Lithostratigraphy, facies, mineralogy and diagenesis of the prograding, syntectonic Neogene Barzaman Formation (Al-Khod, Sultanate of Oman)

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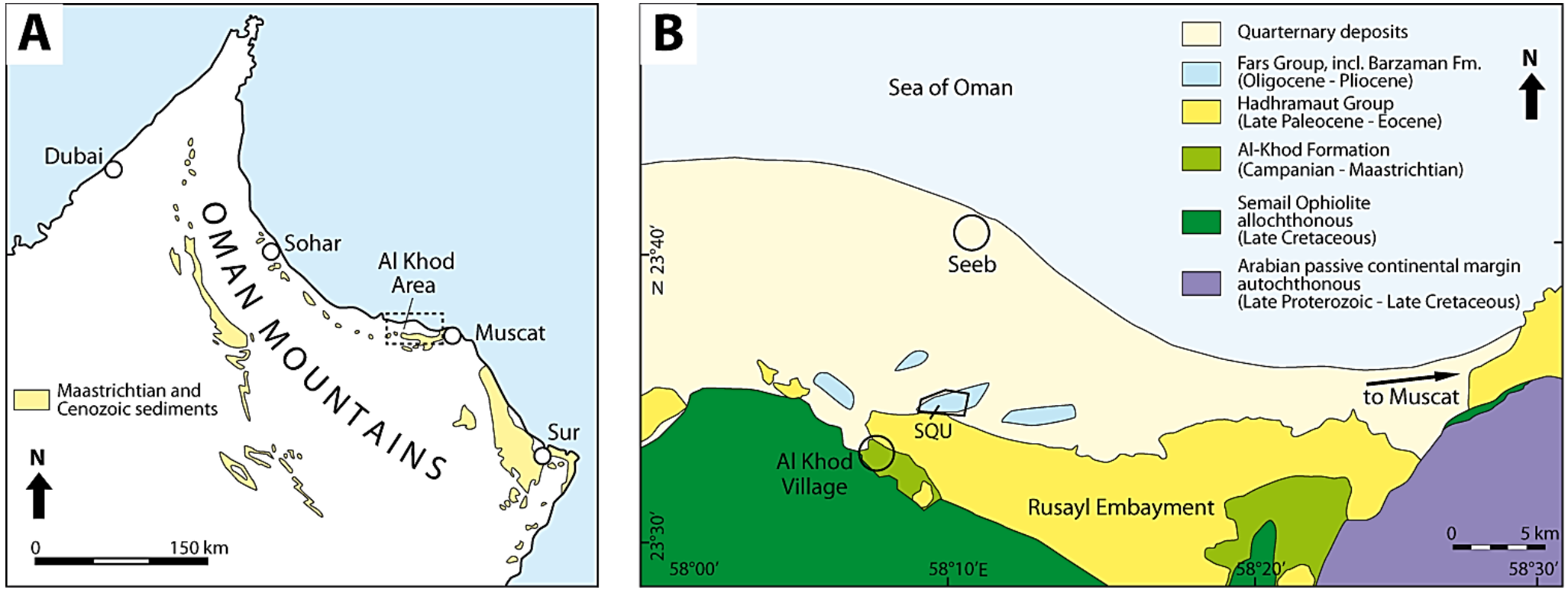
The Barzaman Formation is 150-200 m thick and subdivided in the study area into five lithostratigraphic/facies units recording syndepositional thrusting and changes from shallow marine to terrestrial environments and from arid/semiarid to more humid conditions.

TOP Dolomitic Conglomerates (top) / *>60m thick*
Claystone and Conglomerates / *19m thick*
Varied Thick Sandstones and Conglomerates / *10-35m thick*
Carbonates / *>10m thick*
BASE Lower Conglomerates and Sandstones / >35m thick

Study area in Al Khod is the campus of Sultan Qaboos University (SQU).



(1) The basal Lower Conglomerates & Sandstones are characterized by beige and gray/greenish colors, thick-bedded pebbly, calciclastic litharenites which may display well-rounded detritus and parallel lamination and thick-bedded, matrix-supported pebble to cobble conglomerates with subrounded clasts of chert, basalt, gabbro, quartzite and carbonates. Pores may be lined by isopachous, microcrystalline calcite cement. The depositional environment is shallow marine with one coarse-grained fill of a high-energy tidal inlet.

Guardrail for scale →

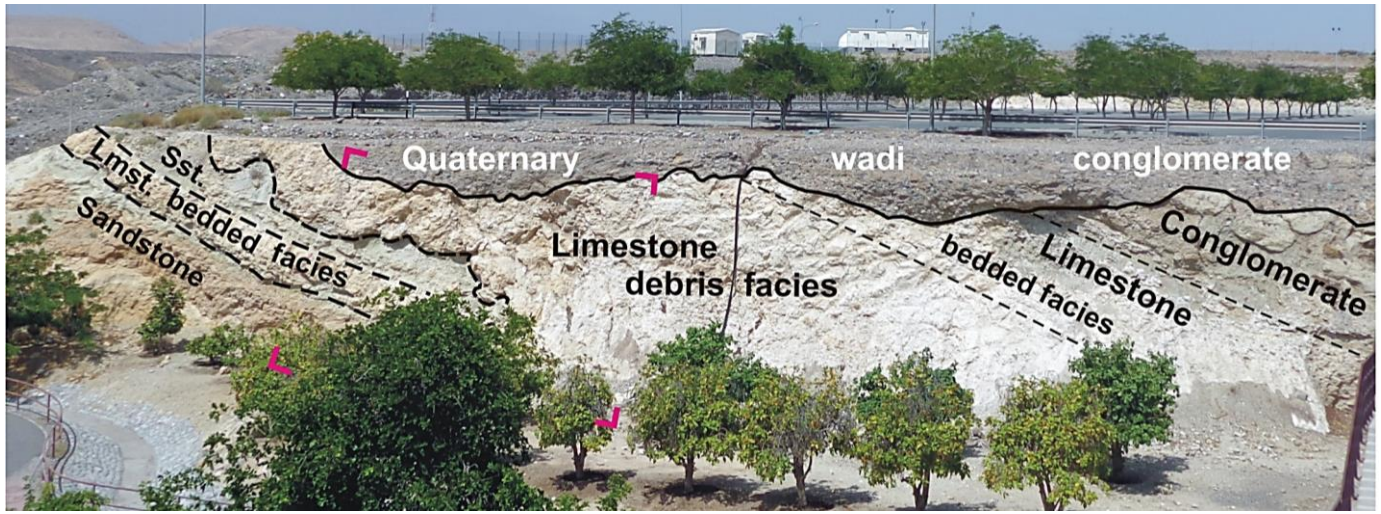
Lower Conglomerates & Sandstones. Coarse-grained fill of a high-energy tidal inlet. Note grain size decrease towards the channel margin!

Within this unit is a local angular unconformity. The upper layers dip more steeply than the layers below the unconformity, suggesting that the unconformity represents an erosional surface about which the younger sediments accumulated.

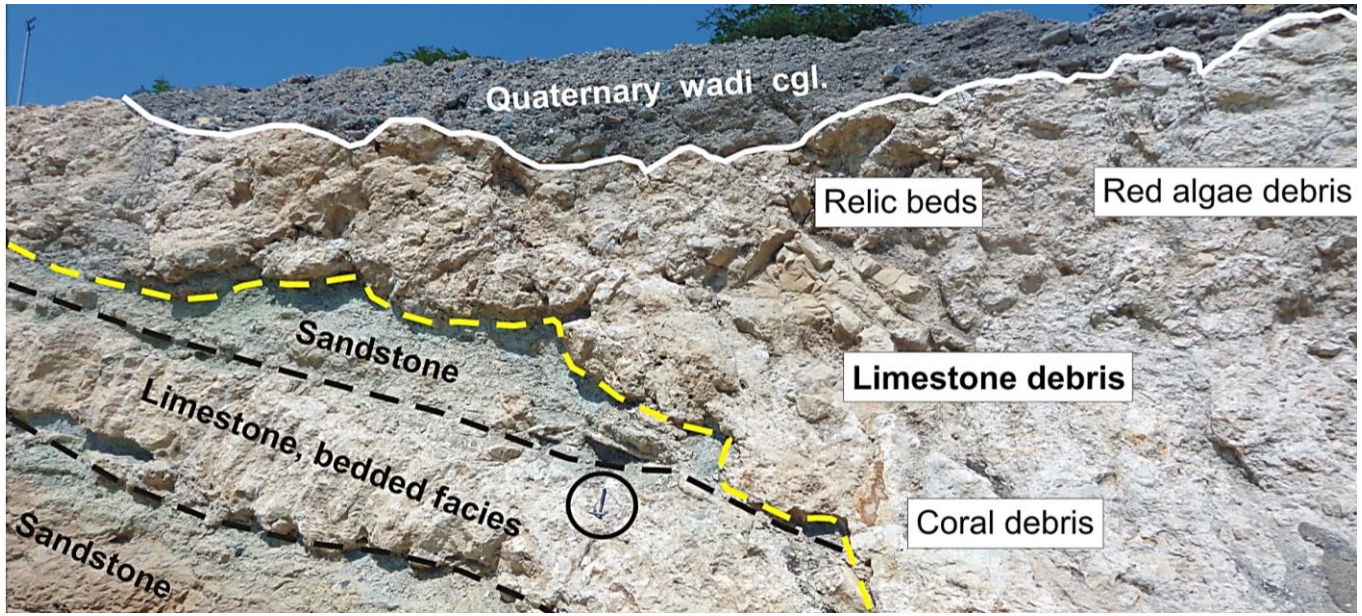
Guardrail for scale →

Lower Conglomerates & Sandstones. Angular unconformity between the yellow arrows.

(2) The light-colored Carbonates consist of thick-bedded coral limestone, a very thick limestone coral and algae debrite and some minor beds of conglomerate and sandstone. The corals may be partly silicified by brown-stained silica. This unit was deposited in a warm, shallow marine, nearshore environment with clear water which may indicate an arid climate.



Carbonates. Overview of the most complete outcrop



Carbonates. Detail of the outcrop shown above. Note debrite with relic beds, coral and algae debris! Circle with hammer for scale.

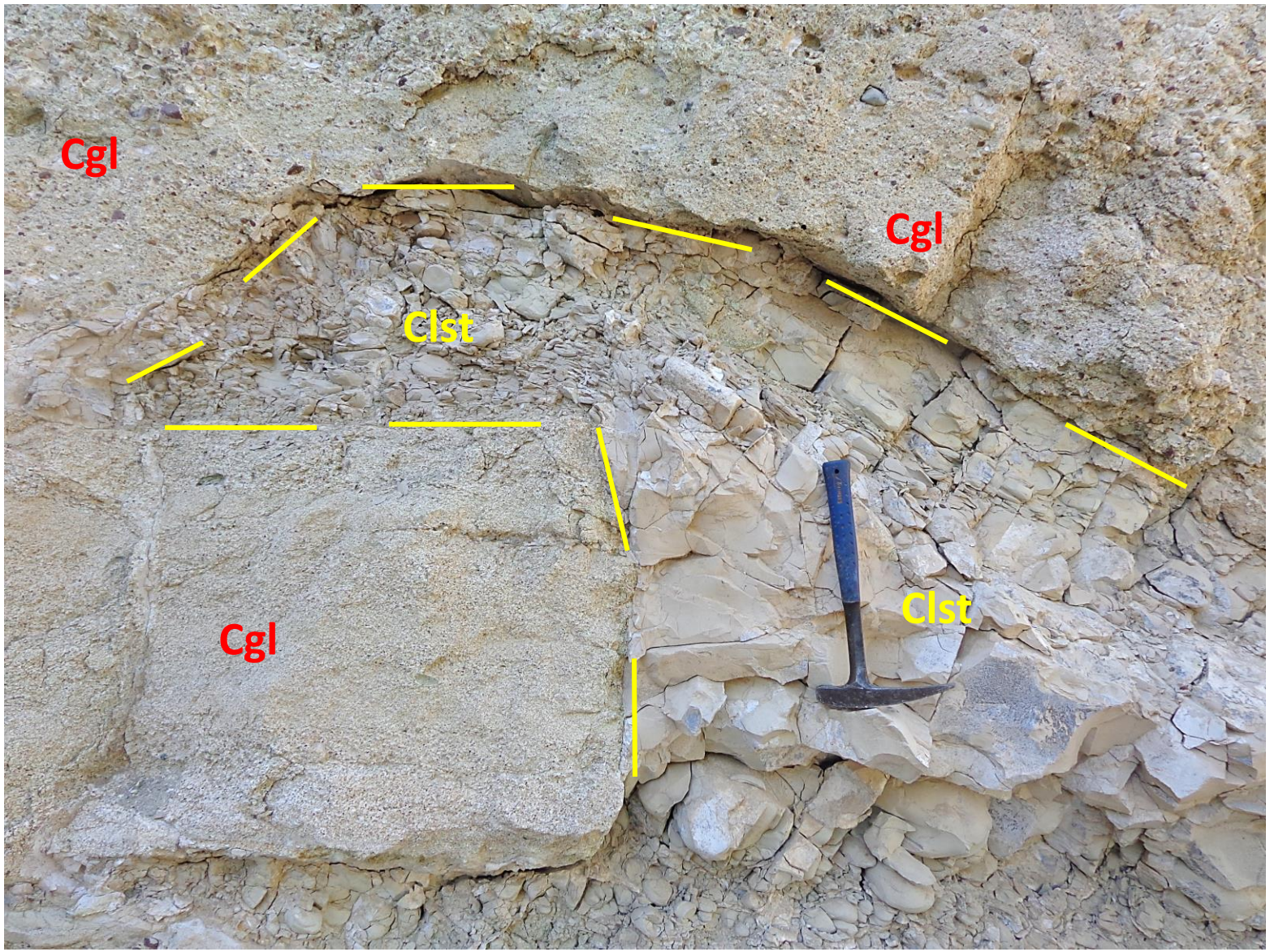
(3) The Varied Thick Sandstones and Conglomerates are similar to those of unit 1, but more colorful, slightly coarser grained (presence of boulders) and include also thin and medium beds. The sandstones may exhibit cross-bedding. The depositional environment is shallow marine as indicated by coral debris.

(4) The Claystone and Conglomerate unit comprises conglomerates that are also similar to those of unit 1, but pebbly sandstones are comparatively rare. Claystone beds are present, including a 20-cm-thick cellular claystone (palygorskite, vermiculite with some calcite) as well as light gray, medium-bedded claystone beds, consisting mainly of palygorskite with some saponite and/or clinochlore, associated with minute, euhedral dolomite or ankerite crystals. All claystone beds are evaporitic, lacustrine deposits of ephemeral ponds and pools on wadi floors whereas the coarser beds represent wadi conglomerates. Some beds are imbricated slide units. The paleoclimate was hot, semiarid or arid.

Claystones and Conglomerates. The claystones are light-colored and of limited lateral extend. They display slide-related imbrication (arrow).

There is more evidence for slope instability as indicated by the slide unit below.

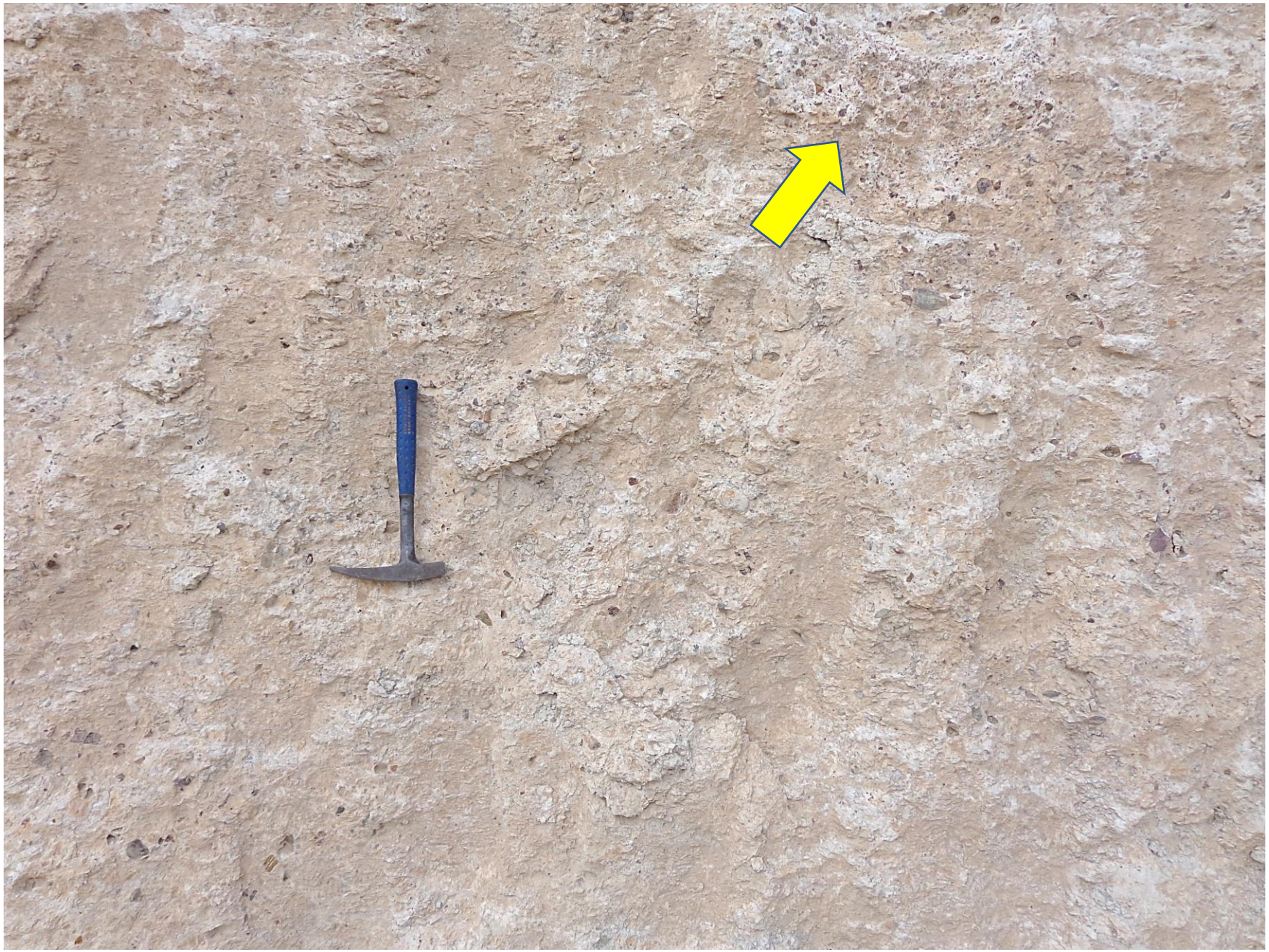
Claystones and Conglomerates. The claystones (Clst) display vertical contact to the conglomerates (Cgl) left of the hammer. The claystones also appear to be squeezed into the Conglomerate. The contact between claystone and conglomerate is indicated by yellow lines.



(5) The Dolomitic Conglomerates consist of weathered clasts and unaltered chert pebbles that seem to “float” in displacive cement (Al-Amri, 2018). Weathering/chemical alteration/dolomitization of ophiolite clasts has been studied by Abbasi et al. (2020). The cements of the basal >10 m may be brown-stained silica and some light-colored dolomite. Where present, the silica content gradually decreases upward. The upper part is dominated by light-colored dolomite and some calcite. The dolomite cement may have formed under phreatic conditions (groundwater) during the Late Miocene to Pliocene when the arid/semiarid Miocene climate became more humid.

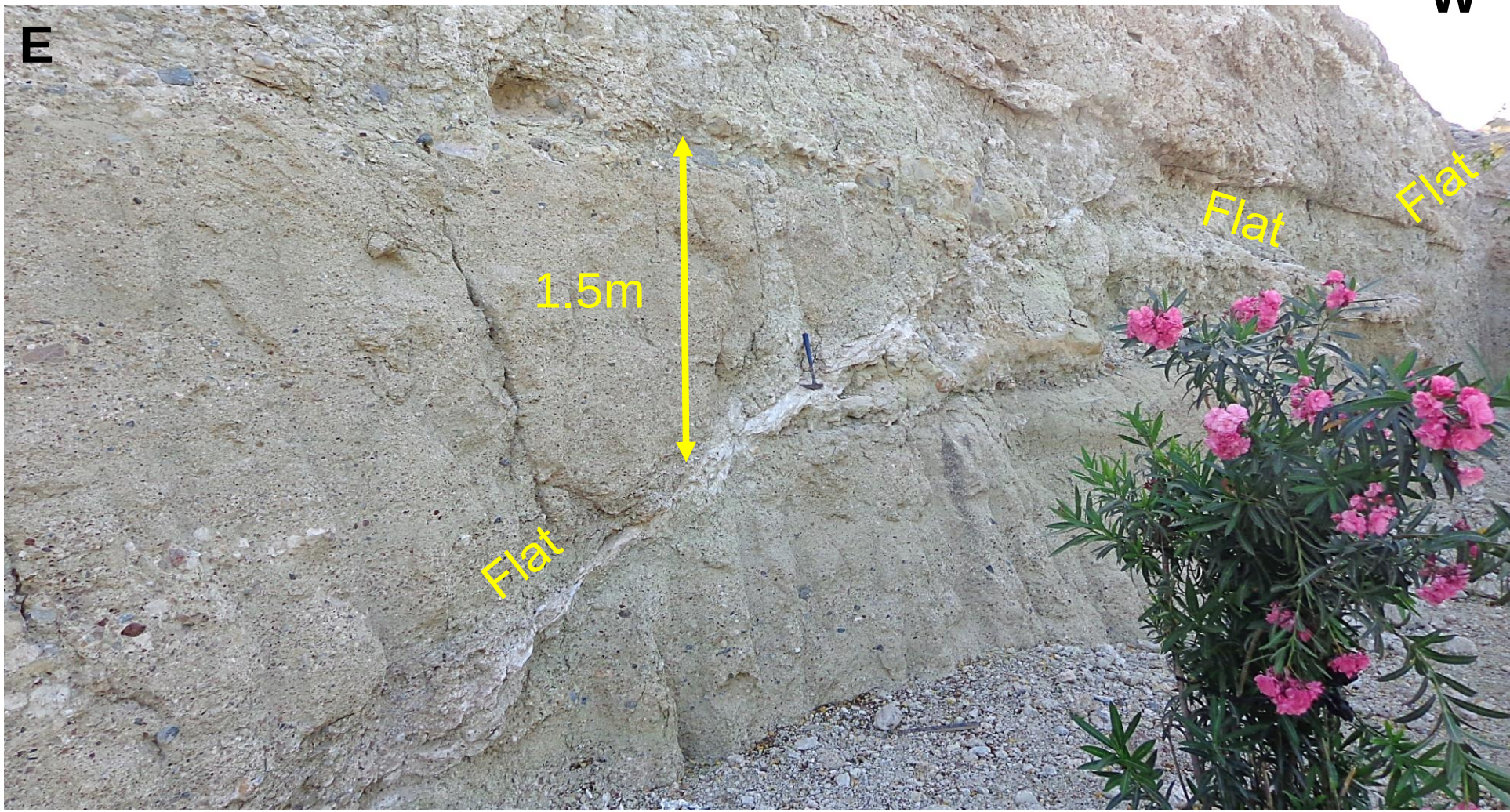
Dolomitic Conglomerate with brown-stained silica cement from the lower part of the unit

Dolomitic Conglomerate
with light-colored dolomite cement from the middle part of the unit. Note how pebbles are “floating” in the cement! At the top right (arrow) some original conglomerate texture has been preserved.



Syndepositional thrusting and slope instability

Close to the base of unit 4, the upper part of an east-dipping syndepositional thrust is exposed (Mattern et al., 2018). Faulting approximately coincides with the change from marine to terrestrial conditions. In addition, the syndepostional tectonic activity may explain aspects of slope instability (debrite in unit 2, slides units in unit 4).



Mineralized syndepositional thrust displaying a ramp-thrust-ramp morphology. The vertical displacement decreases from 1.5m (ramp in foreground) to a few dm (ramp in background) and vanishes completely farther up and farther to the west.

References

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