

Deconstructing a sand sea: an example from the northern Rub' Al-Khali in the UAE

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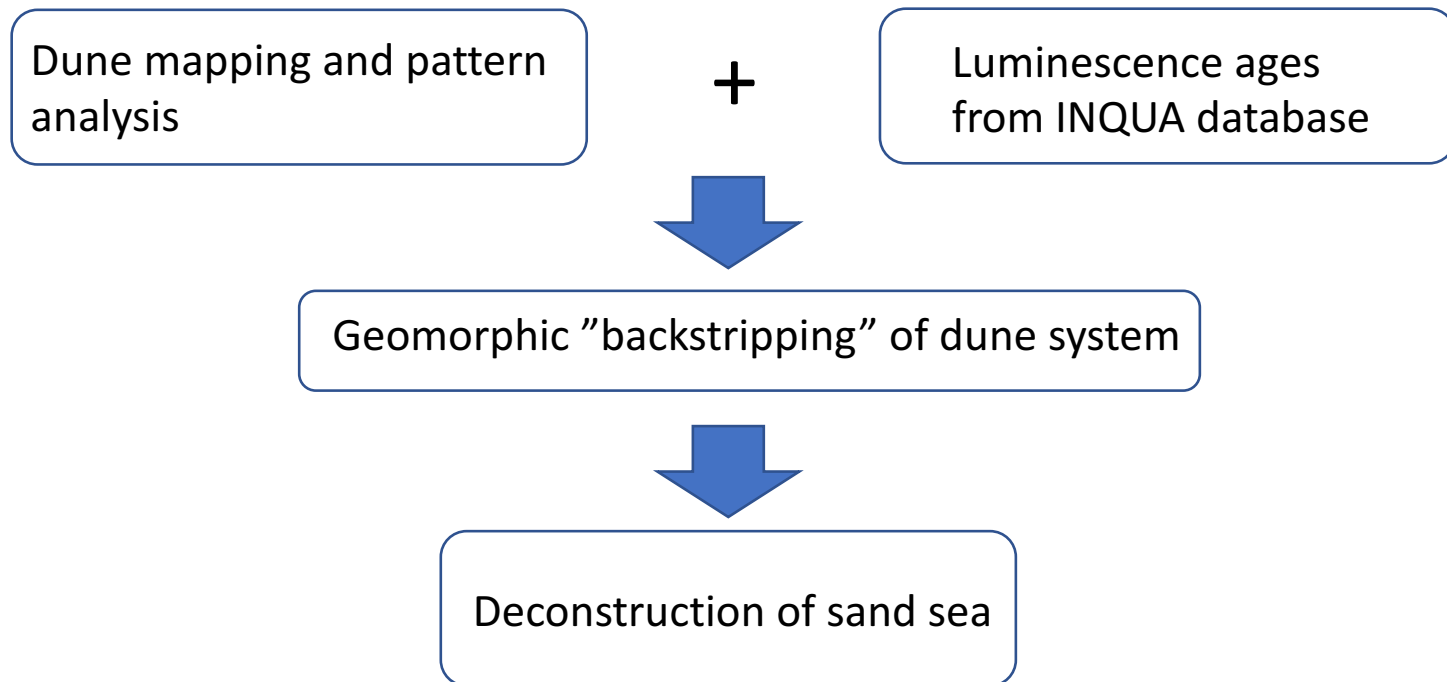
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Motivation

- Development and history of many sand seas and dune fields unknown or poorly known
- INQUA Dunes Atlas Database contains thousands of luminescence ages generated by many studies and investigators
- How can we best use the data that exists to understand dune system development and relations to climate and sea level changes?
- What are the unanswered questions and research priorities?

Approach

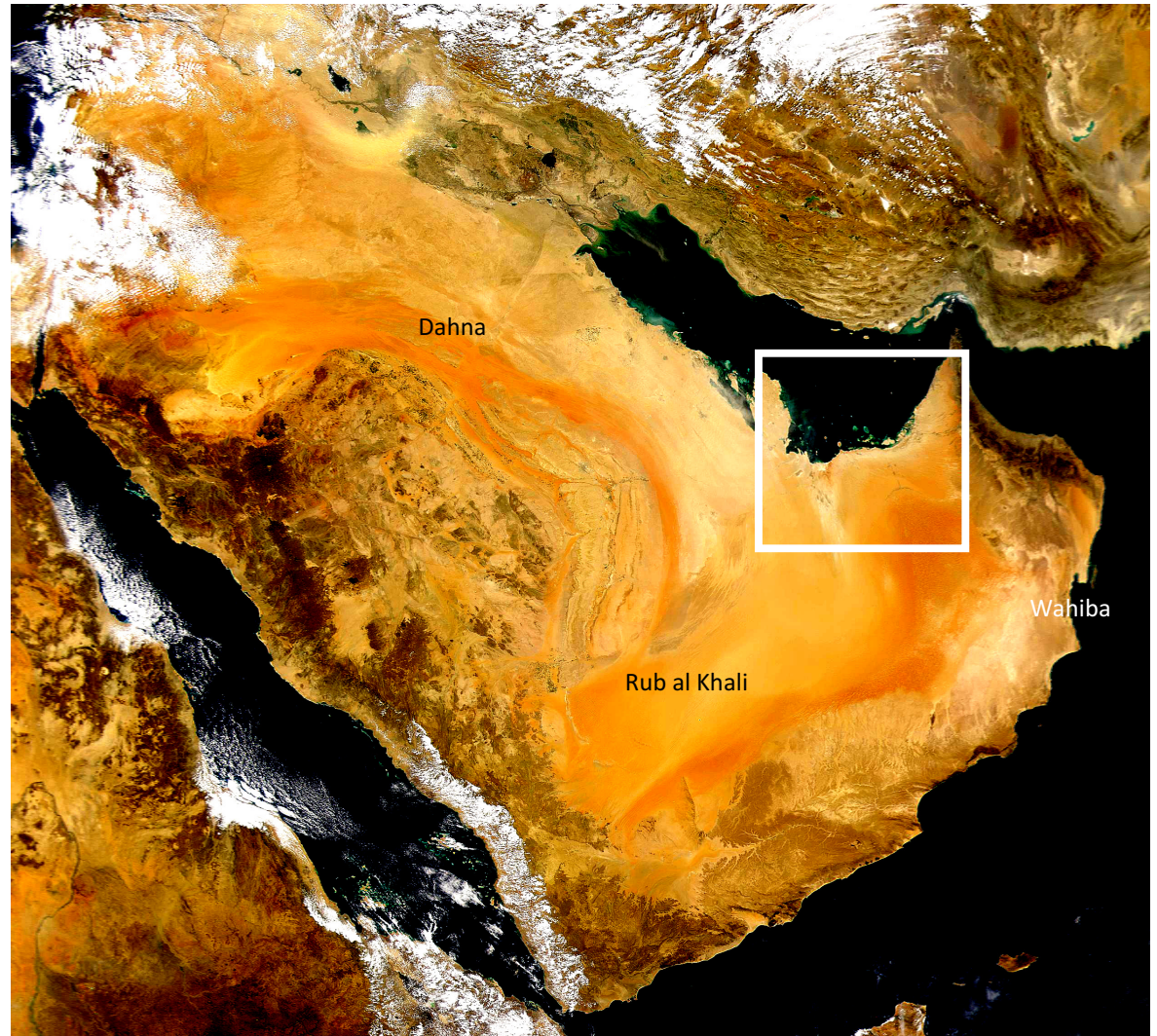


Rub' al-Khali

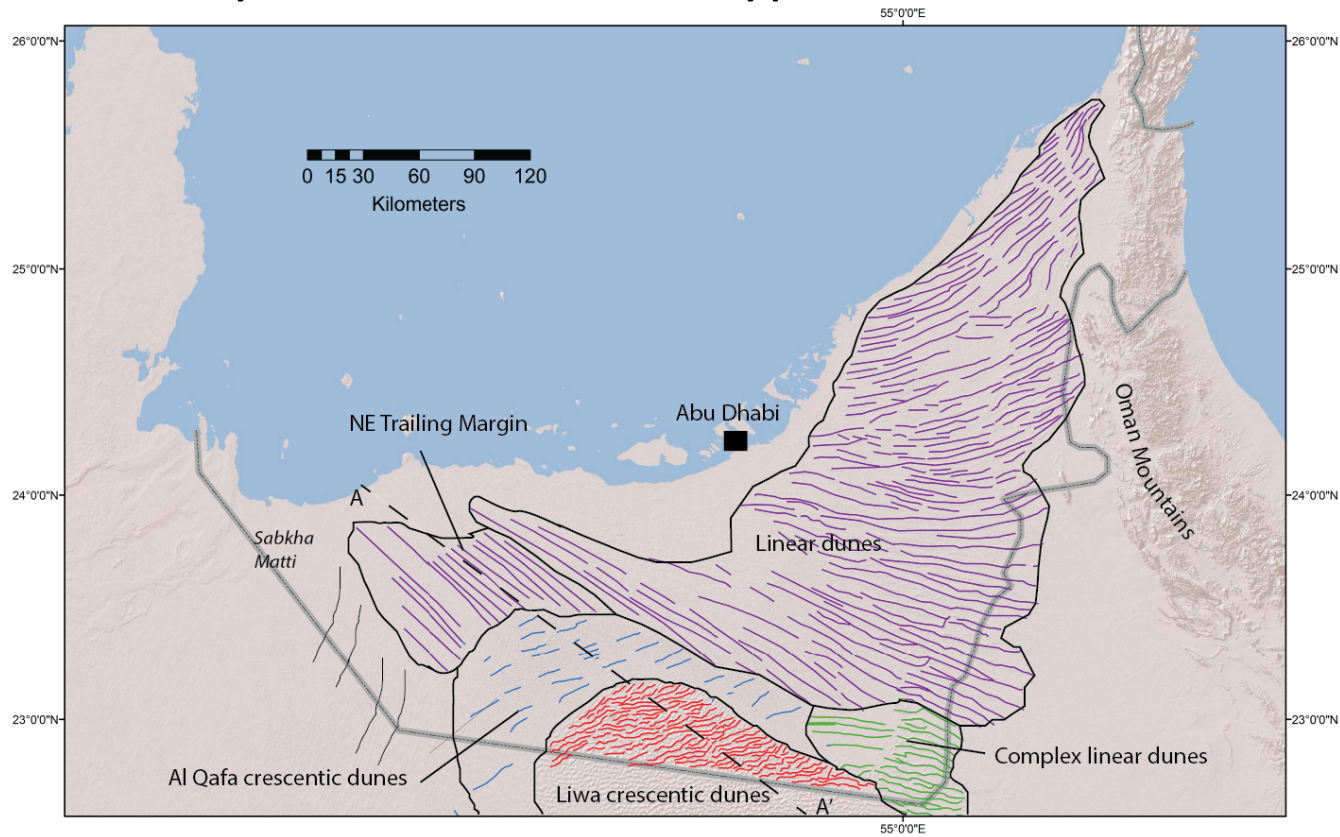
Largest sand sea in the world (650,000 km²)

Multiple dune
Generations

Little known about its
history



Variety of different dune types



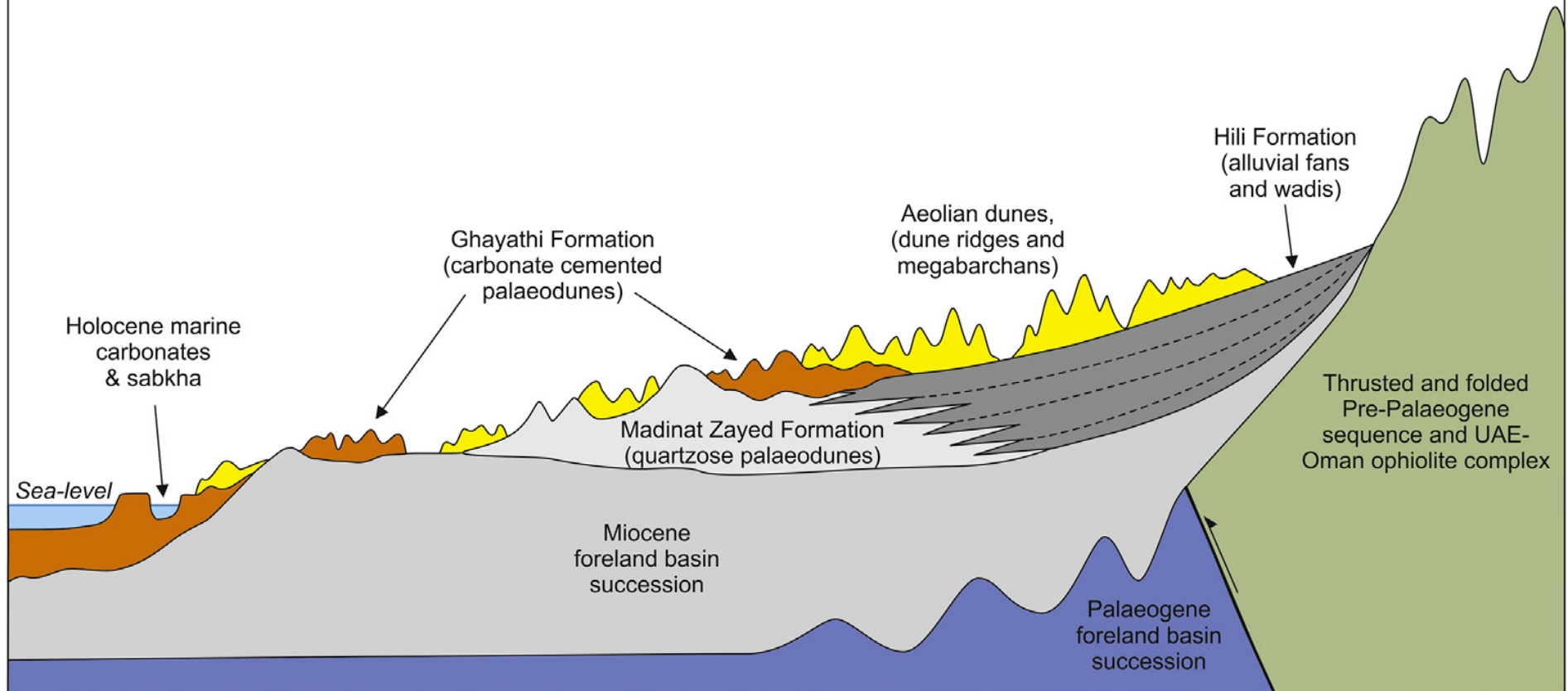
Long history of aeolian sedimentation

- Precursor aeolian units (based on Farrant et al, 2016)
 - Madinat Zayed Formation (quartz-rich)
 - Deposited during MIS 5 with clusters of OSL ages at 50, 70-75, 100-110 and 120 ka
 - Gayathi Formation (carbonate-rich aeolianite)
 - MIS 5e
 - MIS 5a (70 – 80 ka)
 - 54 - 62 ka
- Likely reworked in part for extant dune systems

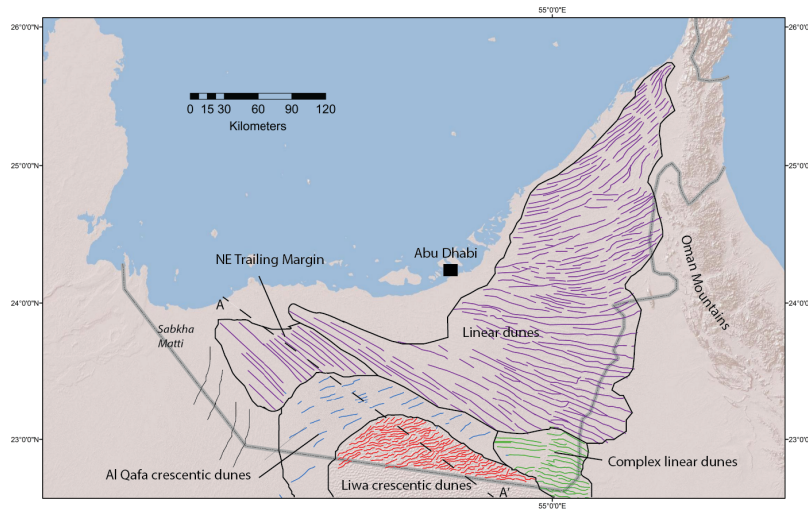
West
(Abu Dhabi
& Dubai)

From Farrant, A.R., Duller, G.A.T., Parker, A.G., Roberts, H.M., Parton, A., Knox, R.W.O., Bide, T., 2015. Developing a framework of Quaternary dune accumulation in the northern Rub' al-Khali, Arabia. *Quaternary International* 382, 132-144.

East
(Hajar Mountains &
the Musendham)



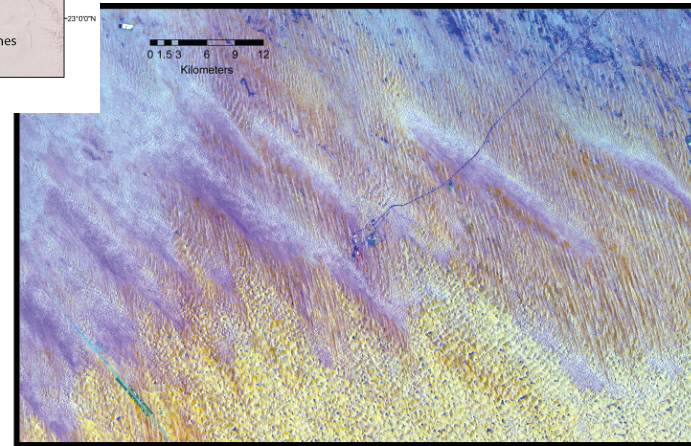
Different scales of complexity

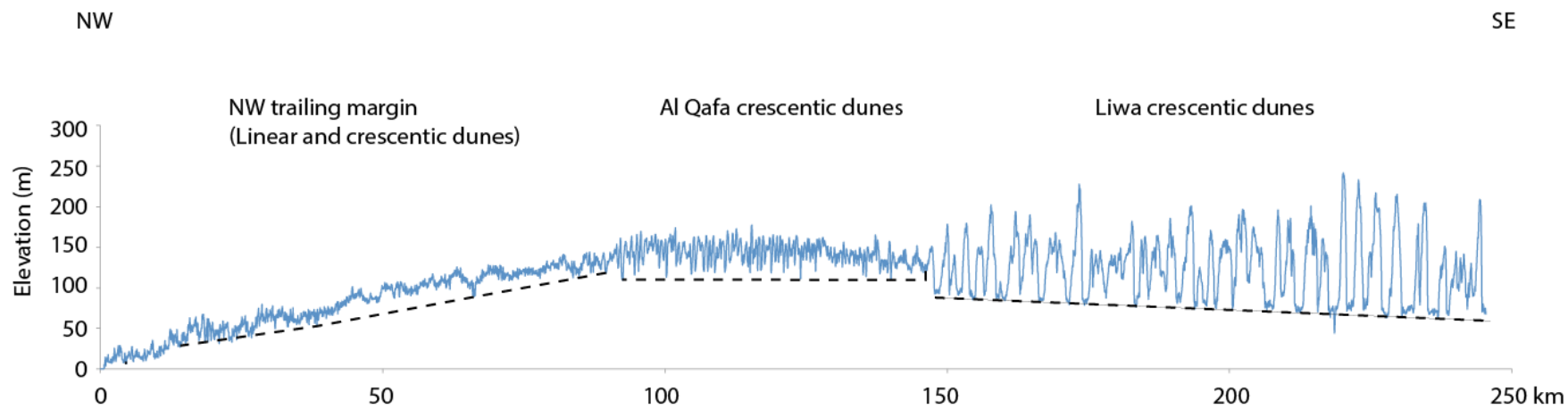


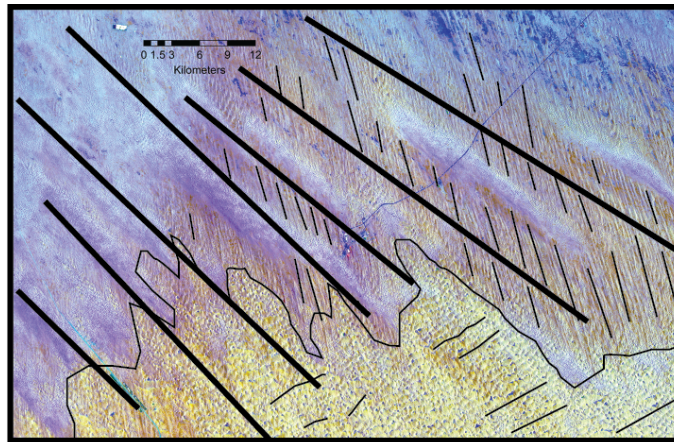
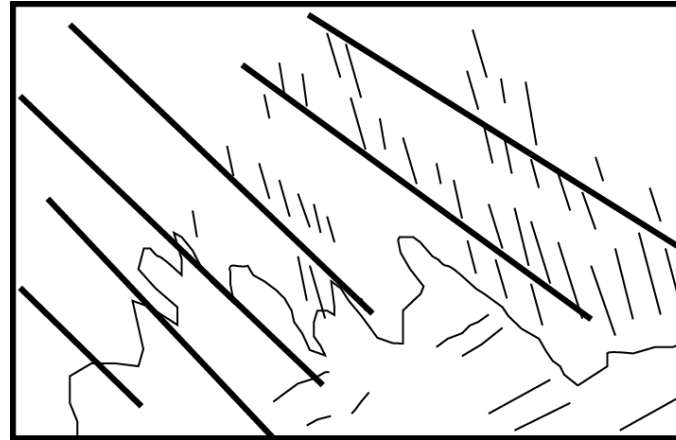
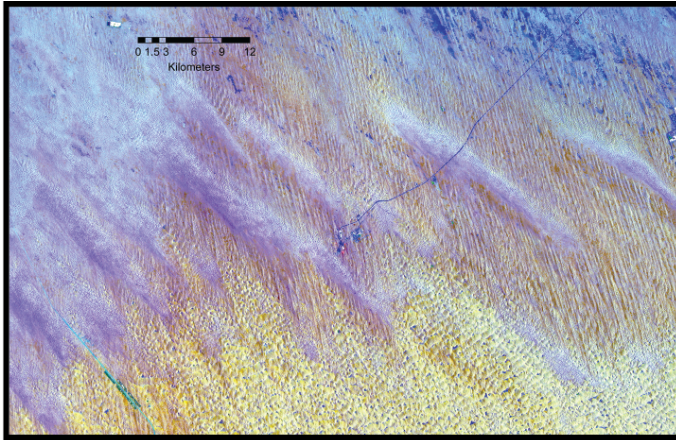
Dunefield scale



Local scale



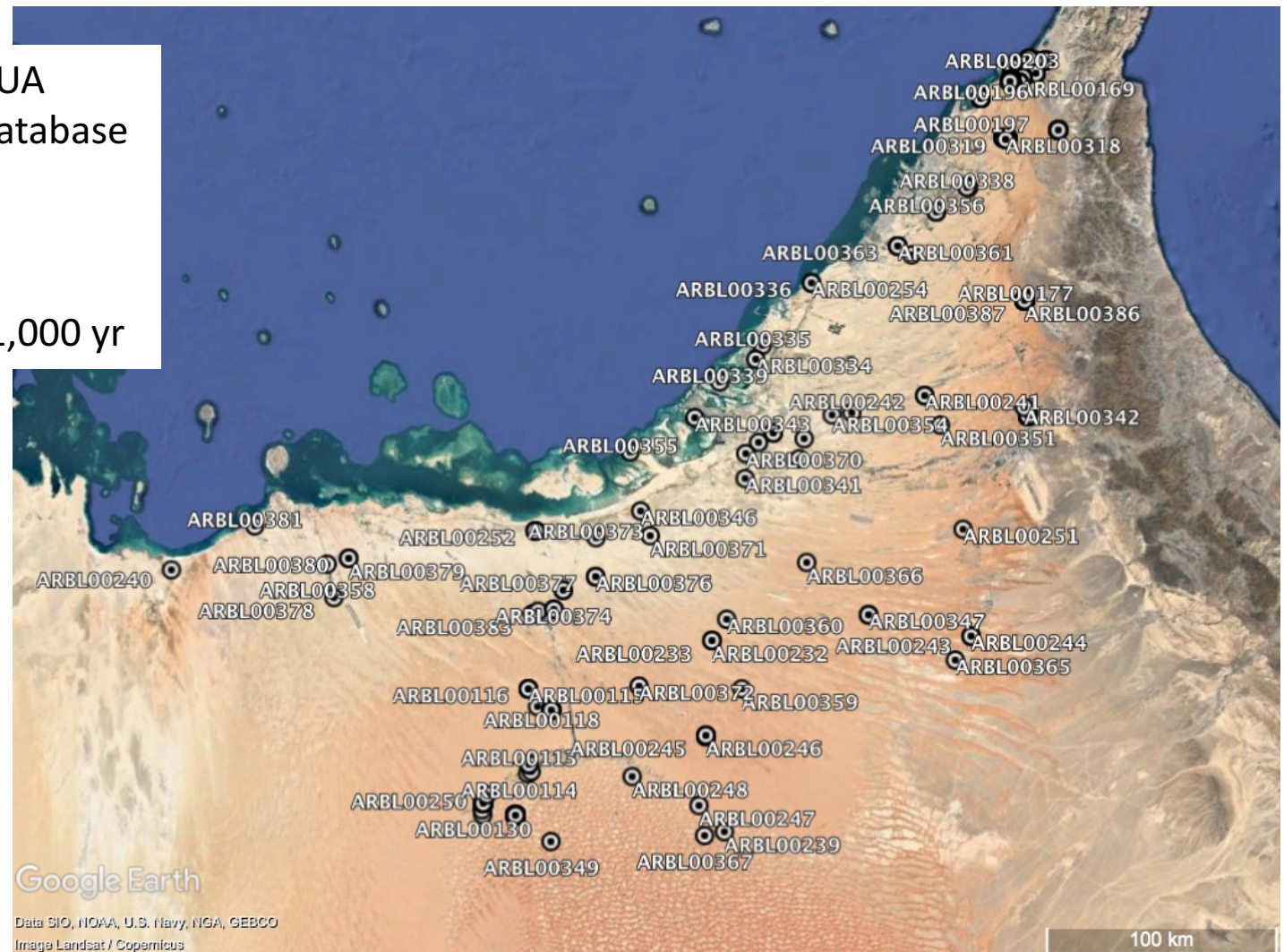




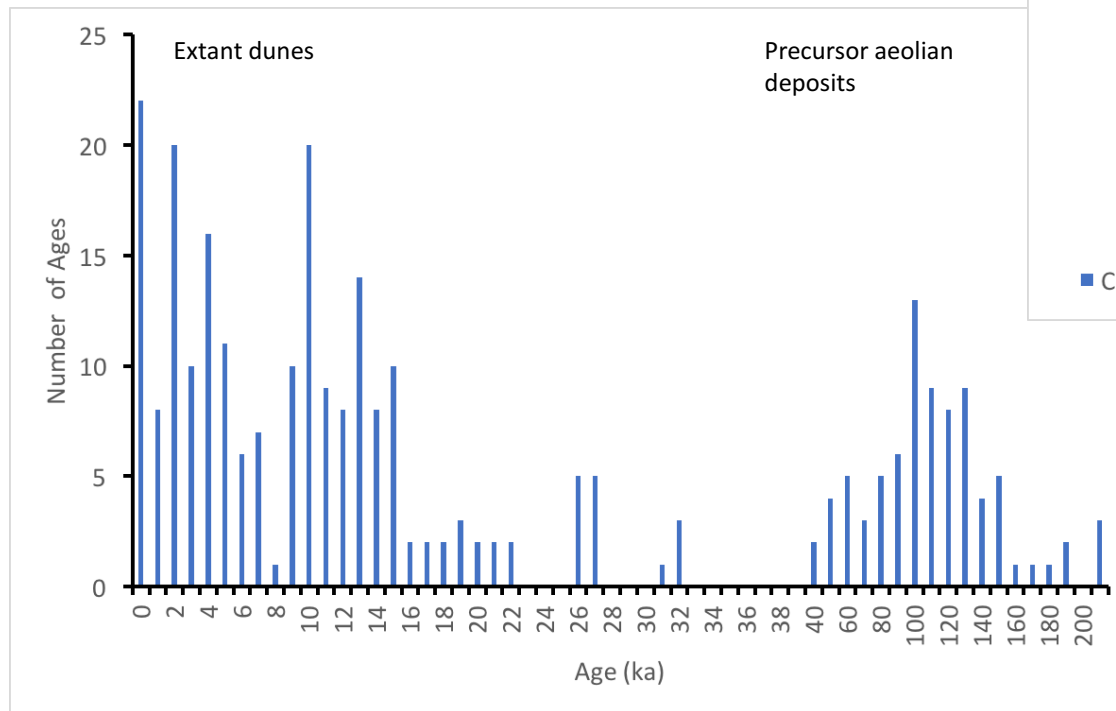
Dated sites from INQUA
Dunes Chronologic Database

Total of 279 ages

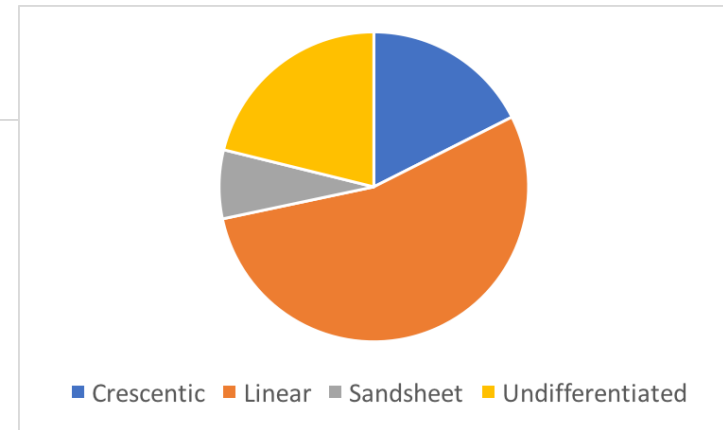
Range from 80 to 291,000 yr



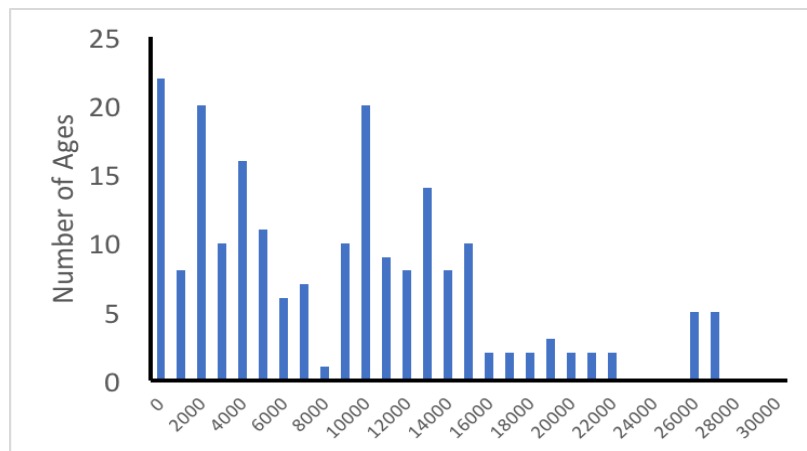
Luminescence ages



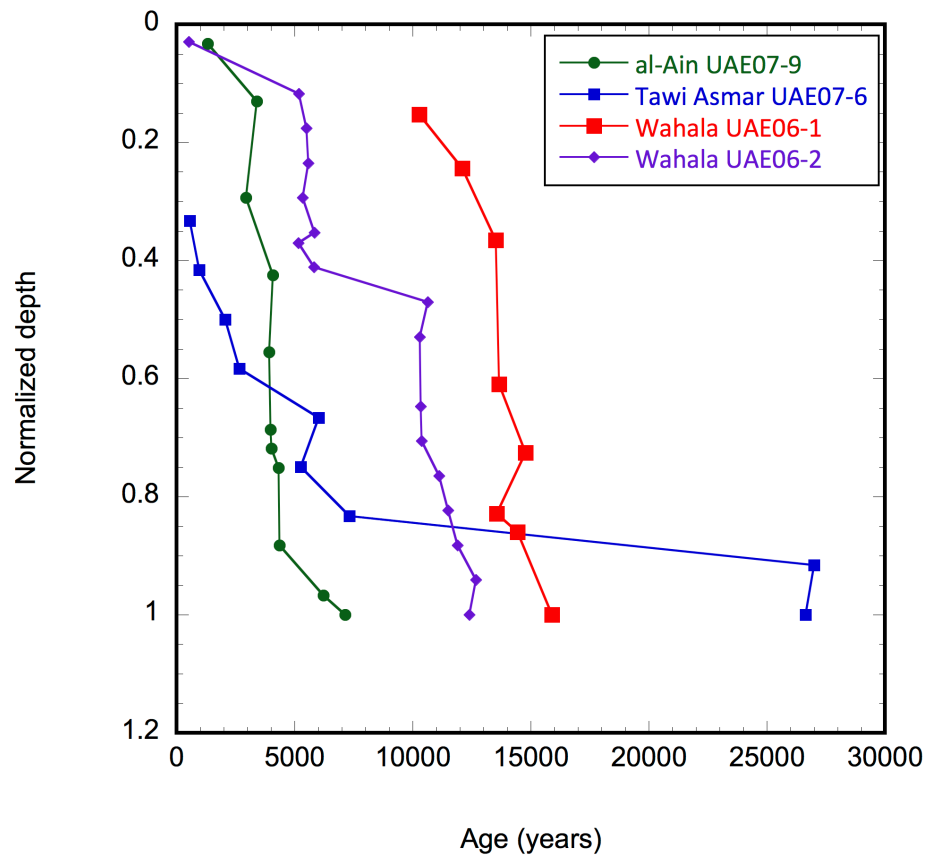
Dune and deposit types



Distribution of ages in time



Last 30 ka – sufficient ages for analysis



Linear Dunes

Rapid accumulation at two periods

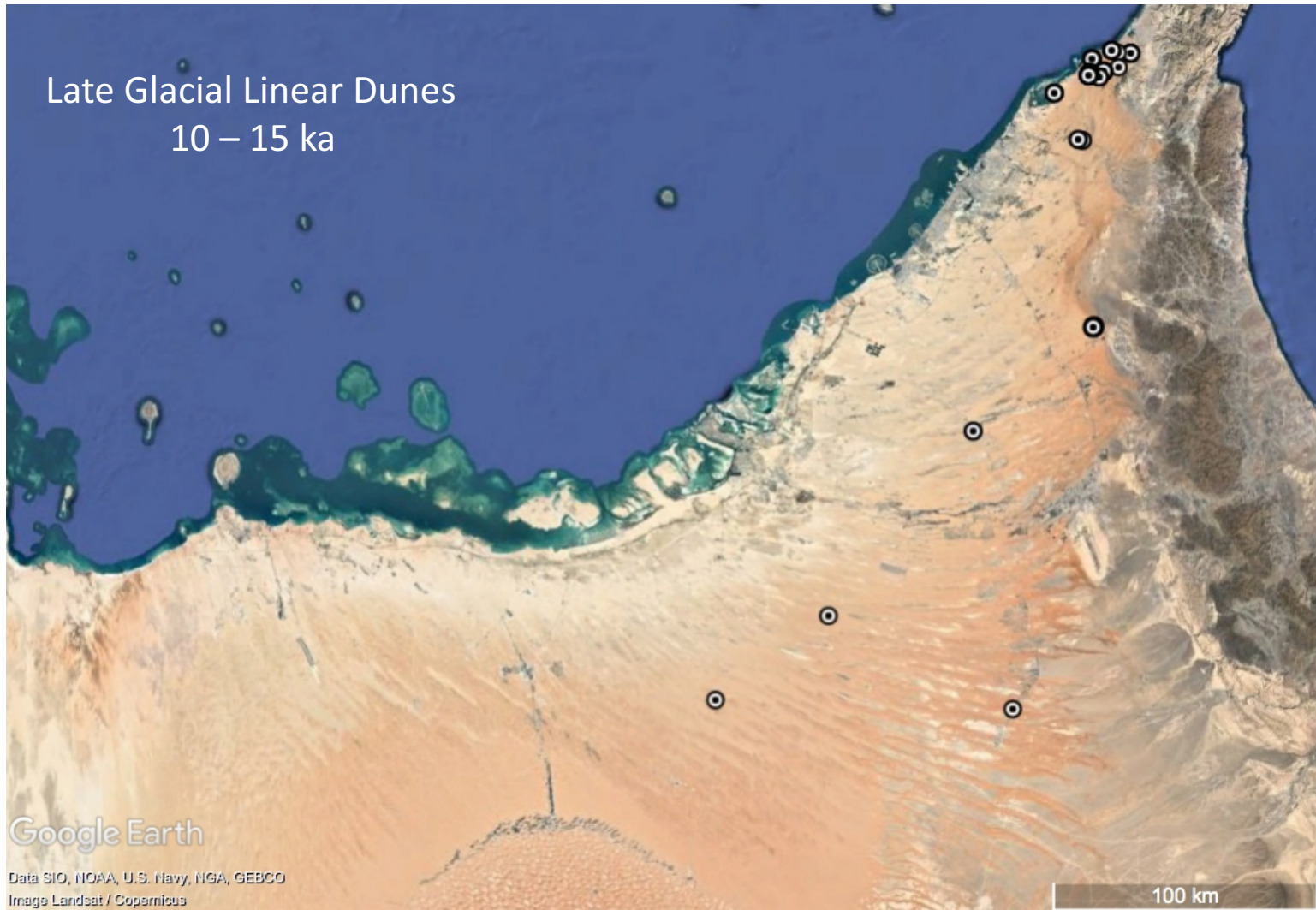
10 – 15 ka

4 -6 ka

Data from:

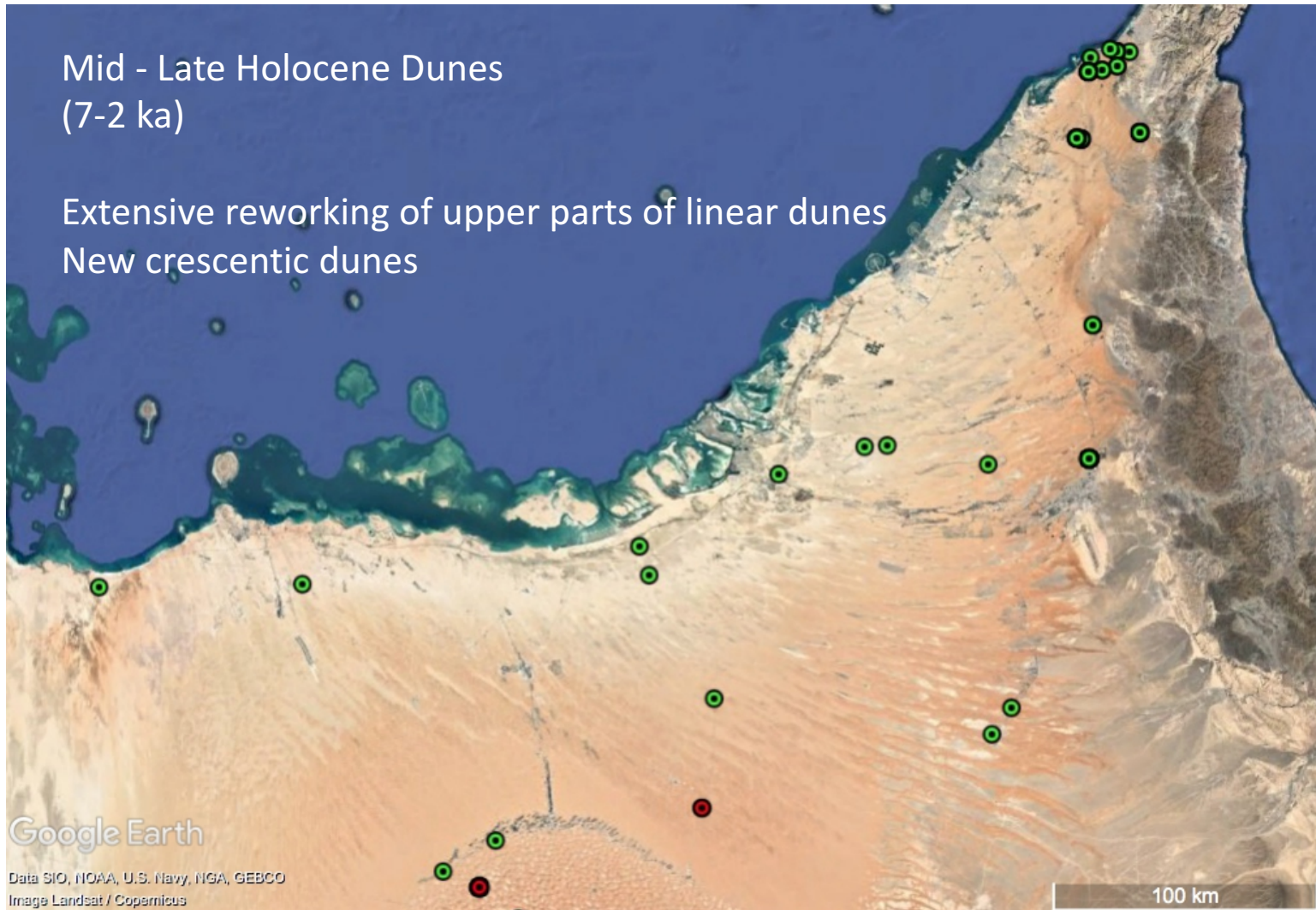
Atkinson, O.A.C., Thomas, D.S.G., Goudie, A.S., Bailey, R.M., 2011. Late Quaternary chronology of major dune ridge development in the northeast Rub' al-Khali, United Arab Emirates. Quaternary Research 76, 93-105.

Late Glacial Linear Dunes
10 – 15 ka

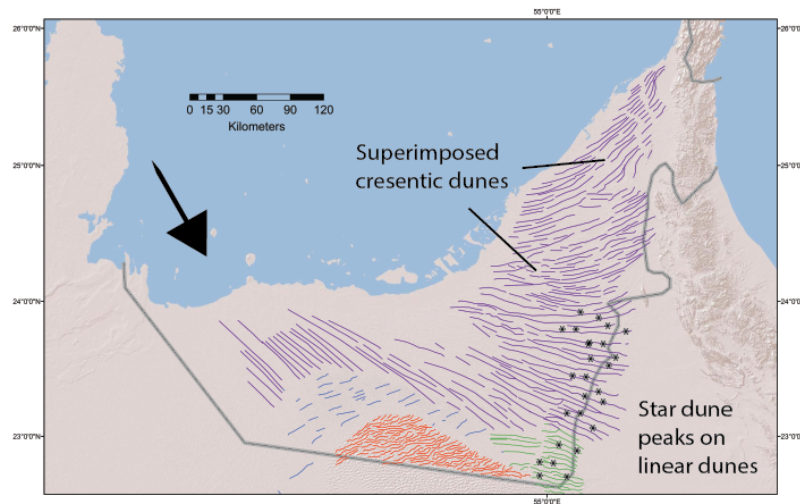


Mid - Late Holocene Dunes
(7-2 ka)

Extensive reworking of upper parts of linear dunes
New crescentic dunes



Dune System Development



7 - 2 ka

Reworking of crestal areas of linear dunes

Formation of coastal carbonate-rich dunes

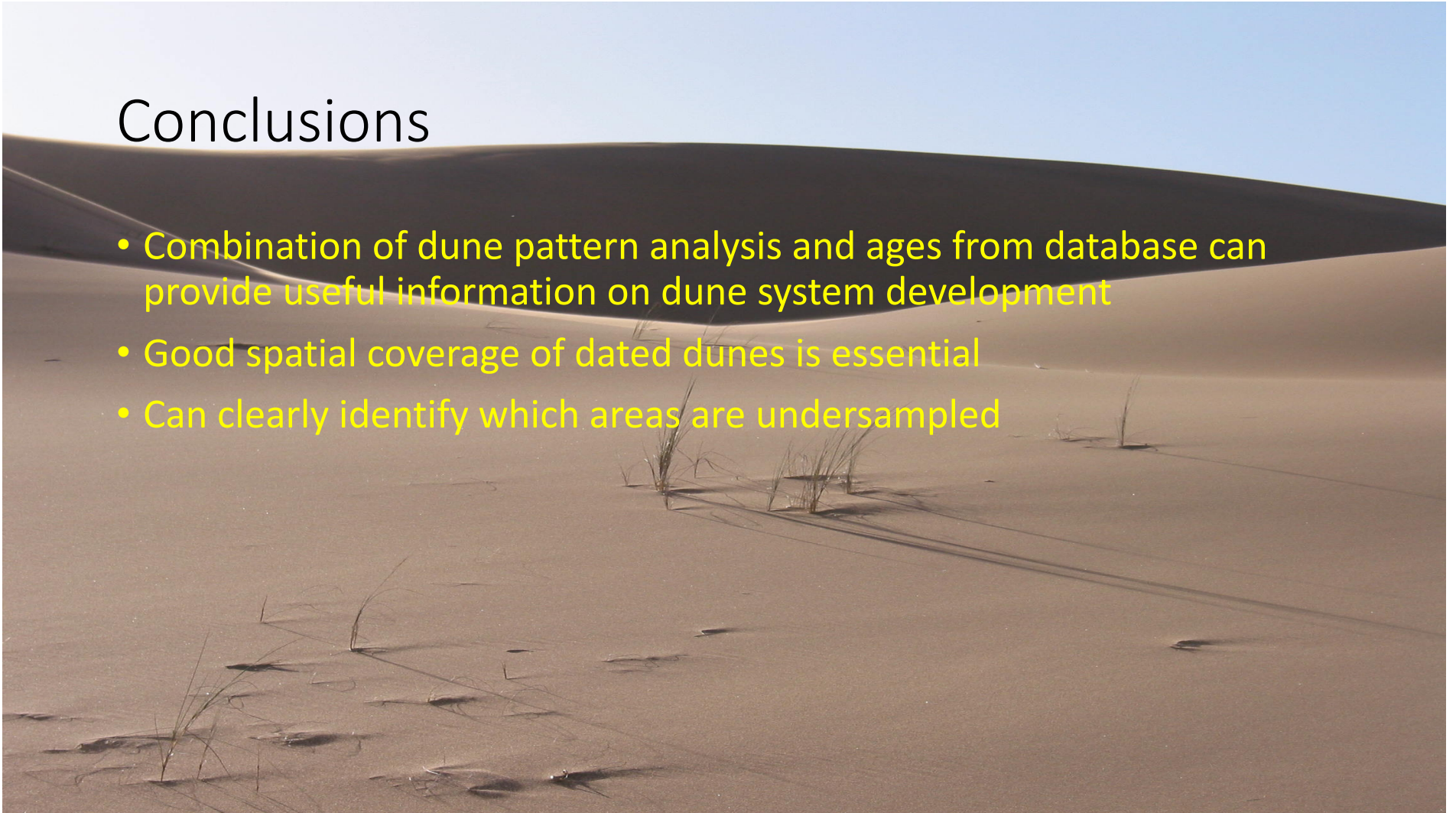
Reworking and formation of crescentic dunes in Liwa - Al Qafa area

Shamal wind regime dominant

Addition of new dune generations
Local reworking of older generations

Conclusions

- Combination of dune pattern analysis and ages from database can provide useful information on dune system development
- Good spatial coverage of dated dunes is essential
- Can clearly identify which areas are undersampled





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