Evidence of rapid evolution of a submarine debris flow from a turbidity current on slope: an example from the Miocene Ushigiri Formation, Shimane, Japan

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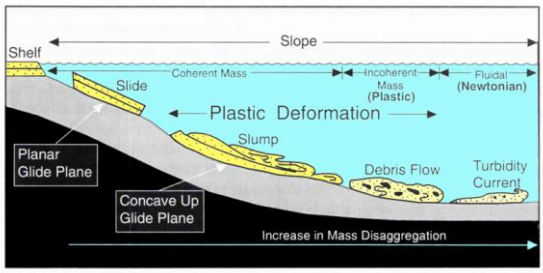
Submarine sediment gravity flows

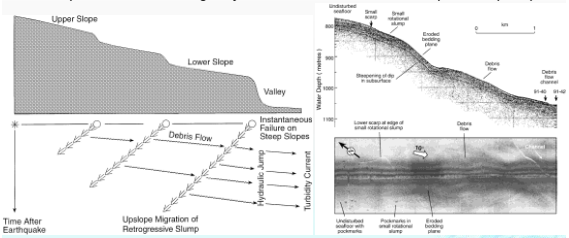


Shanmugam (2006)

Evolution of the submarine sediment gravity flows

Dilution process of sediment gravity flows

Piper et al. (1999)

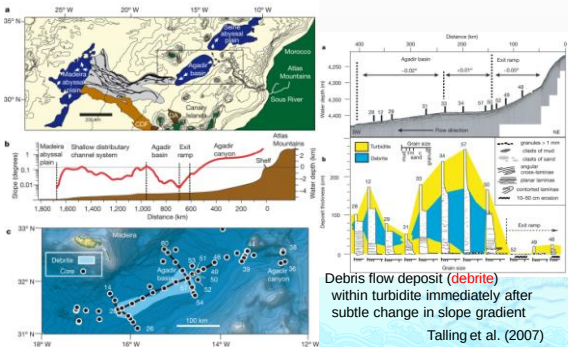


Slump/slide → debris flow → hydraulic jump → turbidity current

↑ jump +water

↑ water

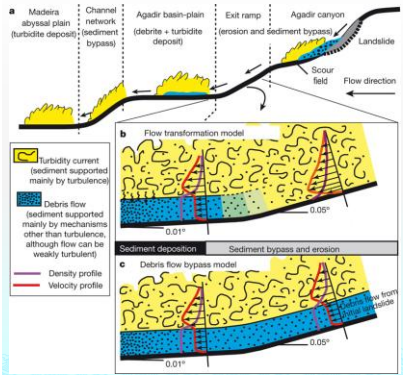
Development of denser sediment gravity flow



Debris flow deposit (debrite) within turbidite immediately after subtle change in slope gradient

Talling et al. (2007)

Densification of flow



Possible scenario for deposition of debrite

generation of denser flow in a thinner flow due to rapid settling within the flow

Bypassing of debris flow on steeper slope

Talling et al. (2007)

Background

Generation of denser sediment gravity flow in submarine environments:

➔➔ causing the breakage of cables.

To understand generation process of denser flow

➔➔ crucial for preventing or reducing damages of cable breakage by such denser flows

Geological record:

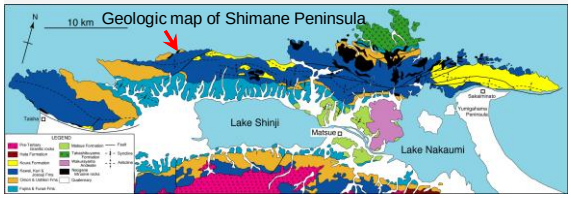
providing details of evolution of sediment gravity flows in the past

Purpose

The Miocene Ushigiri Formation, Shimane
(submarine slope deposit)

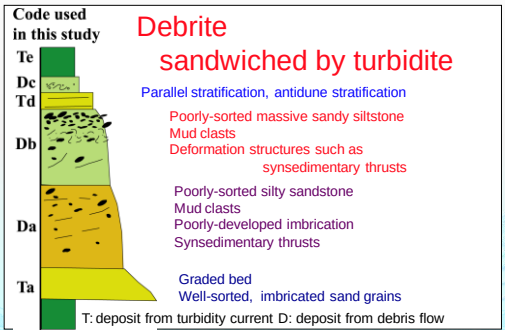
Downslope change from turbite to debris flow deposit (debrite)
within short distance (Sakai and Mishima, 2006)

- To introduce the characteristics of the sediment gravity flow deposits of the Miocene Ushigiri Formation.
- To discuss flow evolution and its mechanism.

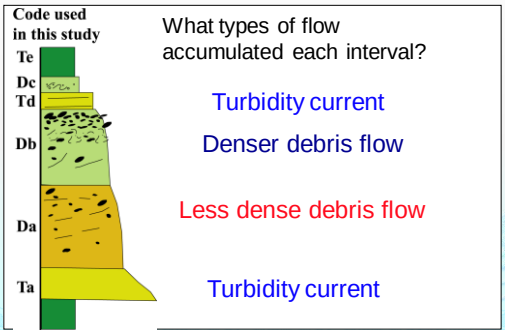


Geologic map

Sediment gravity flow deposit of the Ushigiri Formation



Interpretation



An example of sand bed

Tracing single bed along a tuff

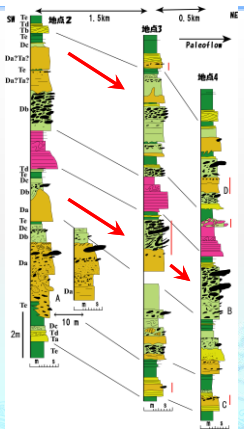
Downslope change

Ta or Da are dominant
in the proximal sediments

To the downstream,

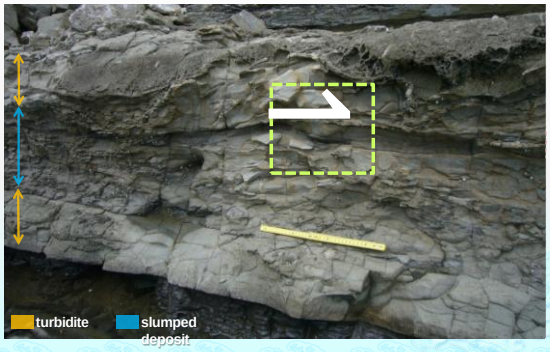
Db intervals become
dominant within
2km

Sudden increase in
mud clasts



Why mud clast increases?

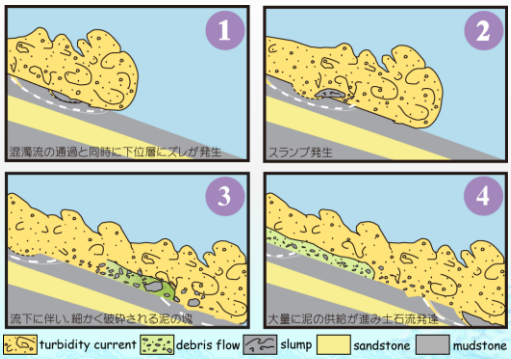
What generated depressions?



Slip faces just below sandstone beds

Sediment grains along slip faces

Debris flow evolution model



Conclusions

Denser sediment gravity flow formation in turbidity current was evidenced from the Miocene Ushigiri Fm

Denser flow generation must be contributed by mud clast supply to the flow

Slide of near surface mud when flow passed
- ➔ tear-off of mud block from the underlying mud
- ➔ leading to mud supply to the flow sufficient for generation of debris flow in the turbidity current