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NATURWISSENSCHAFTLICHE FAKULTÄT

Implications for cyclicity-based stratigraphic dating from the selective compaction and cementation of a halysitid coral from the Silurian of Gotland (Sweden)

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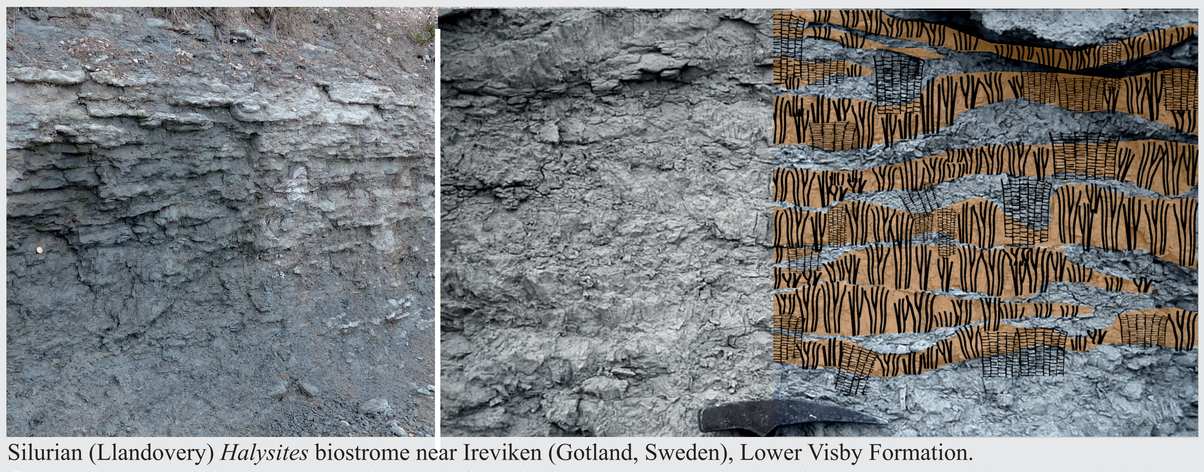
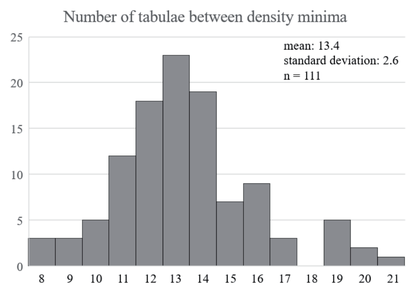
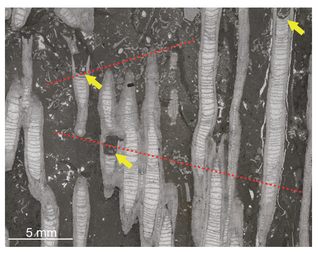


Silurian (Llandovery) *Halysites* biostrome near Ireviken (Gotland, Sweden), Lower Visby Formation.
Calm environment below storm wave base, platform slope, spans several hundret of square meters with up to 1 m heigth.

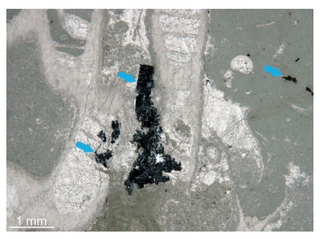
Questions

- How much time is recorded by the coral colony and how does this compare to a single limestone-marl couplet that penetrates through the coral colony as well as the couplets outside the colonies?
- How does the sediment-baffling coral influence the distribution of limestone and marl?
- How well are events, which are recorded in the coral skeletons, displayed by changes in lithology?

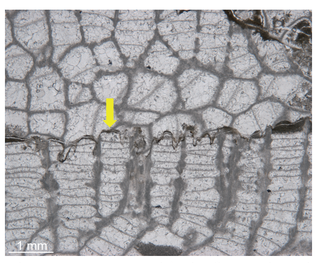




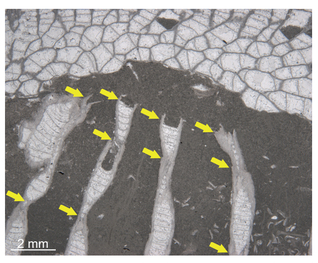
Contemporaneous sediment infill and growth of *Halysites*, and different angles between coarser layers



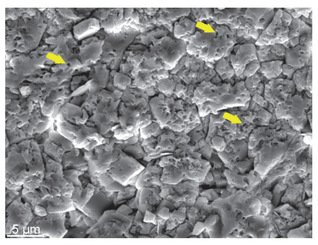
Sphalerite in and outside *Halysites* corallites.



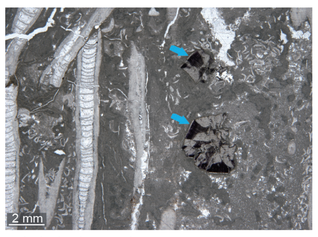
Stylolites show compaction within the favositid coral in the marl. It is too solid to break like *Halysites*.



Contemporaneous death and rejuvenation of *Halysites* corallites indicating changes in the environment.

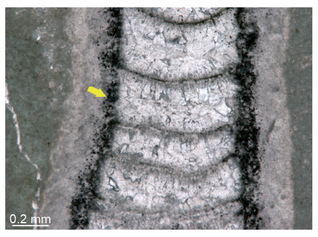


Pitted microspar indicates primarily presence of aragonite needles resp. aragonite mud.

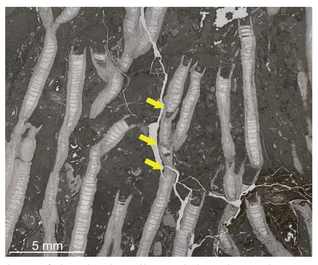


Sphalerite in matrix.

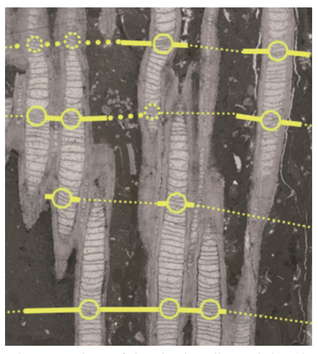
Pyrite in and outside *Halysites* corallites.



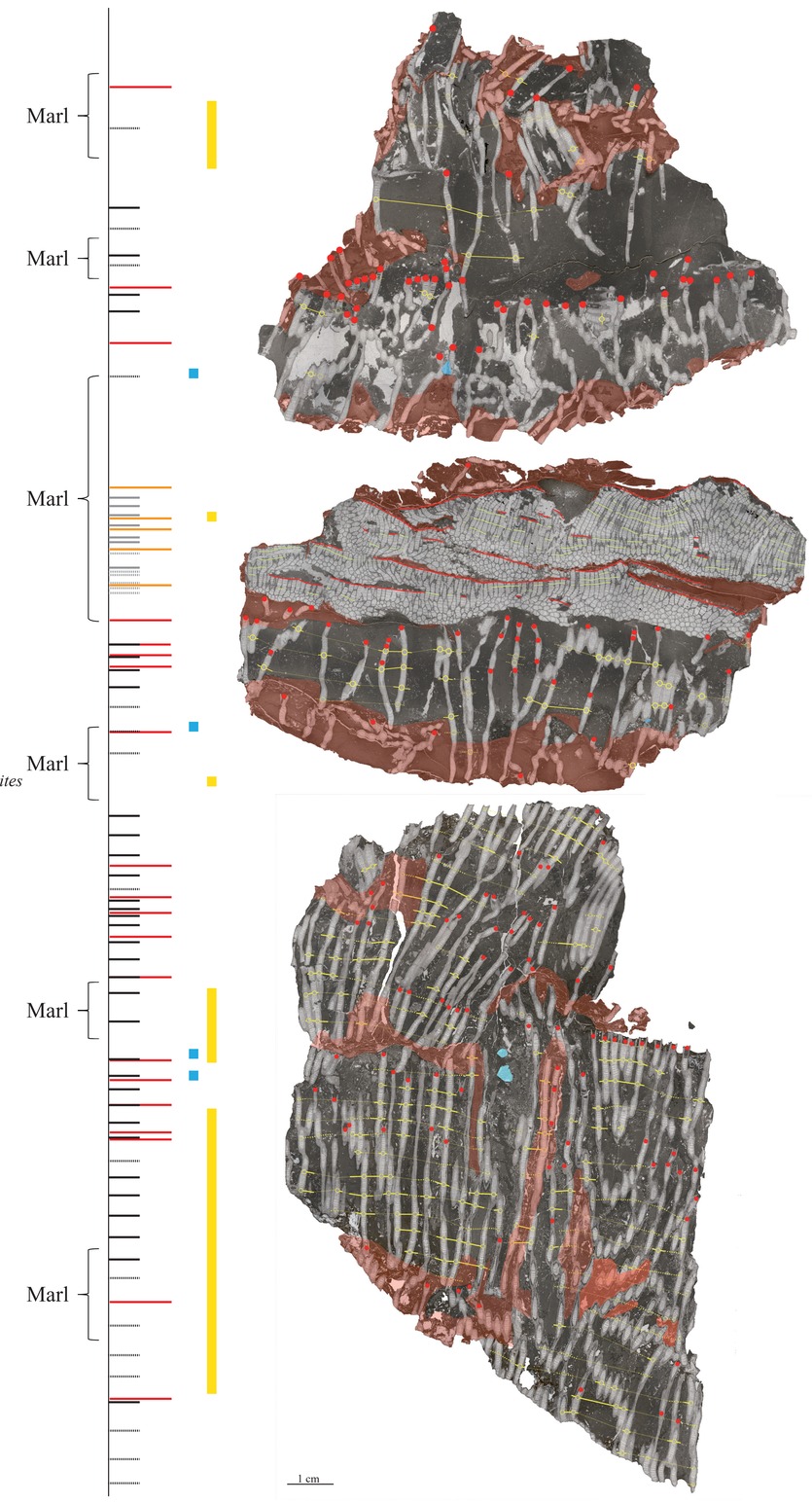
Pyrite in *Halysites* corallite.

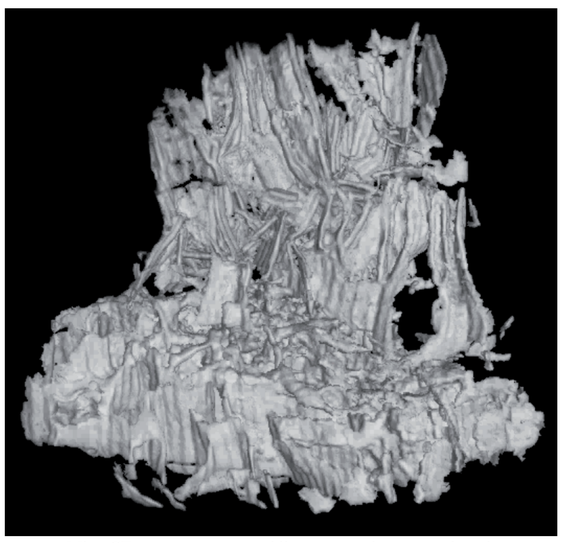


Close-up view of density banding minima in *Halysites*.

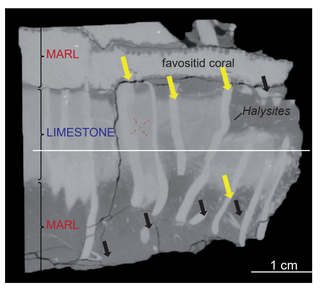


Close-up view of density banding minima in *Halysites*.

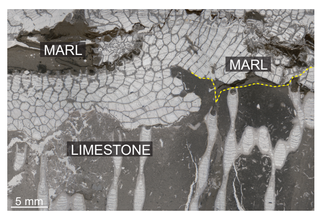




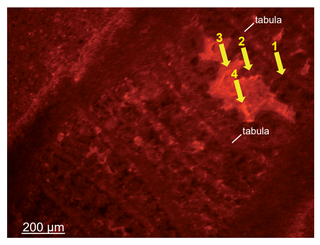
MicroCT-scans: uncompacted limestone and compacted marl, as well as *Halysites* corallites continuing across the boundary

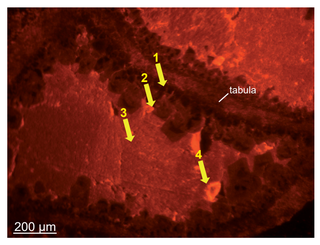


MicroCT-scans: density differences reveal areas of limestone and marl, as well as favositid and *Halysites* coral colonies

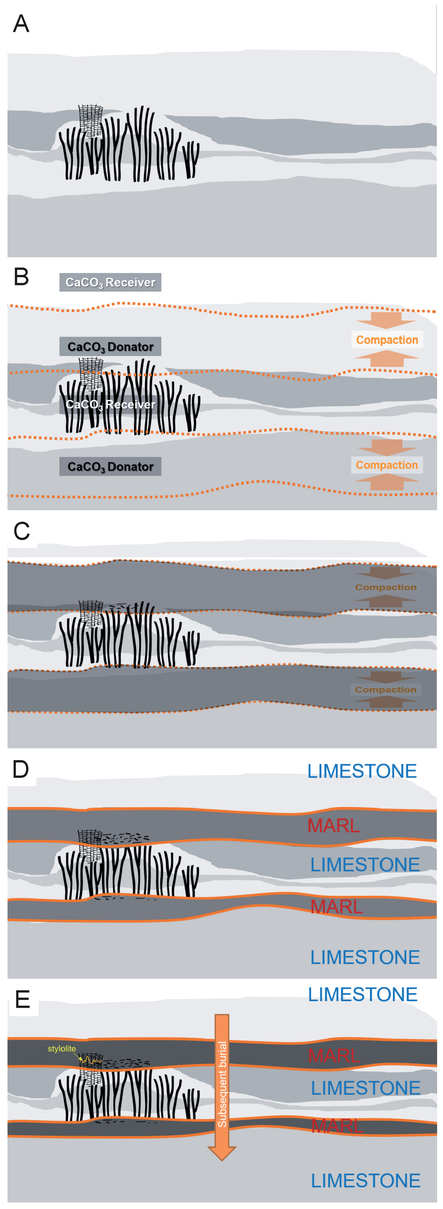


Thin section: favositid coral started growing in limestone area (left side), and in marl (right side)





Cathodoluminescence in *Halysites*: left: limestone, right: marl; the arrows indicate the four cement generations.



Conclusions

- Annual density banding minima provide a temporal framework also for the surrounding limestone-marl alternation, even though limited.
- The reconstructed high sedimentation rate of 3.5 m/k.y. for a short observation interval of slope deposits is in line with the Sadler-effect. But the results imply that the missing time in the depositional record is rather reflected by hiatuses than condensed sedimentary cycles.
- Changes in the depositional environment and primarily sedimentary structures are not necessarily reflected by lithification. The driving mechanism for the bedding of limestones and marls is differential diagenesis and not a change in sedimentary input.
- Aragonite mud can serve as a source for the calcium carbonate redistribution of differential diagenesis.
- Differential diagenesis can distort or disguise primary environmental signals even within reefal structures and can cause a strong preservation bias.
- The time span recorded in a single bed can be inconsistent depending on the spot of observation, putting into question the uncritical application of lithological changes in limestone-marl alternations for cyclostratigraphic analysis.

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