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Boulders

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Definition

Rock fragments, particles, or grains larger than 200 mm in size (British soil scale) or greater than 256 mm in size (North American scale). Boulders are the largest grain size within the category of gravel. The term likely derives from the Swedish term “bullensten” or Middle English term “bulderston.”

Context

Boulders range in size from a minimum of 200 or 256 mm to isolated pieces weighing multiple tons (megaboulders or megaclasts). Glacial deposits around the northern hemisphere commonly host boulder sized clasts in the form of isolated erratics or within chaotic multitextural deposits such as ice-contact gravel features. Large glacial erratics are static features generally avoided during construction efforts and more often a tourist attraction (e.g., Okotoks erratic in Alberta, Canada). Typical natural processes capable of transporting boulders include landslides (e.g., debris flows, rock avalanches), lahars, tsunamis, flash floods (including natural and artificial dam bursts), and storms (typhoons, super storms, etc.) (Dewey and Ryan 2017; Hungr et al. 2014). Artificial efforts to move boulder sized rocks require mechanized support (e.g., backhoe).

Resedimentation of boulders is a significant issue and poses risk to humans and infrastructure around the world. In mountainous areas, debris flows are capable of moving large numbers of boulders at elevated speeds along natural and engineered channels that are crossed by roads and

bridges. The damage to bridge piers and other support structures is substantial and solutions require engineered design needs such as the construction of anti-collision pier structures on the upstream side of bridge piers to reduce potential damage from forces associated with boulder impacts. Comparable considerations are required for dams, weirs and other structures affected by boulder impact and deposition.

In the assessment of boulder movements, the calculated Froude number (a ratio of inertial and gravitational forces) can range appreciably depending on the local conditions: natural versus hard-engineered channels, noncohesive versus bedrock surfaces, bulk density of the fluids, boulder composition and porosity, impulsive forces, etc. Challenges for engineering geologists includes appropriate modelling applications to advise the civil engineers.

Cross-References

- [Bedrock](#)
- [Bridges](#)
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- [Glacial Environments](#)
- [Hazard](#)
- [Landslide](#)
- [Mountain Environments](#)
- [Sediments](#)
- [Tsunamis](#)

References

- Dewey JF, Ryan PD (2017) Storm, rogue wave, or tsunami origin for megaclast deposits in western Ireland and North Island, New Zealand? *Proc Natl Acad Sci* 114:E10639–E10647
- Hungr O, Leroueil S, Picarelli L (2014) The Varnes classification of landslide types, an update. *Landslides* 11:167–194