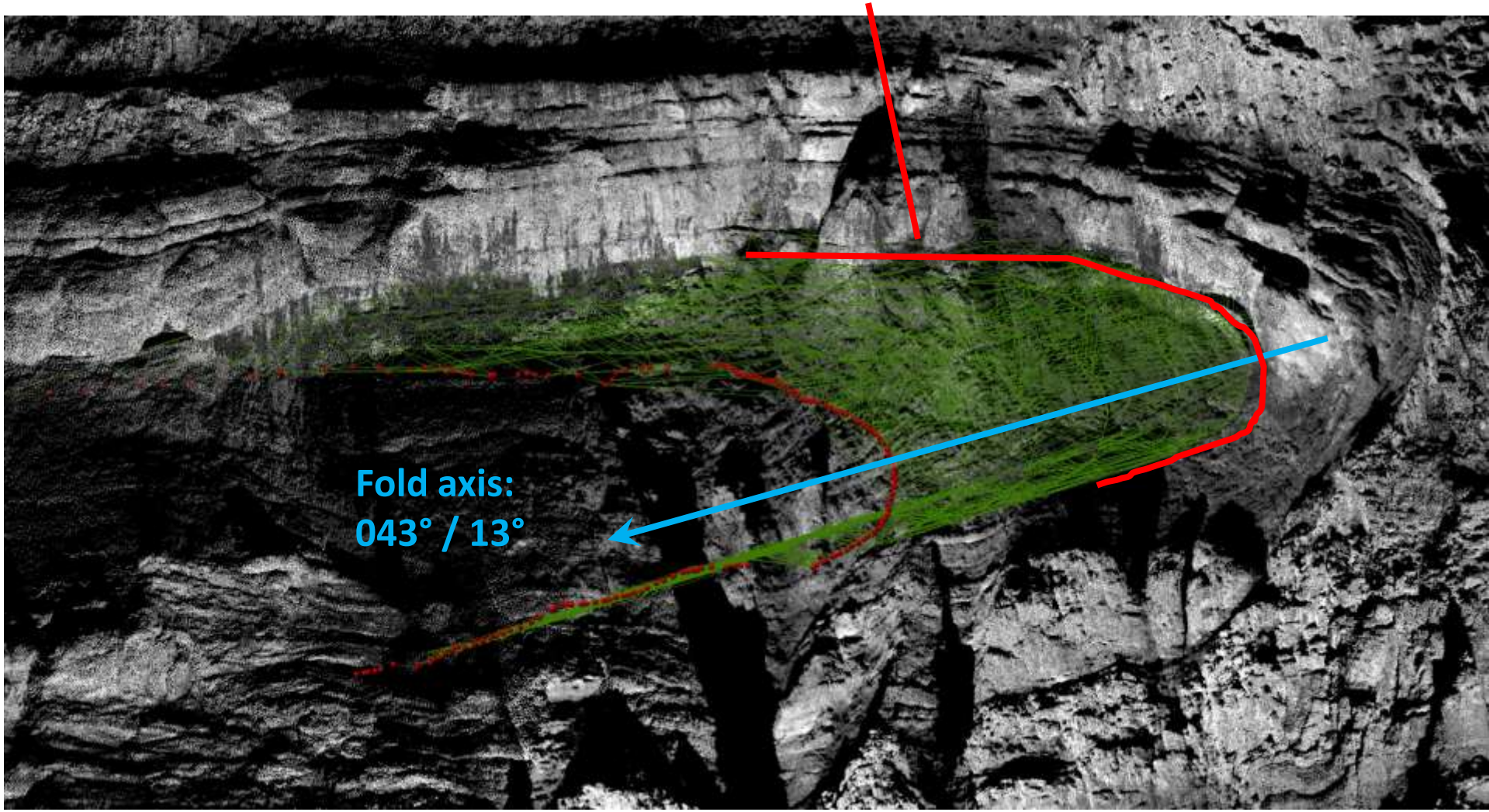
Coltop3D



Fold axis plunging slightly to the NE :

043° / 13°

Fold surface reconstruction with Matlab



Conclusions

Advantages

- TLS: The possibility to collect a large number of measurements on inaccessible and vertical areas.
- Coltop3D: Fast and accurate way of mapping geological limits to build a 3D geological model
- Dynamic visualization of 3D geological information

Limitations

- Not completely remote method. Preliminary field work is necessary to characterize the rocktypes.
- This mapping method is still largely manual. Thus it can be applied only to relatively simple geological settings

Perspectives

- Complete correction of intensity data should be performed to improve the lithologies differentiation : according to the distance from the scanner and to the angle of intersection between the beam and the topography
- Automatic geological mapping

The End

Thank you for your attention!!