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

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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

Dune mapping and pattern analysis + Luminescence ages from INQUA database

Geomorphic "backstripping" of dune system

Deconstruction of sand sea
Rub’ al-Khali

Largest sand sea in the world (650,000 km$^2$)

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
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

Extant dunes

Precursor aeolian deposits

Age (ka)

Number of Ages

Dunes:
- Crescentic
- Linear
- Sandsheet
- Undifferentiated
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:
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

Addition of new dune generations
Local reworking of older generations

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
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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