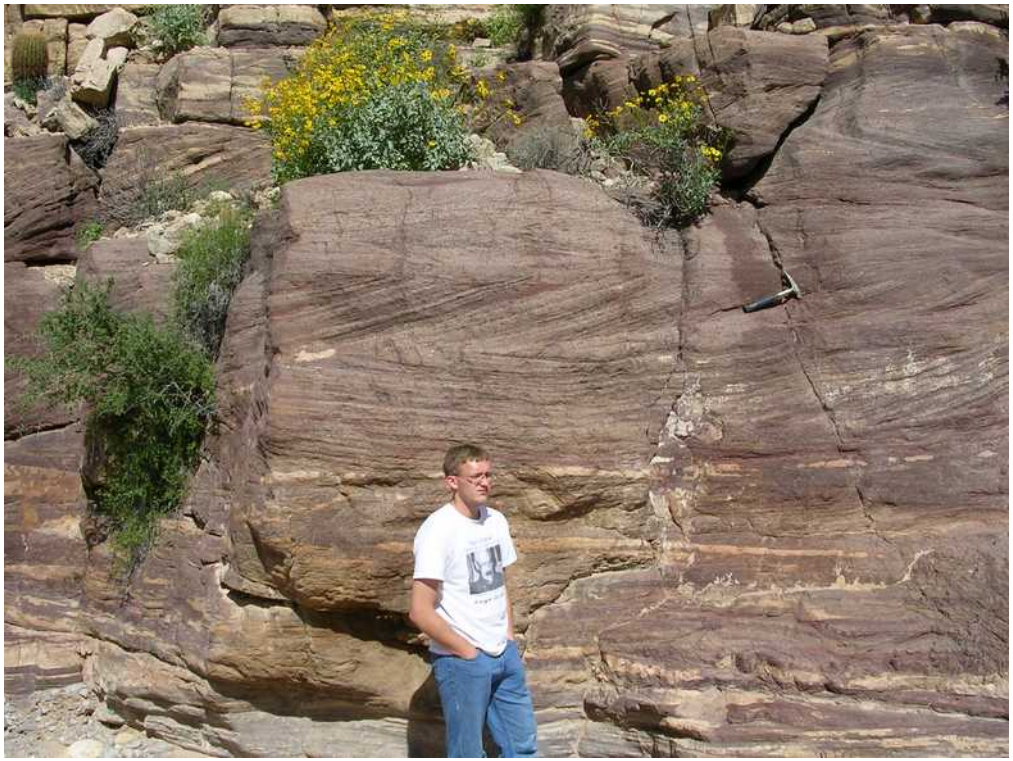
Interpreting Sedimentary Rocks



Types of sedimentary rock

Clastic

Formed by mechanical breakdown of source material

Composed of rock fragments and individual grains

Examples include breccia, conglomerate, sandstone, mudstone

Chemical

Formed by precipitation of material from solution

Composed of crystalline or cryptocrystalline minerals, often cemented together

Examples include some limestones, rock salt, iron ore, chert

Organic

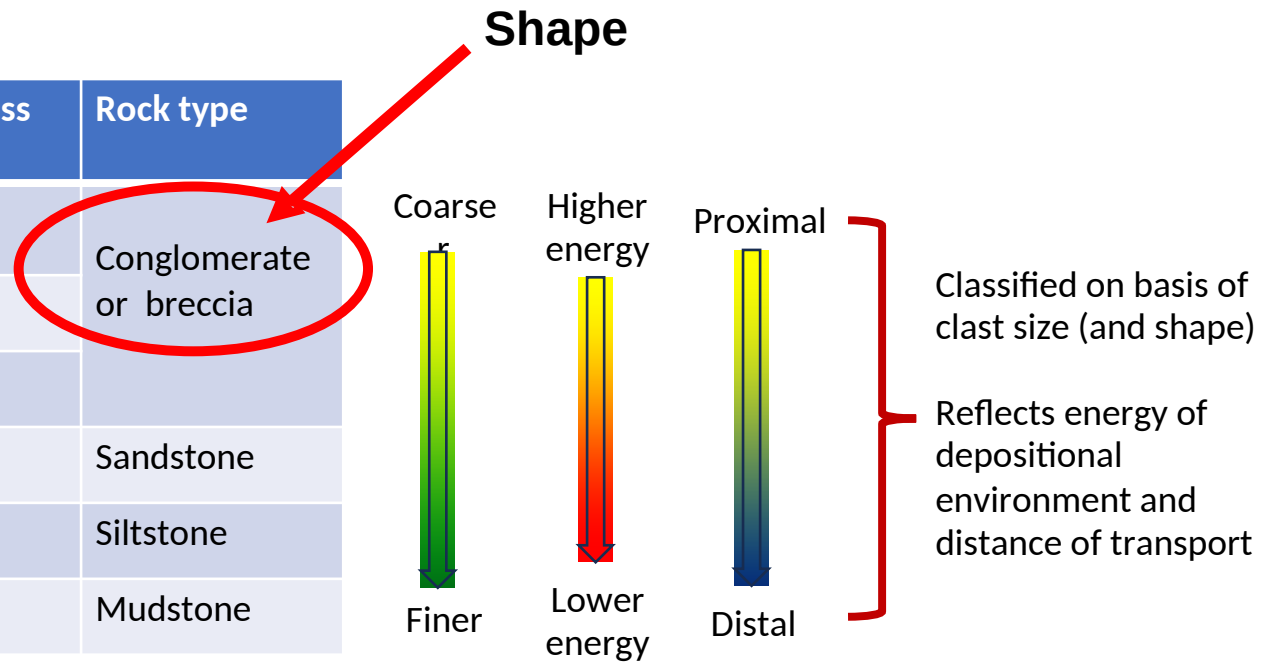
Formed by accumulation of plant or animal debris

Composed of organic materials or excreta sometimes cemented together

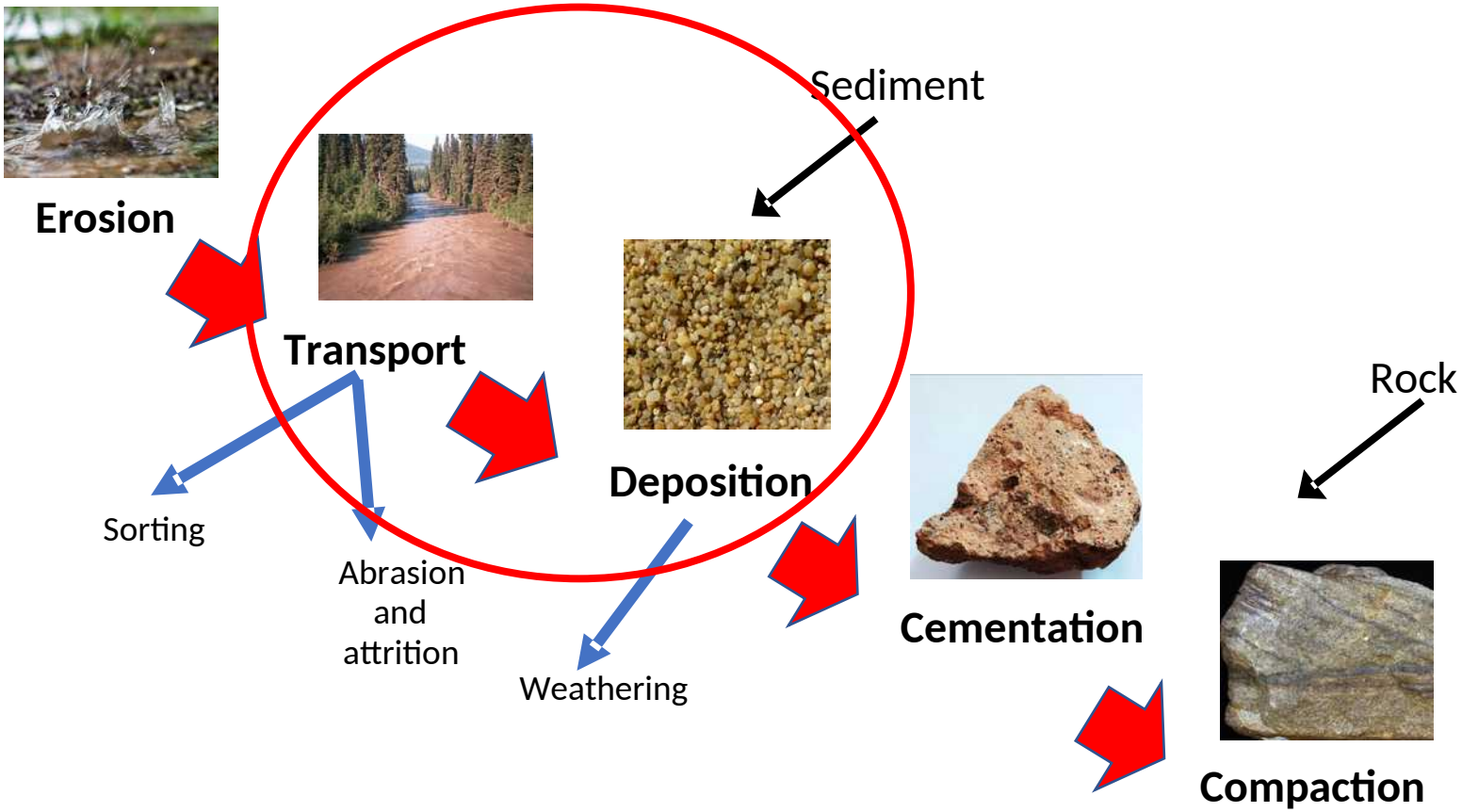
Examples include chalk, shelly (e.g. reef) limestones, coal, flint(?)

Classification of clastic sedimentary rocks

Diameter (mm)	Sediment class	Rock type
> 200	Boulders	Conglomerate or breccia
63 - 200	Cobbles	
2 - 63	Gravel	
0.063 – 2.00	Sand	Sandstone
0.002 – 0.063	Silt	Siltstone
< 0.002	Clay	Mudstone



Clastic sedimentary rock formation



Sediment transport in a fluid medium

What did you see?

Sediment moves intermittently

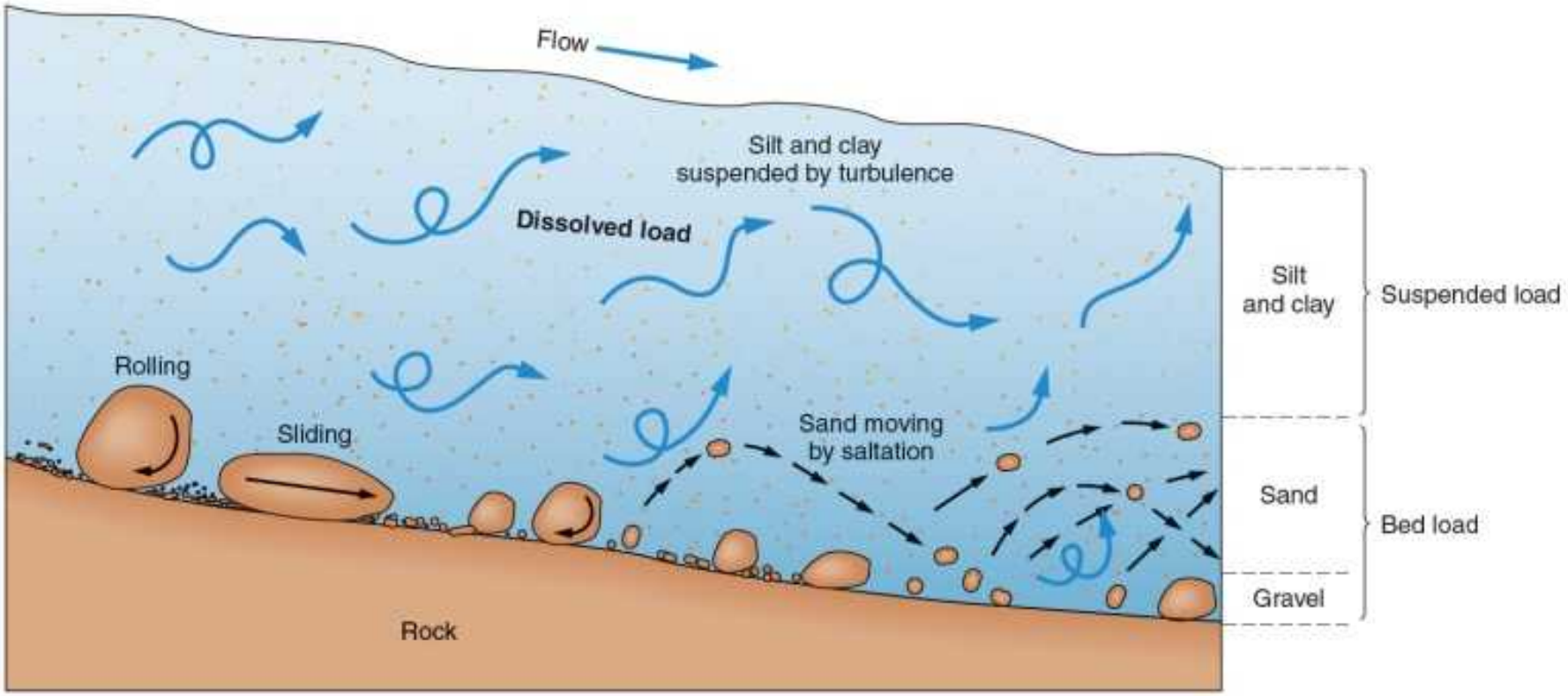
Clasts move in different ways – e.g. rolling, sliding, bouncing, floating

Clasts sometimes gets pushed into moving by the force of other clasts

Sediment moves at different heights within the water column

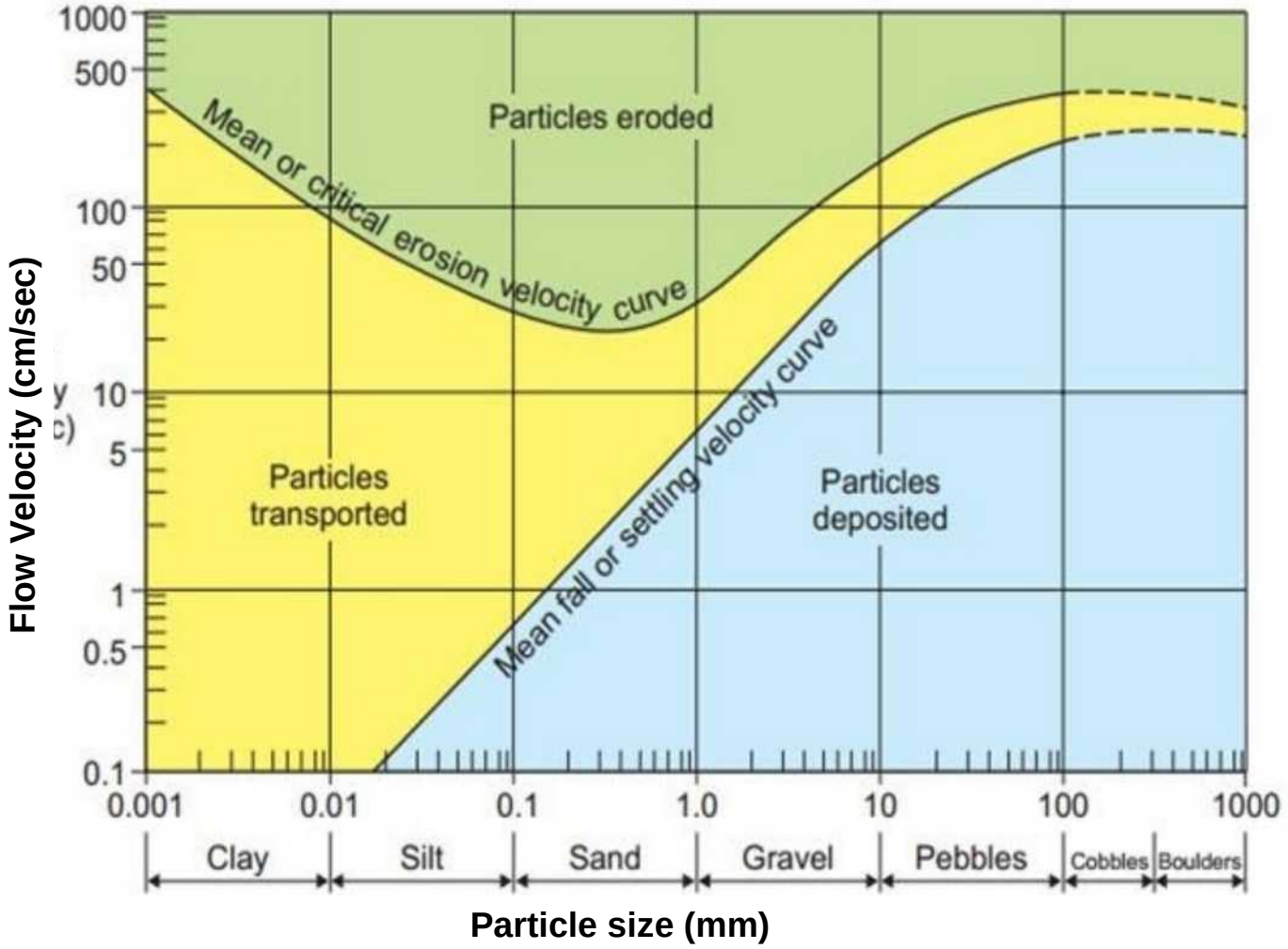
Sediment moves at different speeds

Pathways of sediment transport

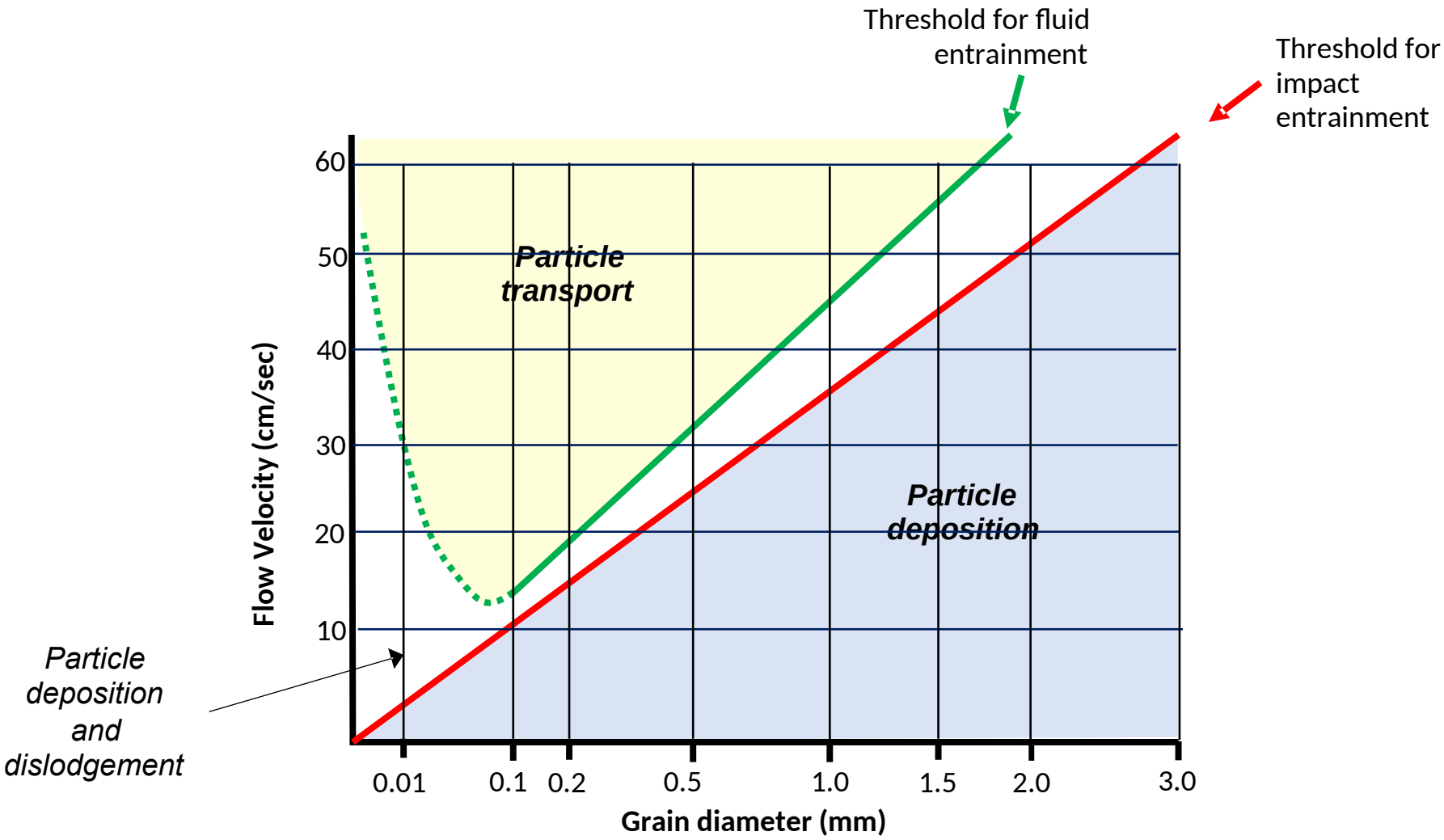


Material higher in the water column move faster.
Friction slows water velocity and sediment movement near the bed

Flow velocity and sediment transport:
Fluvial environments (the Hjulstrum diagram)

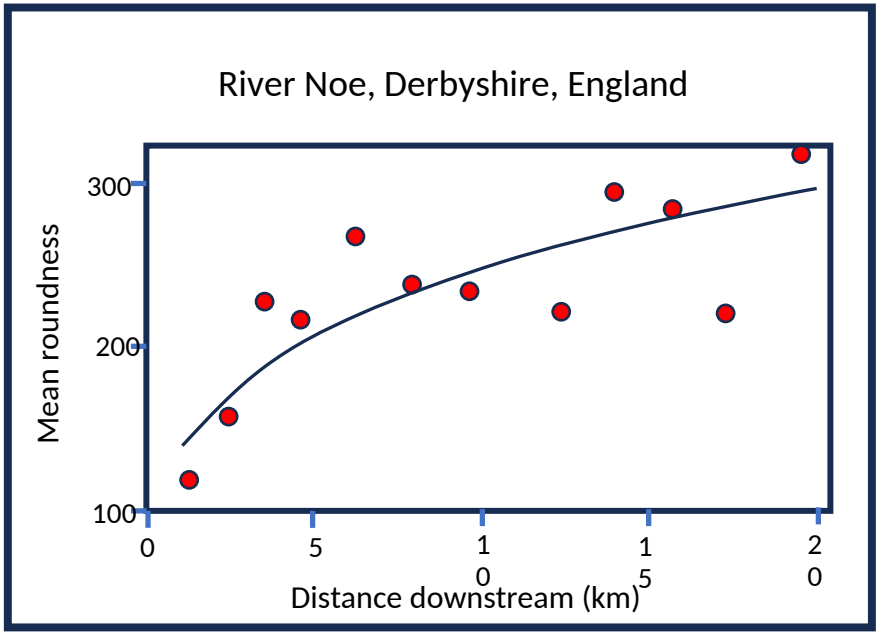


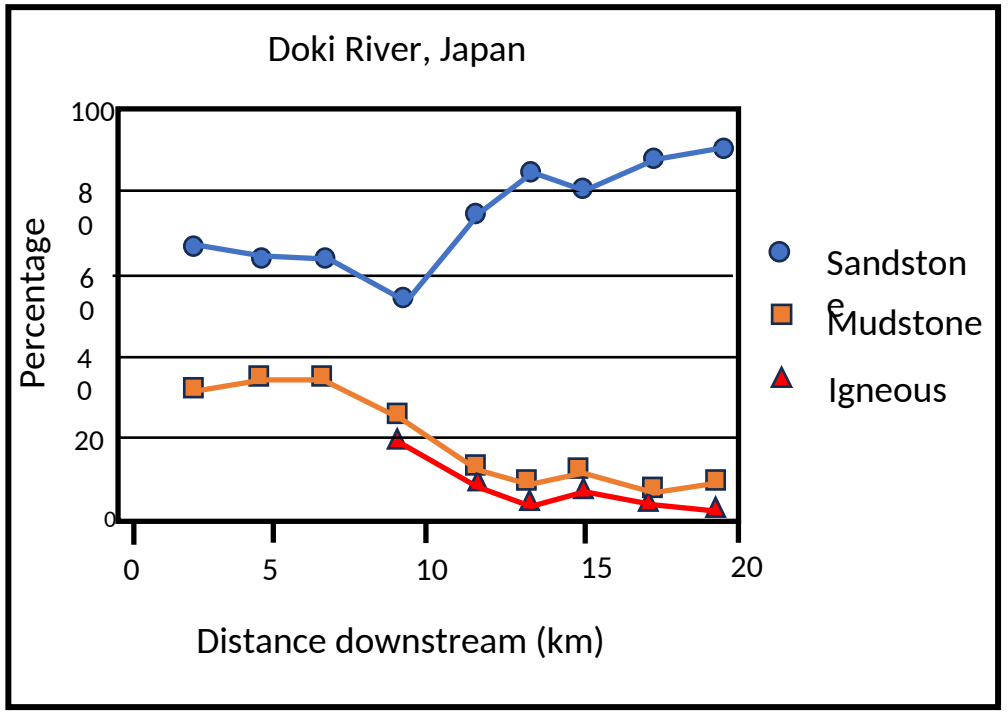
Flow velocity and sediment transport
Aeolian environments (the Bagnold Diagram)



Changes in sediment characteristics during transport

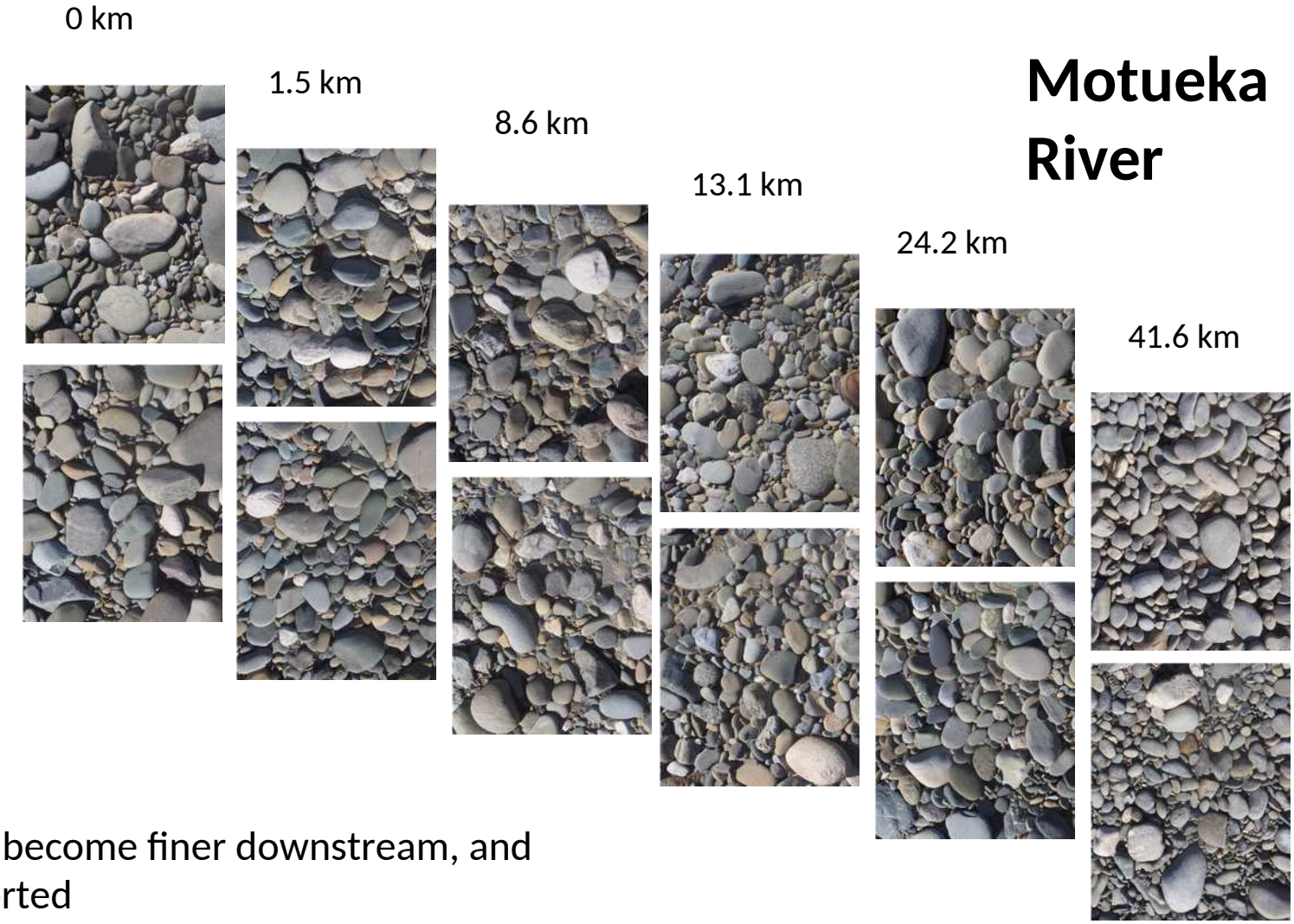
Particle shape





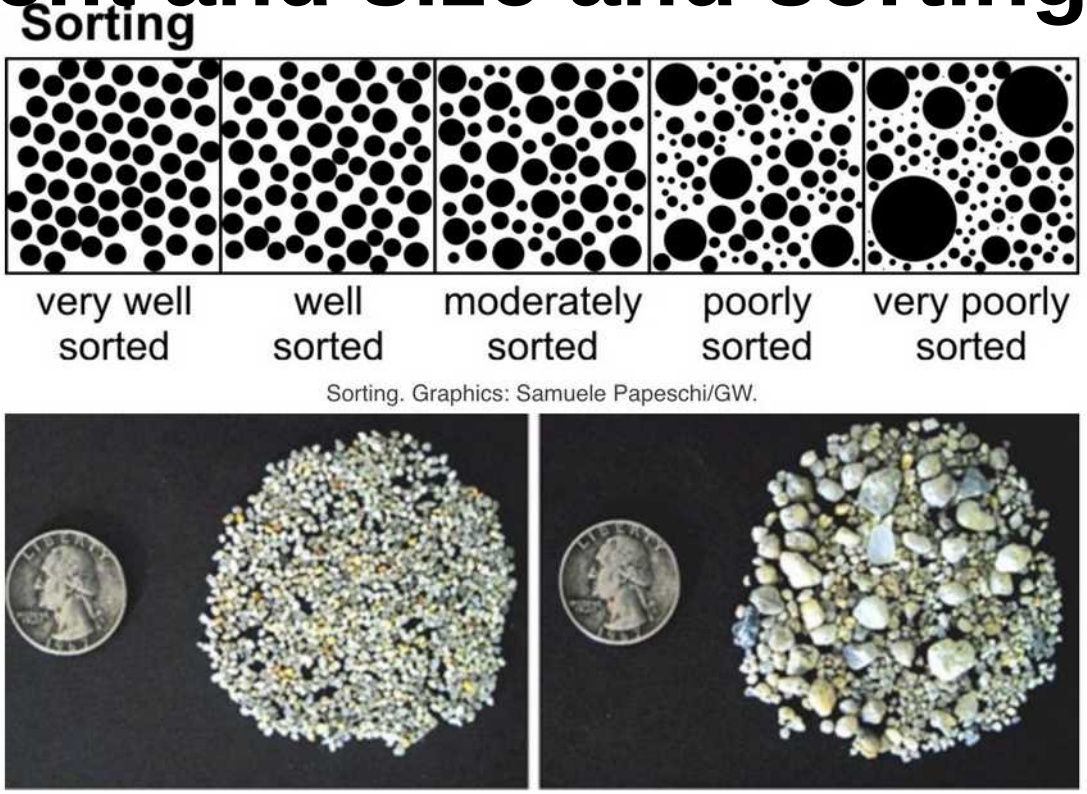
Lithology

Effects of sediment entrainment and transport: size



Particles become finer downstream, and better sorted

Sediment and size and sorting



Poorly sorted sediments may be caused by:

- The viscosity/density of the medium (e.g. ice) which limits segregation of the sediment load
- Variations in flow velocity
- Infiltration of finer sediments into coarser ones

Sorting and texture

Matrix supported conglomerate

The finer material (matrix)must have been laid down at the same time at the coarser clasts

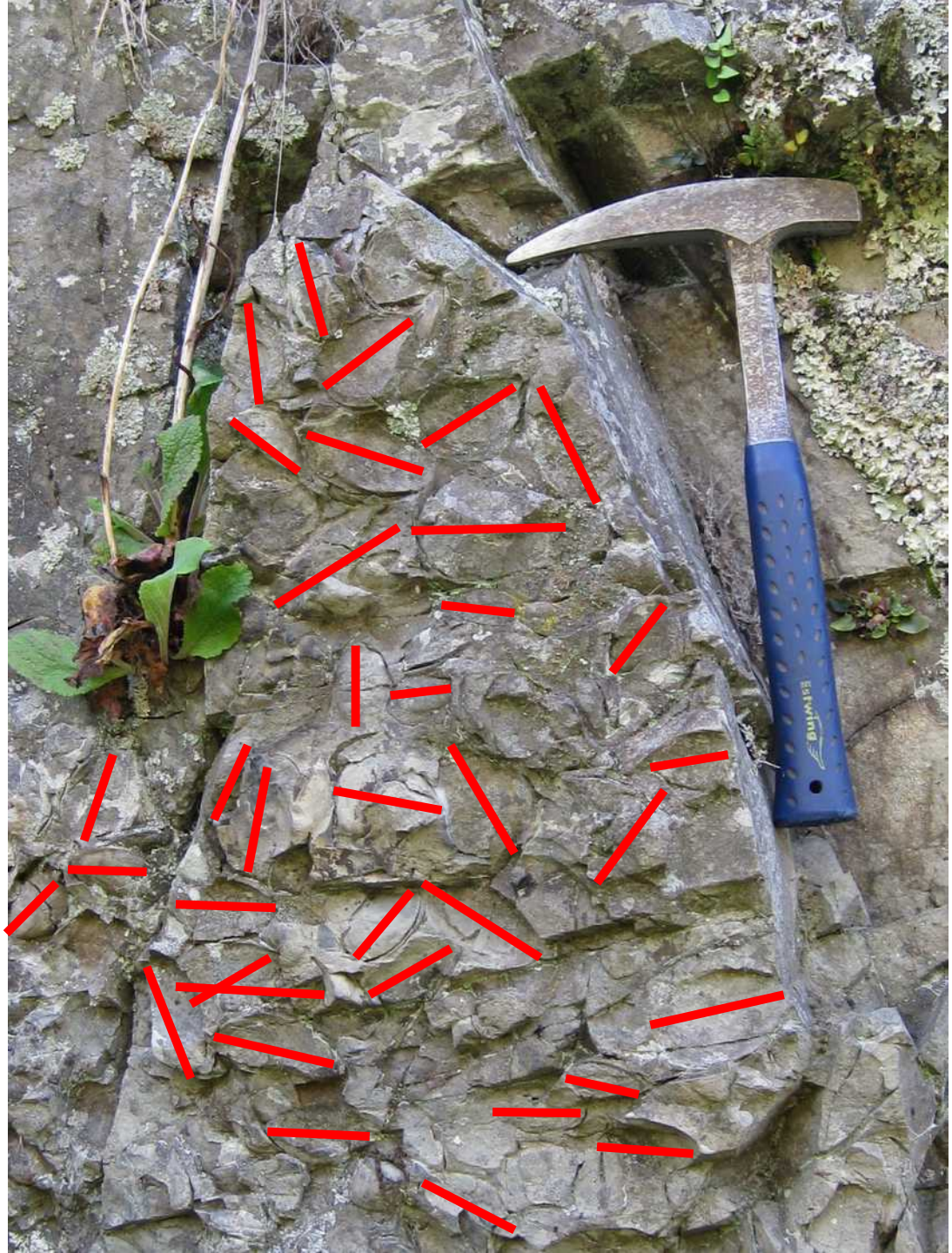
This suggests variable and probably turbulent flow

Clast supported conglomerate

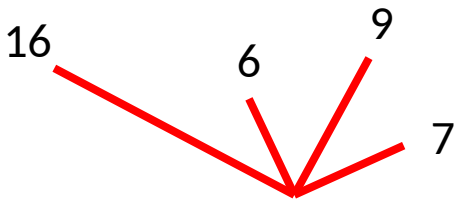
The finer material (matrix) may may been infiltrated into the gravel after it was laid down)

Anything else of note in this specimen?

Manticula problematica bed, Highfield



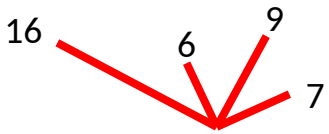
Orientation



Sediment fabric

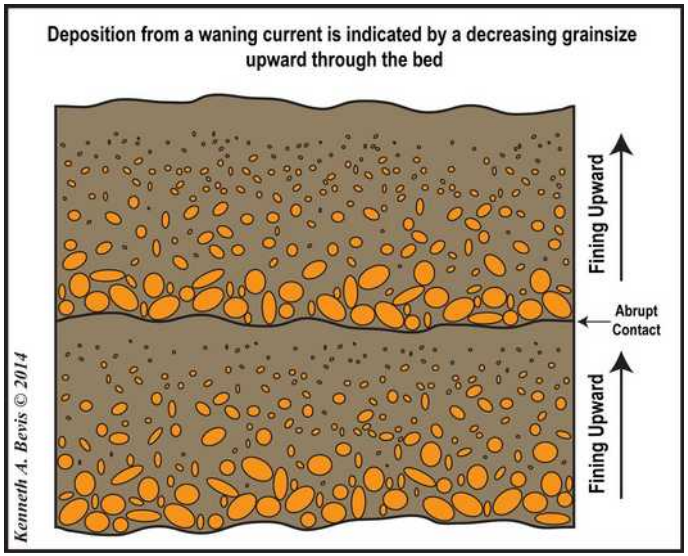
Imbrication in river gravels.
Motueka River
The stream flows from right to left

Orientation



A fossil bed in the Triassic rocks at Highfield farm (*Manticula problematica*)

Graded bedding



Slope-wash gravels?, Cobb Valley

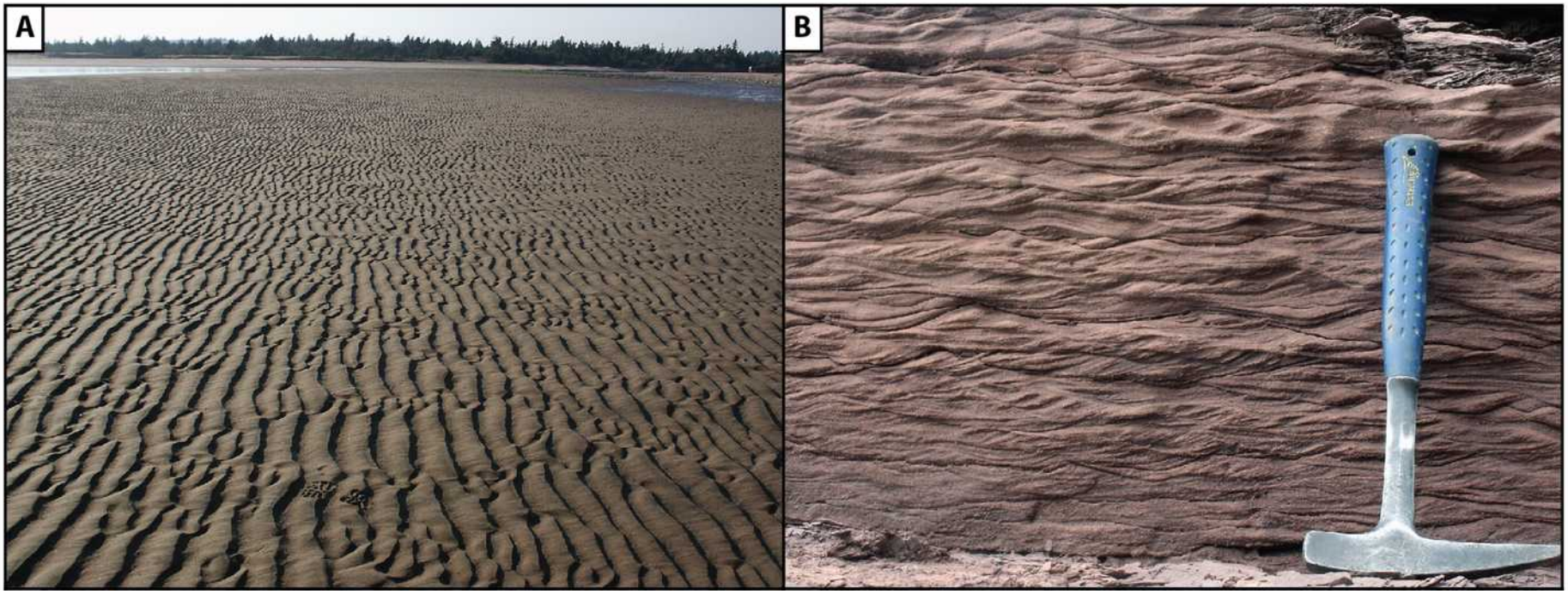
Sediment transport in a fluid medium

Sediment movement in oscillating flows

Bedforms: plane bedding

Forms in unidirectional currents at low flows in coarse material or high flows in fine material. Often shows lineations on the surface - i.e. bedding plane (inset)

Ripple bedding: unidirectional flows



In unidirectional flow (e.g. a stream) ripples are asymmetrical (steeper on the downstream side) and migrate downstream – the direction of the dip of the beds.

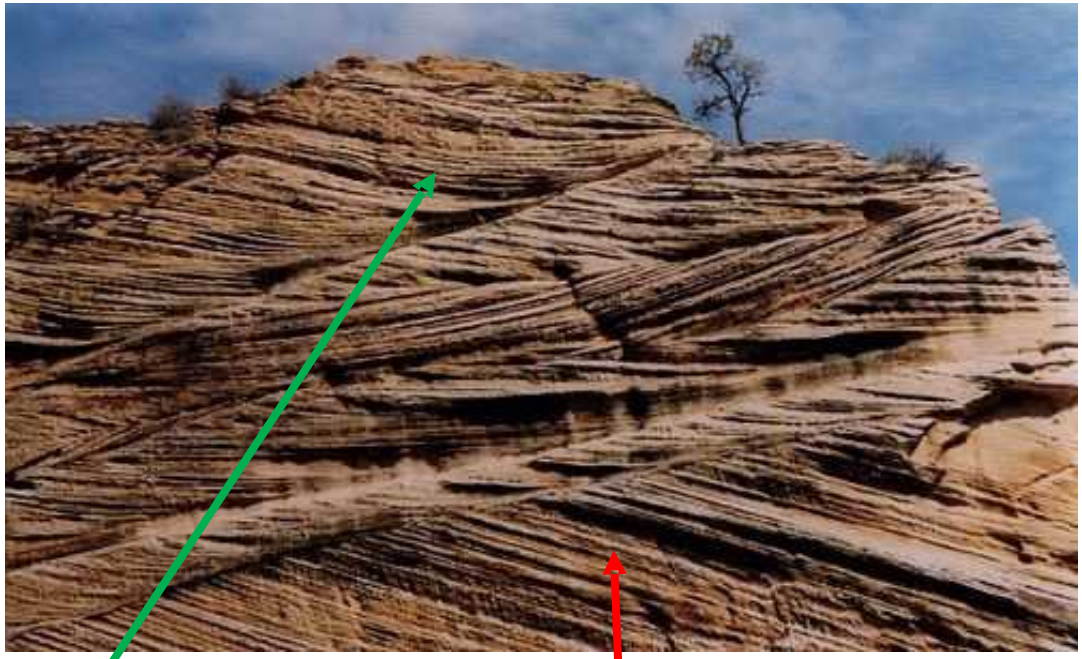
Ripple bedding: oscillating flows

In oscillaJng flow (e.g. on a beach) ripples are symmetrical and do not migrate. Ripples arwe usually preserved (i.e. define) the bedding planes.

Lenticular bedding

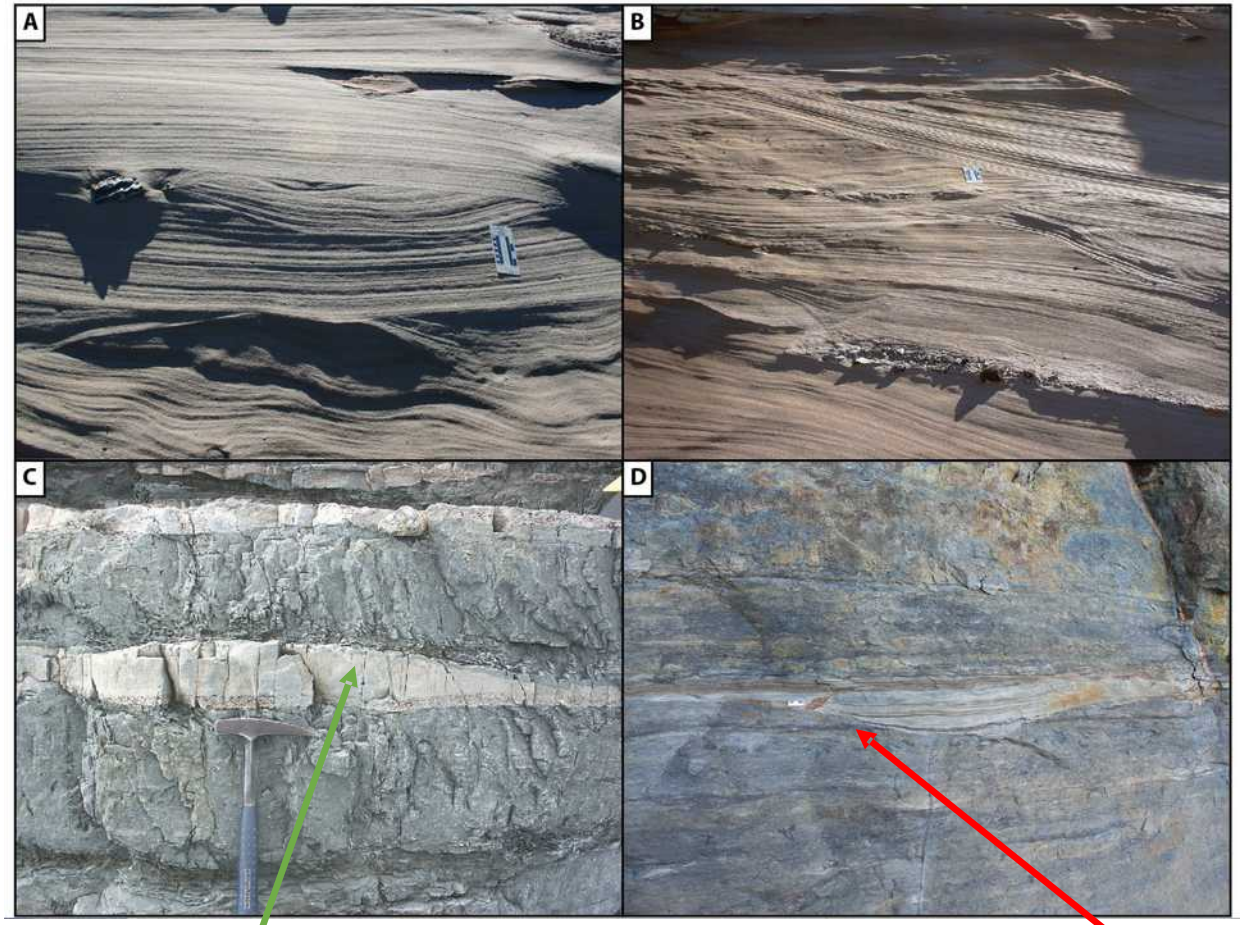
Lenticular bedding occurs where sand ripples migrate across a clay surface, and lithification preserves the alternating beds of clay and sand,

Dunes/cross bedding



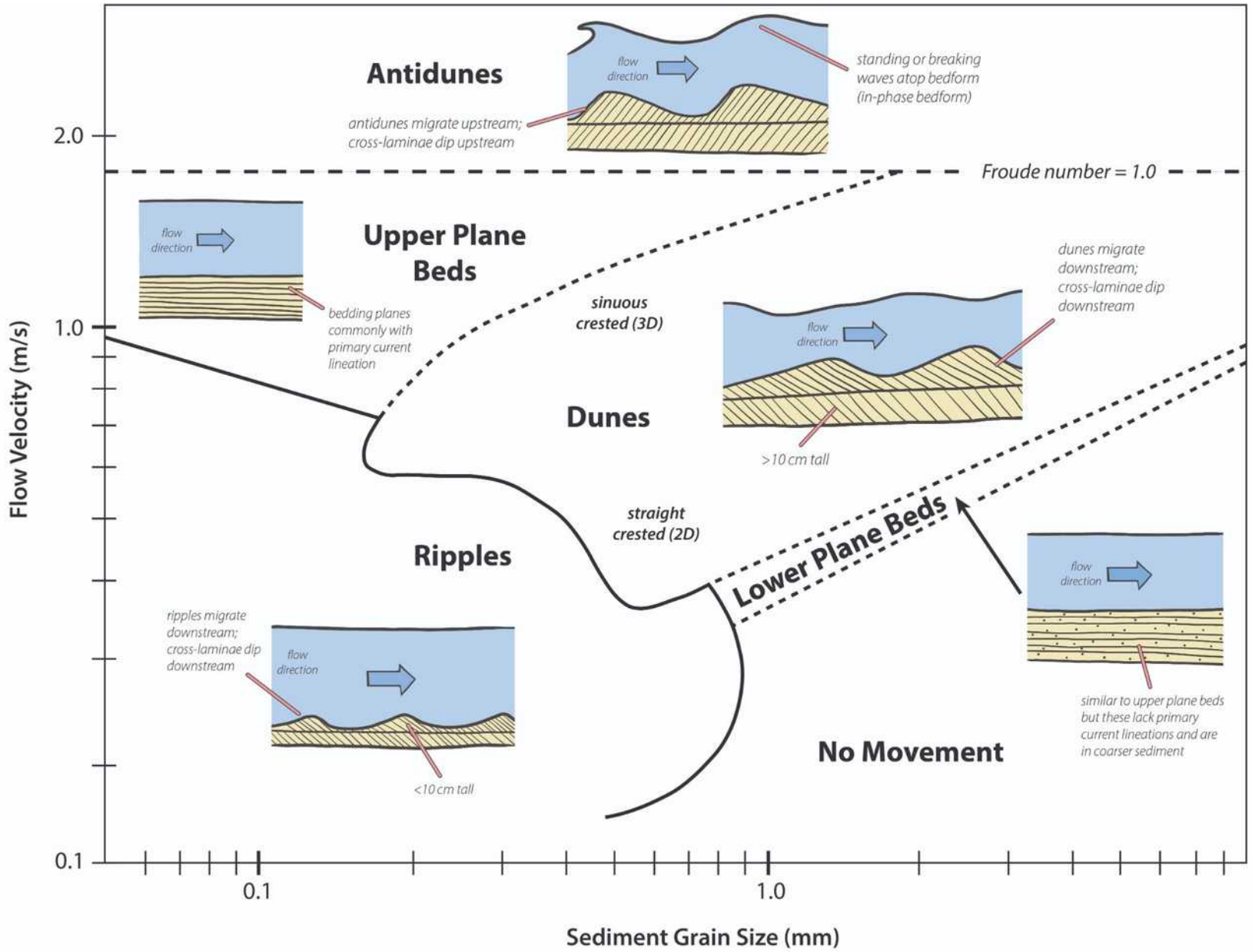
Dunes are simply large ripples (>10 cm tall). They form in the same way, but at higher velocities and beds dip downstream (the direction of migration). Dunes may be straight or sinuous. Straight dunes form **tabular cross-beds**. Sinuous dunes form **trough cross beds**.

Humocky cross-bedding



Hummocky cross-bedding forms where storms cause chaotic wave motion and irregular “sloshing” of water at depth. They typically consist of concave-up **swales** and convex-up **hummocks** that manifest as cross-cutting laminae in the sediments.

Bedforms in unifirectional flow



Conclusions

1. Sedimentary rocks are defined primarily by the size of the clasts. Classification is easy!
2. Careful examination of clast characteristics and bedding can reveal a great deal about their formation, including:
   - the sedimentary environment in which they formed
   - the energy (e.g. flow velocity) of the flow
   - the direction of transport
   - how far away they are from their source
   - the nature of the source materials
   - which way up the rocks are and their order of deposition
3. Sedimentary rocks are best examined in the field so that the larger bedforms can be seen

To read more about sedimentary rocks go to:

https://geo.libretexts.org/Courses/SUNY_Potsdam/Sedimentary_Geology%3A_Rocks_Environments_and_Stratigraphy