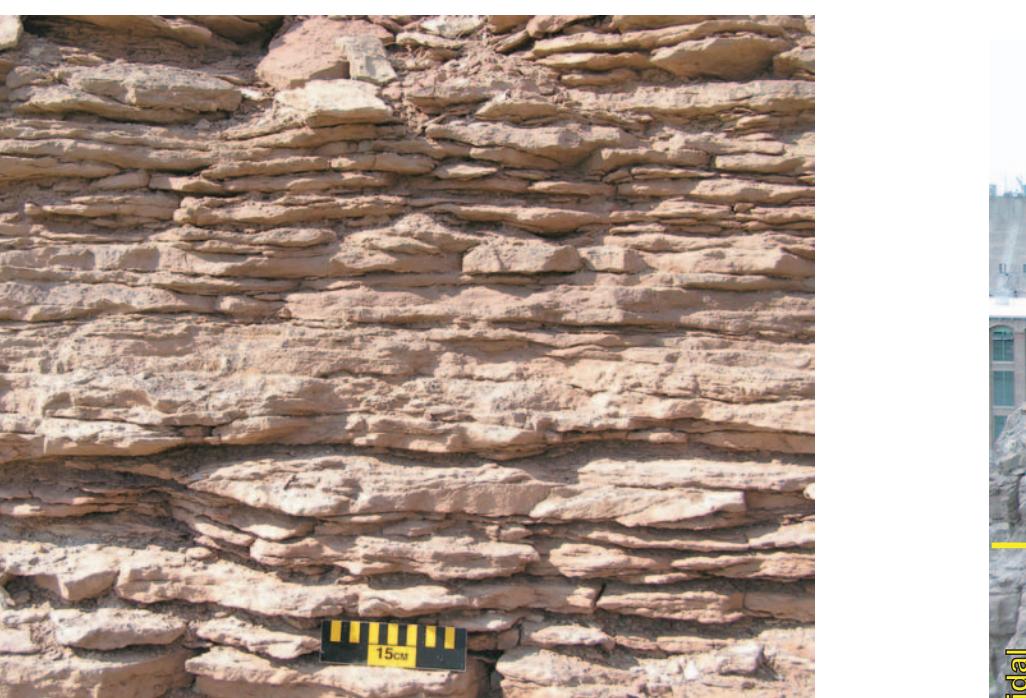


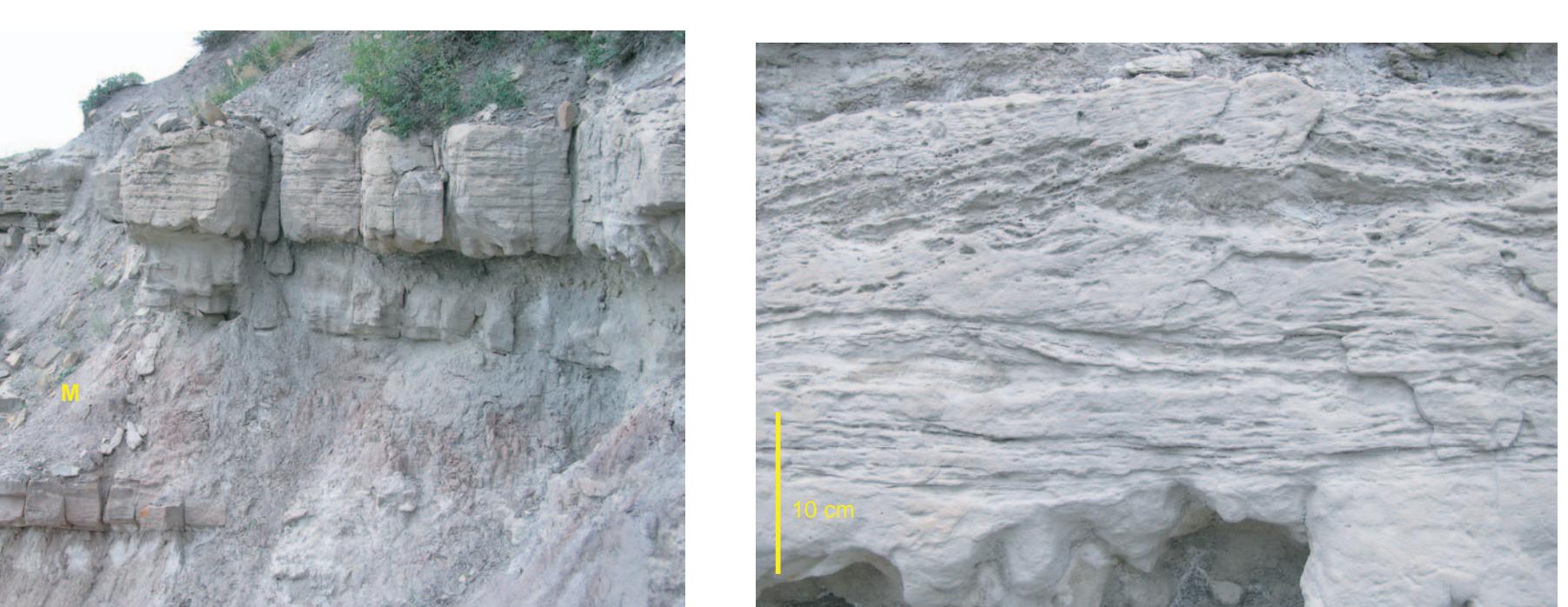
TIDAL FLAT & SUBTIDAL FACIES



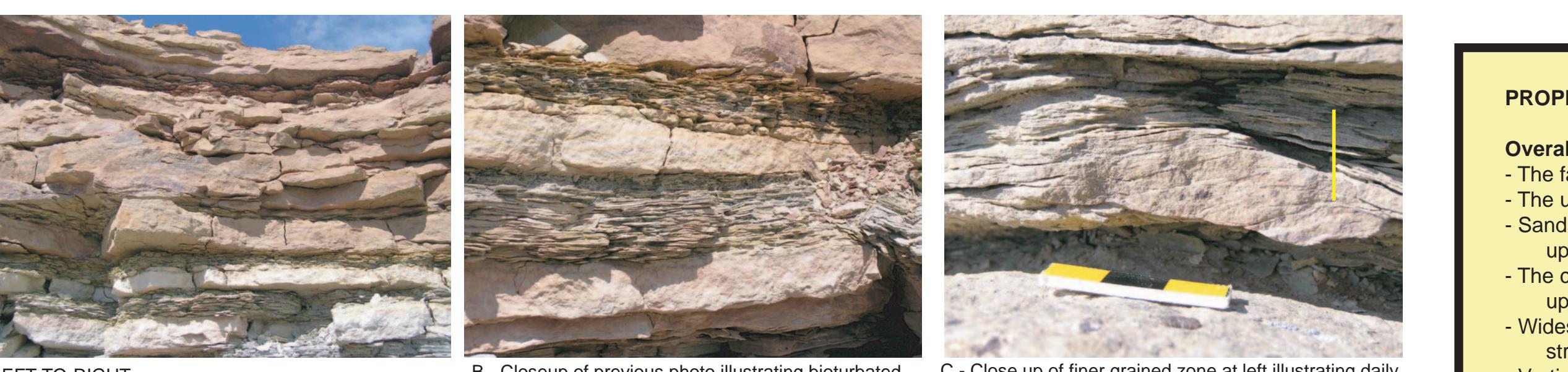
Upward fining and coarsening tidal-flat and subtidal successions above the sand wave facies at Fields, MT. "Mud" and "sd" above designate mudstone- and sandstone-dominated zones at the end points of trends. Stratigraphic section shown in sand wave section of poster #1.



Rhythmic mud and bioturbated sandstone tidal laminations.



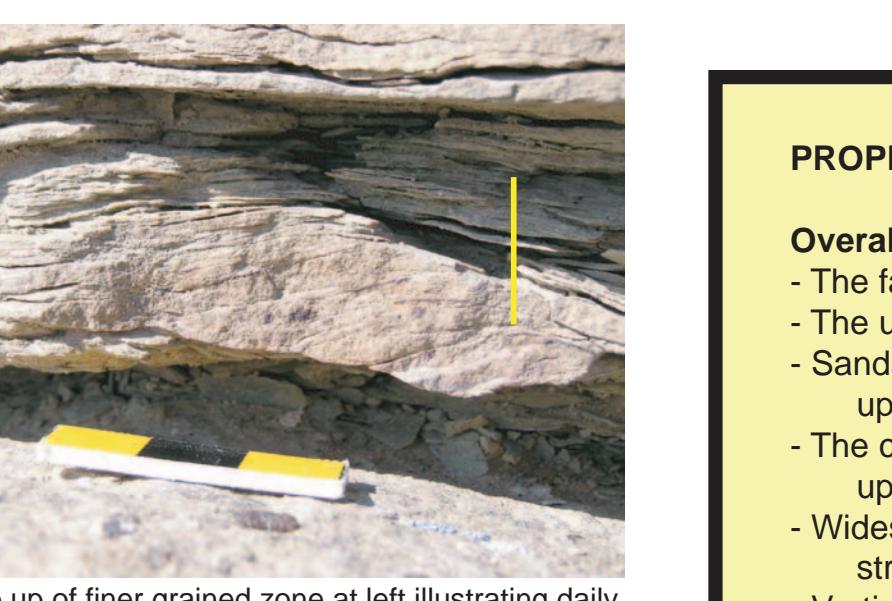
Upward coarsening ("regressive") tidal flat-to-subtidal succession above the tidal channel facies at Ryan Dam. The maroon mudstone unit (M) represents a mud-flat setting whereas the overlying widespread tabular sandstone (see photo to right) represents a higher energy subtidal setting.



LEFT-TO-RIGHT
A - Upward coarsening succession of tidal bedding.



B - Closeup of previous photo illustrating bioturbated sandstone alternating with finer grained zones within which numerous alternating tractive flow and slack conditions are recorded (i.e., daily tidal flux).



C - Close up of finer grained zone at left illustrating daily scale of tidal flux. Alternating tractive flow and slack conditions resulted in mm-scale mud drapes in between ripple foresets and subhorizontal sand laminations. The yellow line indicates a spring-to-neap sequence.



Two temporal scales of tidal sedimentation: A - The spring-to-neap ("biweekly") tidal cycle is reflected by individual upward-finishing bundles of sand and mud laminations. B - A longer term cycle (e.g., yearly) is reflected by overall upward fining and coarsening of tidal bundles.



Close up of bundled tidal laminations and biogenic structures.



Wave-ripple bedforms and corresponding internal structures from within tidal flat facies.



Flaser bedding containing symmetric and asymmetric (current-modified) wave-ripple cross-lamination.

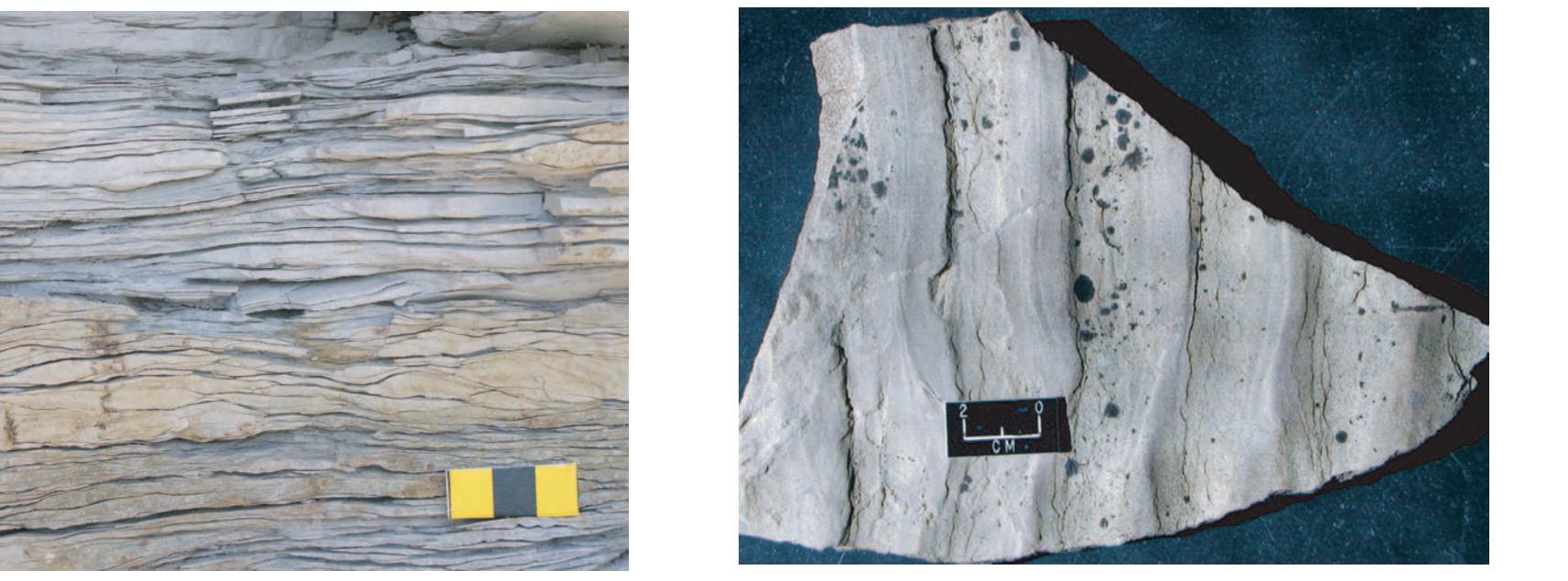
PROPERTIES OF TIDAL FLAT / SUBTIDAL FACIES

Overall

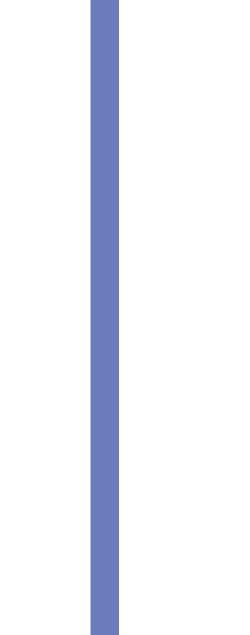
- The facies occurs at the top of the Sunburst interval with a thickness range of ~1- 12 m.
- The upper contact is transitional into oxidized mudstone and lithic sandstone of the nonmarine Kk4.
- Sandstone- and mudstone-dominated units occur; each type of unit consists of upward fining and upward coarsening successions.
- The composite vertical succession ranges from being a single upward-finishing unit to multiple, upward fining and coarsening units that culminate with fining into the Kk4.
- Widespread, generally tabular, rhythmic beds and the presence of tide- and wave-associated structures indicate deposition in tidal and supratidal flat settings.
- Vertical increases in mudstone, degree of bioturbation, organic debris, and oxidation reflect landward shallowing and energy decrease from intertidal mixed- to supratidal mud-flat settings.
- Thicker, coarser, amalgamated sandstone beds with a relative abundance of current ripple forms, medium-scale trough cross-stratification, and undulating or channel-like scour surfaces are consistent with modern subtidal sand-flat settings where tidal-current and wave-energy increases.

Other Sedimentary Structures

- Flaser bedding and wavy bedding.
- Bimodal cross-stratification.
- Lingoid/lunate- and flat-crested wave-ripple bedforms.
- Mud drapes.
- Bundles of spring-neap parallel laminations.
- Shallow erosional channels (gullies) and furrows (gutters) filled with sand and mud (produced on tidal flats during emergence and runoff).
- Abundant bioturbation, commonly overprinting physical structures. Various ichnogenera including *Planolites*, *Diplocraterion*, and lingulid and horseshoe crab trace fossils (an estuarine tidal flat association).



Flaser bedding containing undulatory sandstone laminations and asymmetric wave-ripple cross-lamination.

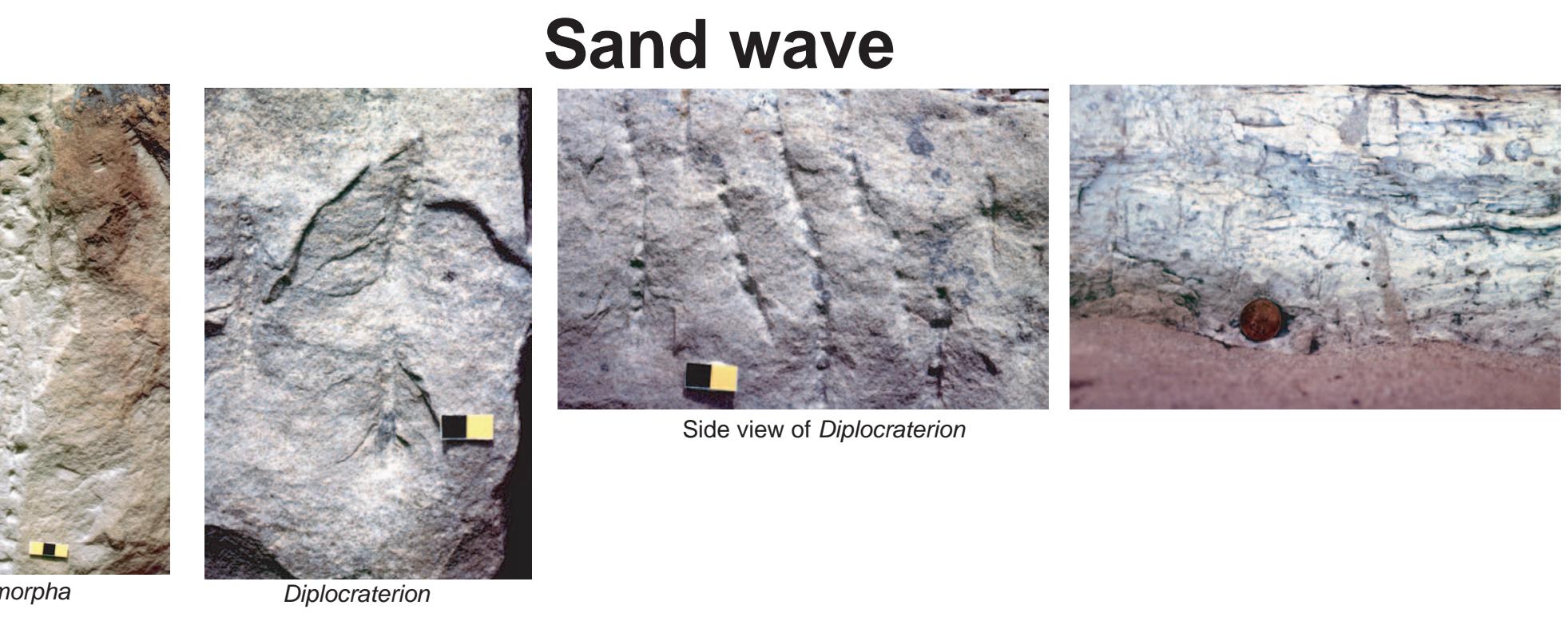


Flat-crested wave ripples caused by emergence in intertidal setting.

TRACE FOSSILS

The following trace fossils, although mostly unidentified, serve to further establish a marine to brackish water setting.

Sand wave

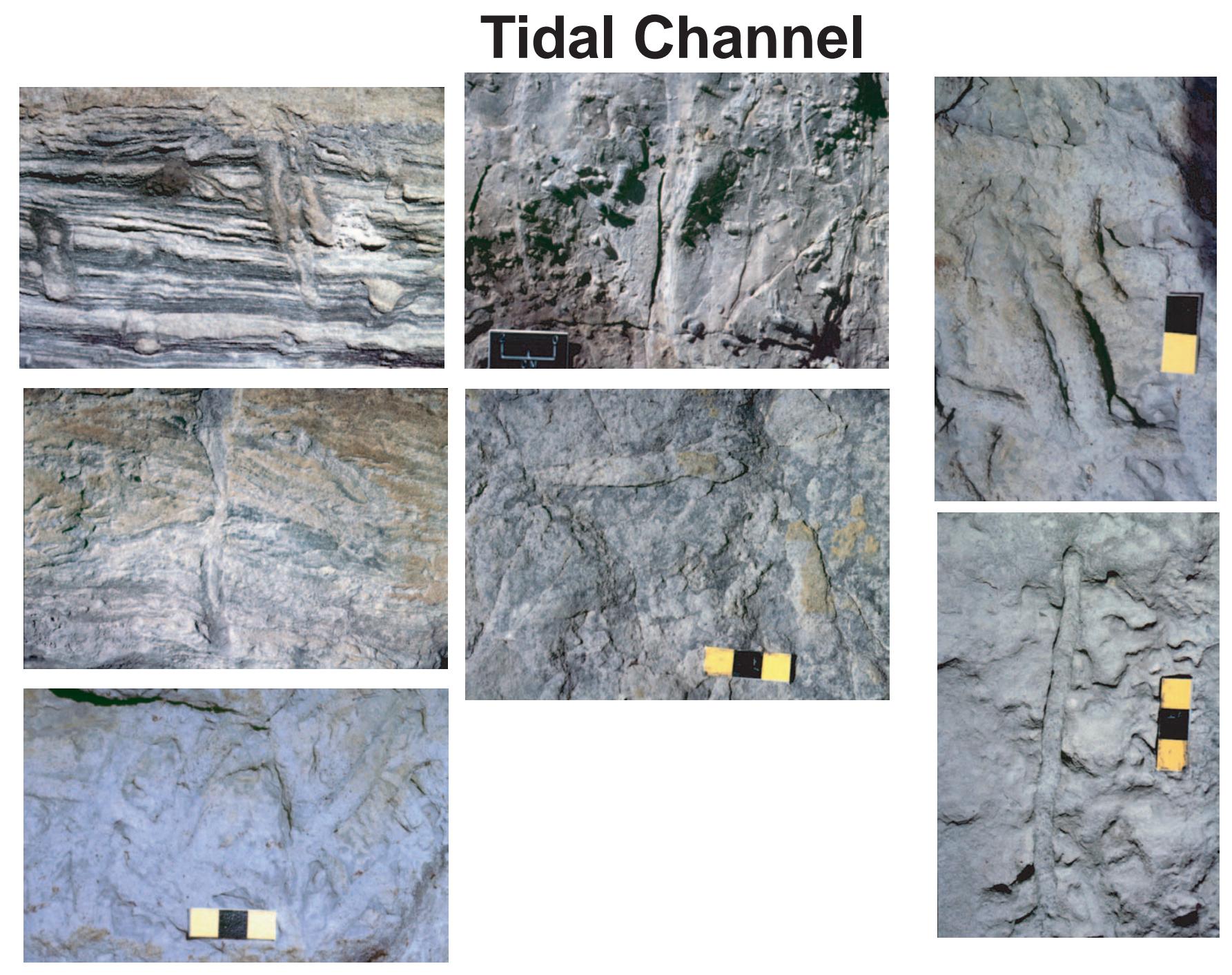


Side view of *Diplocraterion*

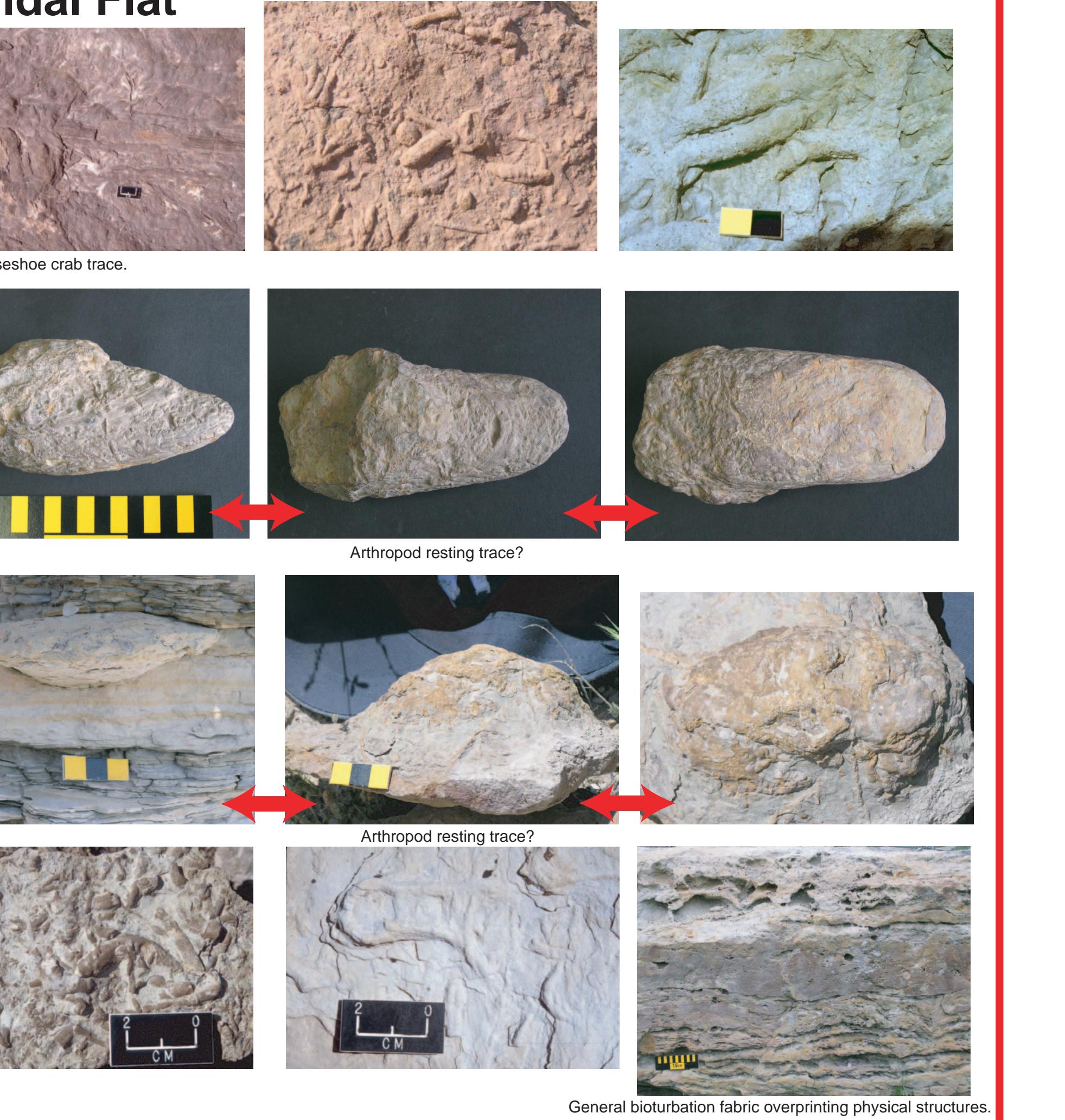
Ophiomorpha

Diplocraterion

Tidal Channel



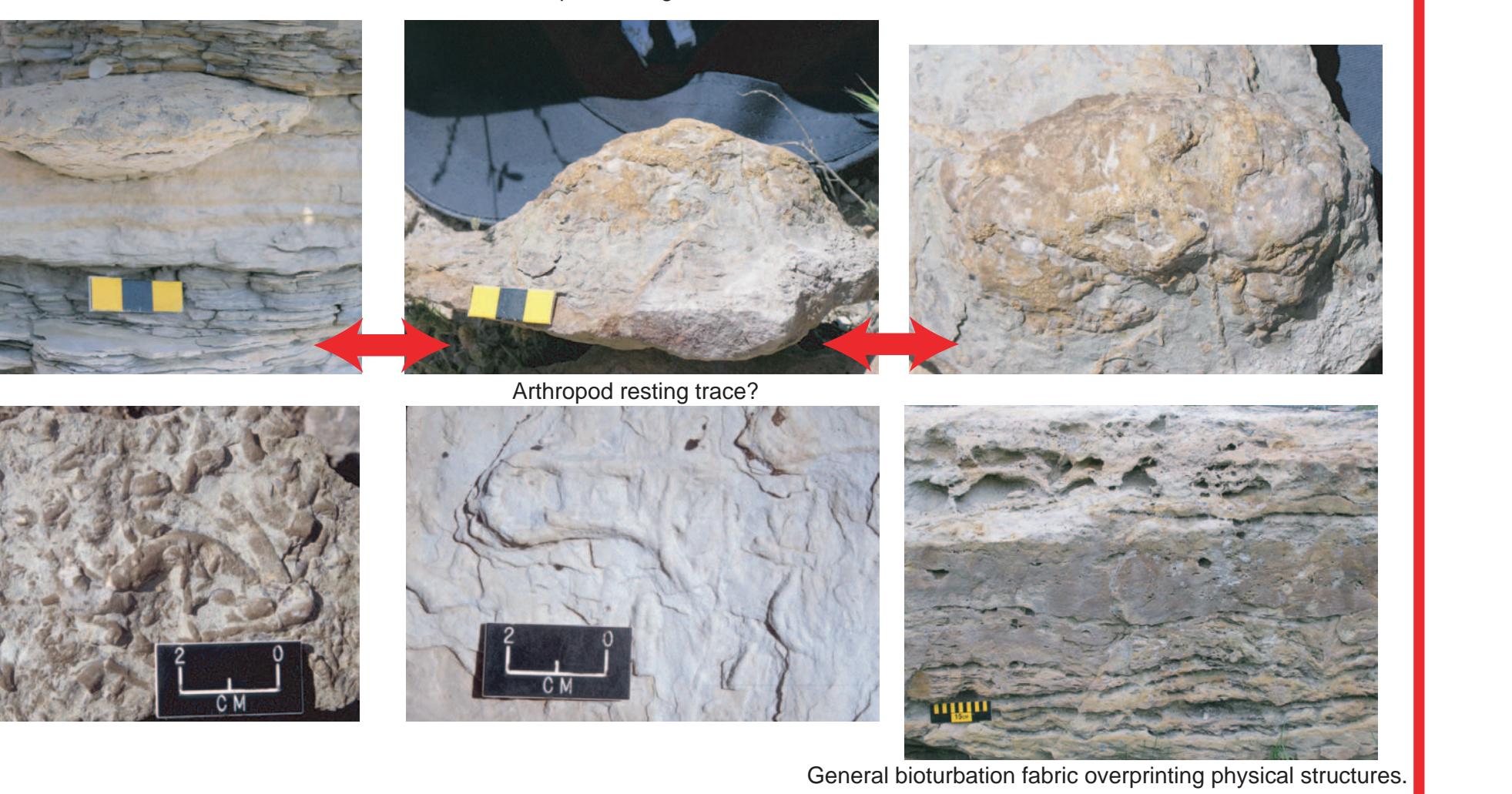
Tidal Flat



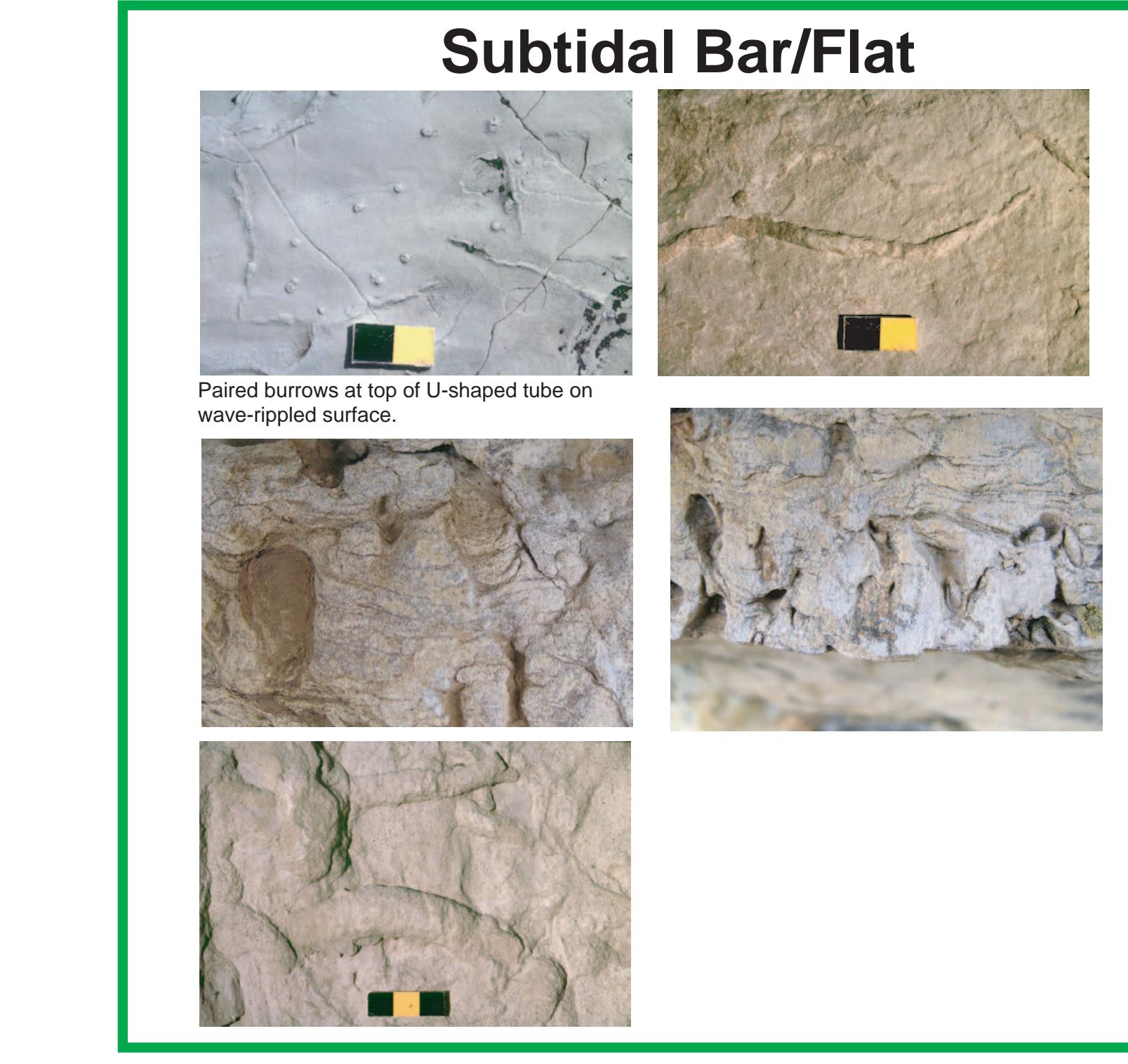
Horseshoe crab trace.



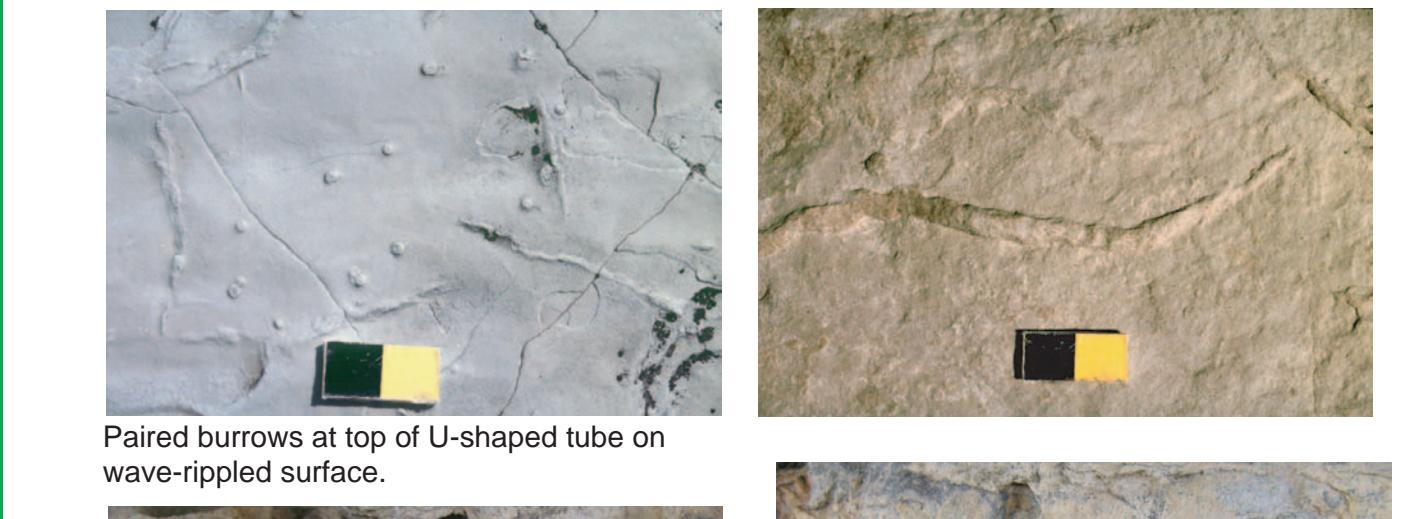
Arthropod resting trace?



Arthropod resting trace?



Subtidal Bar/Flat



Paired burrows at top of U-shaped tube on wave-rippled surface.



General bioturbation fabric overprinting physical structures.

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