

ATTEST: Grindability test instrument for estimating rock attrition

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Partners

Boliden Mineral AB, LKAB

Project duration

2024-2025



Goals of the project

To develop and assess an innovative test method specifically designed for the evaluation of the grinding response of rock and drill core materials, with a particular emphasis on autogenous grinding processes (including AG mills and pebble mills).



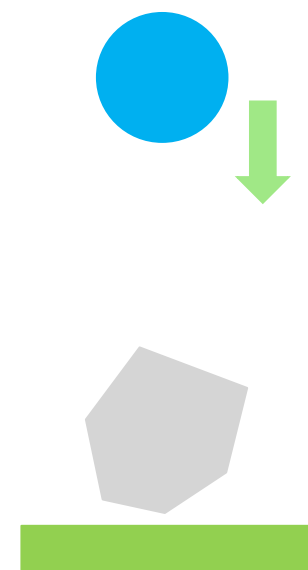
Background

- Autogenous mill is characterized by being energy-intensive and high throughput while being superior than traditional Rod and Ball milling by eliminating steel charge (e.g. Boliden Aitik Primary mill ~22.5 MW power, ~1500 t/h)
- Generally, Bond Work Index or Axb value of Drop Weight Test is used, however in case of AG and pebble mill, attrition is more relevant. In Boliden and LKAB (Sweden) grindability is used. The amount (kg) of fines generated per kWh spent.
- The grindability values helps to predict plant throughput and allows for optimum scheduling (resource-efficiency) and predictability.

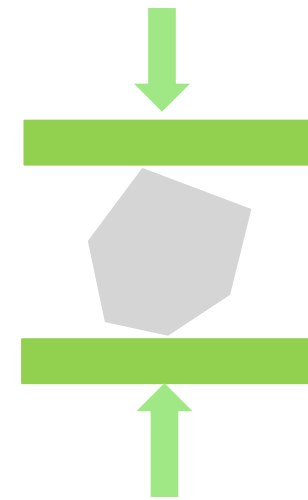
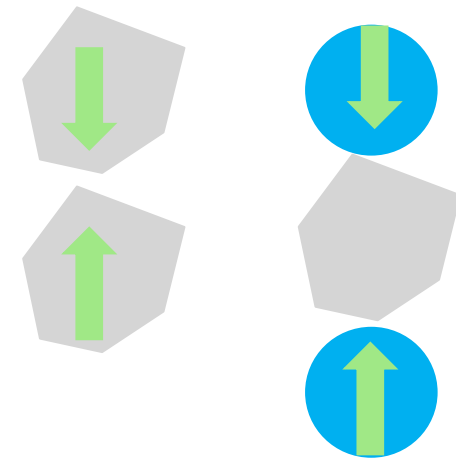


Loading (energy transfer) on particles in comminution

Impact / compression

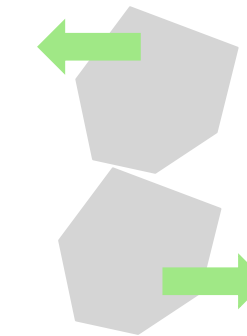


Ball mil

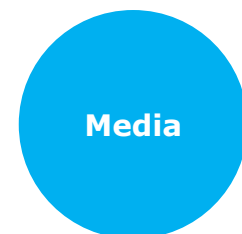
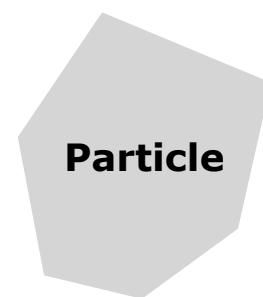
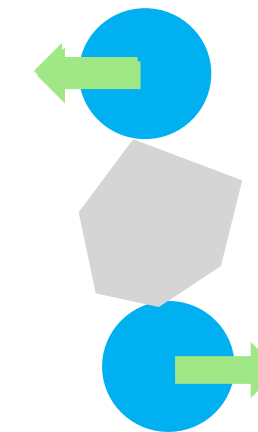


Crusher

Shear (attrition)

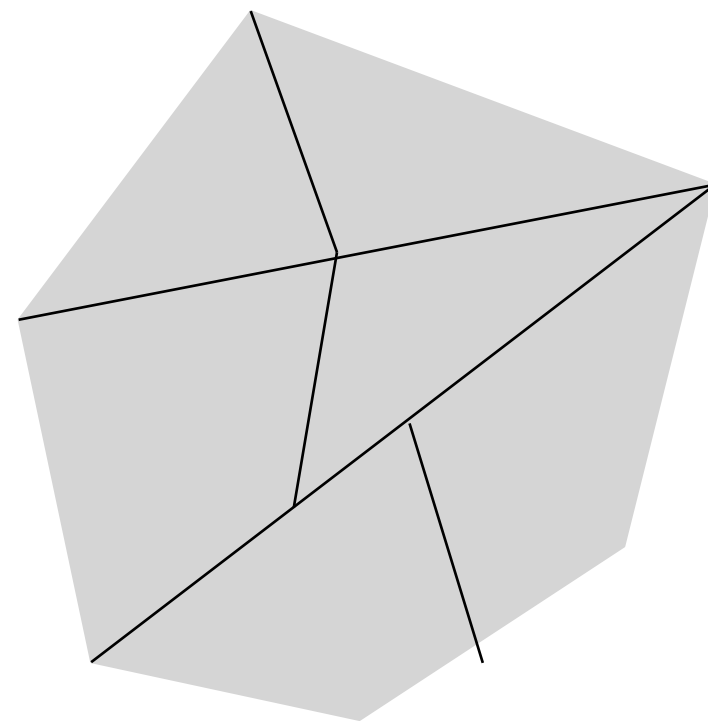


Pebble mill



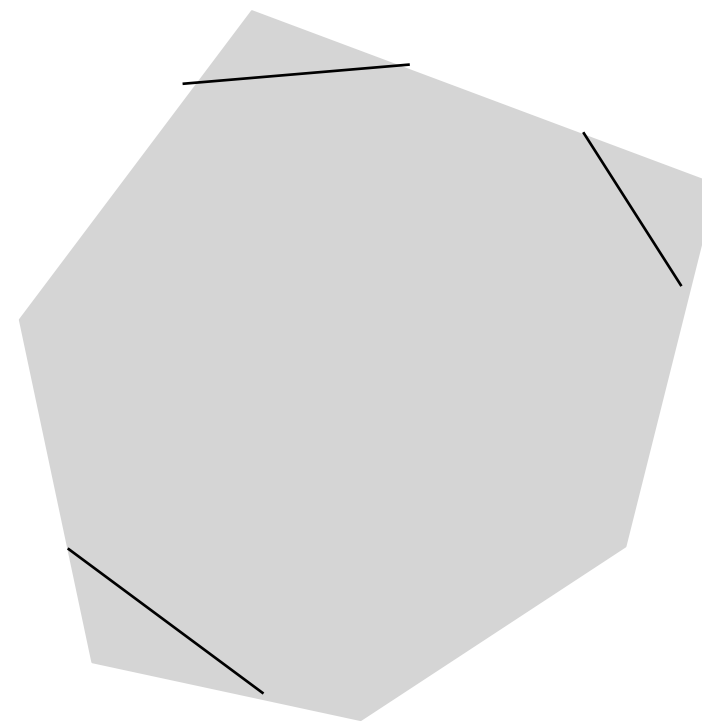
Breakage mechanisms based on particle size and shape

Shattering and cleavage



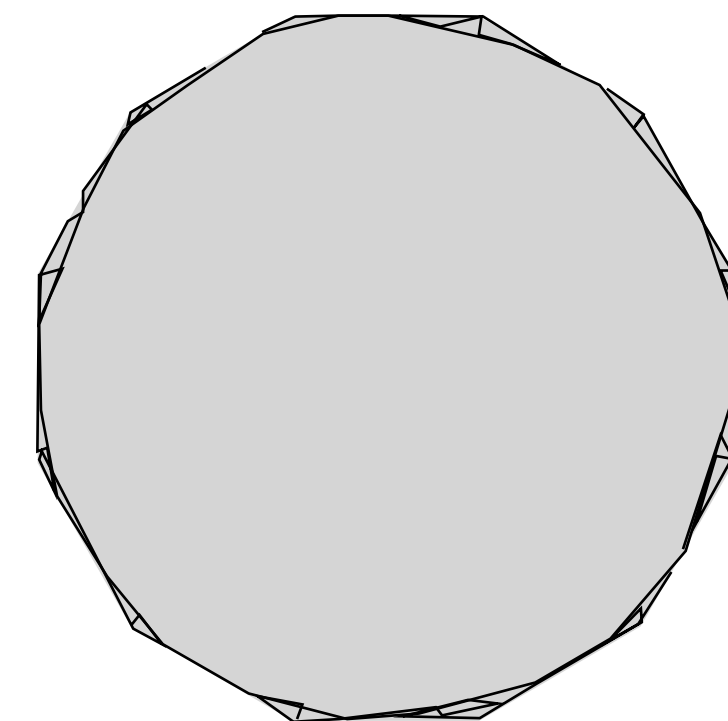
Generates large particles

Chipping



Generates small particles

Abrasion



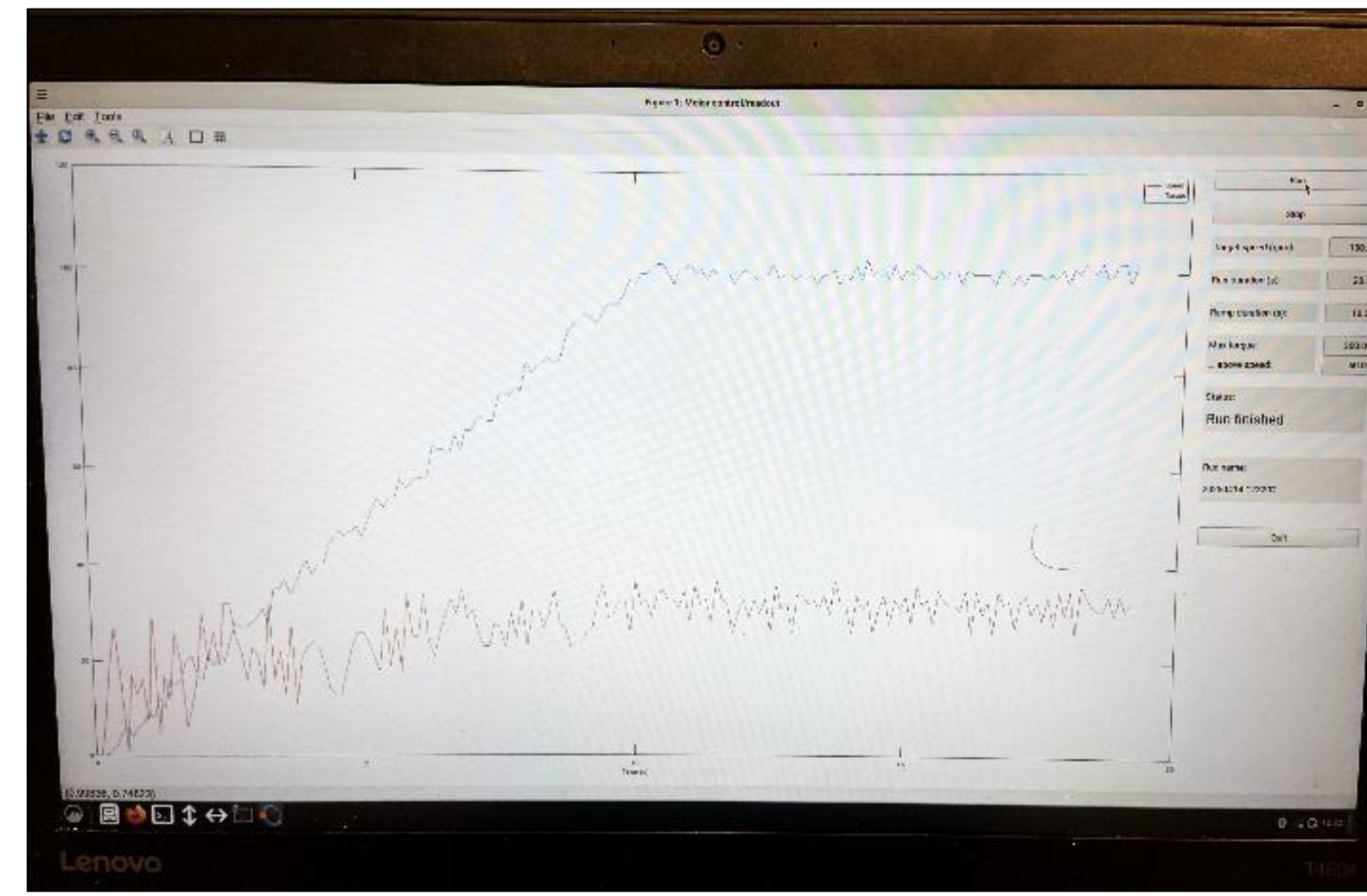
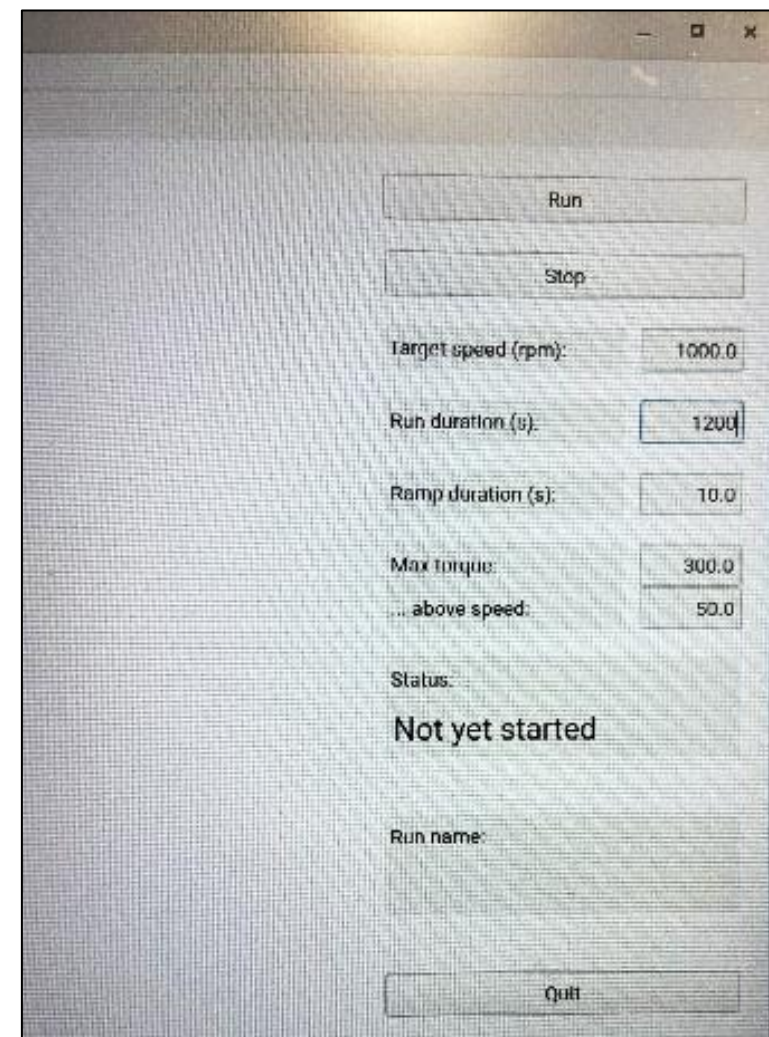
Generates very fine particles



Traditional wear test (3 days to a week)



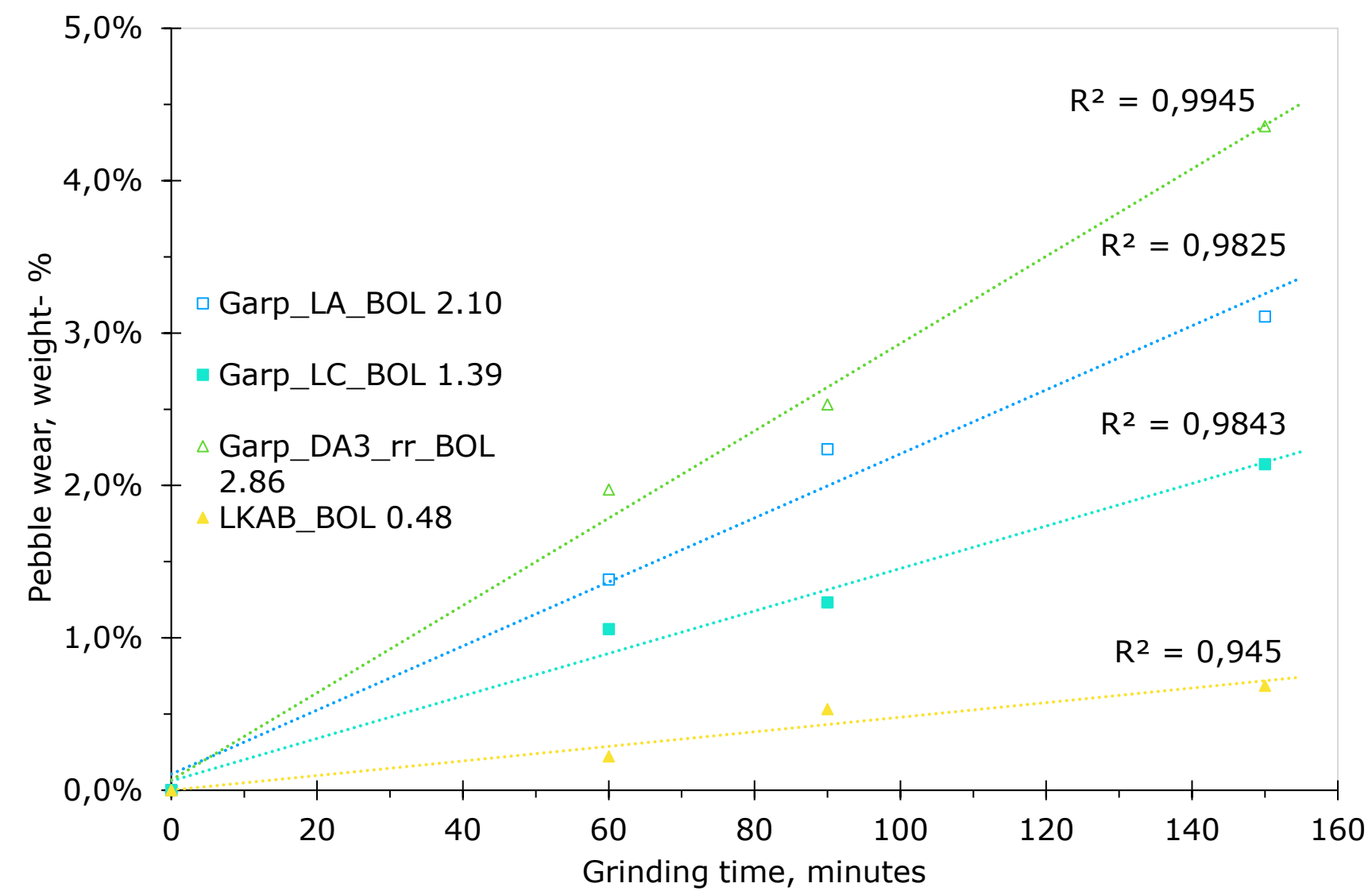
Prototype development and manufacturing



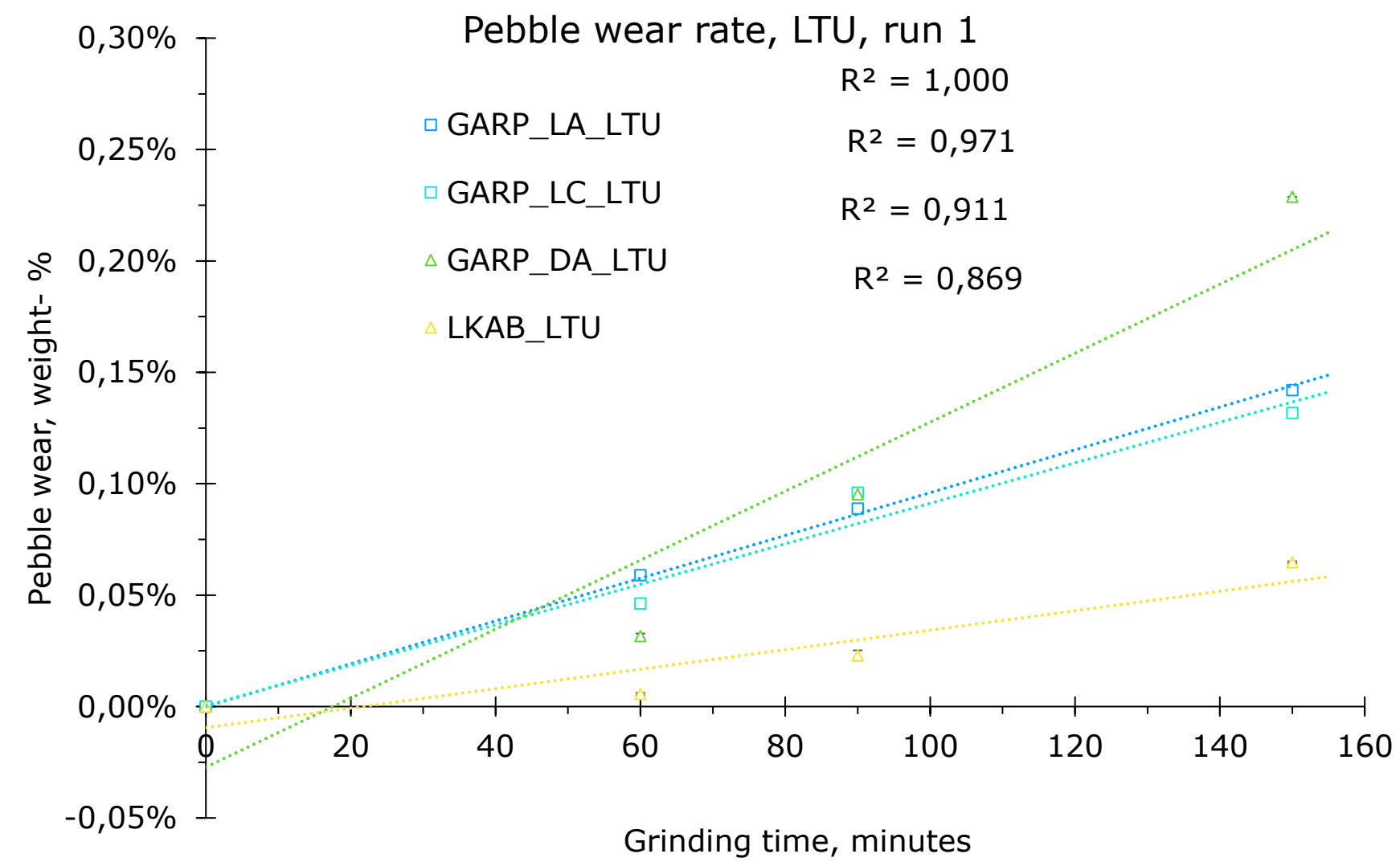
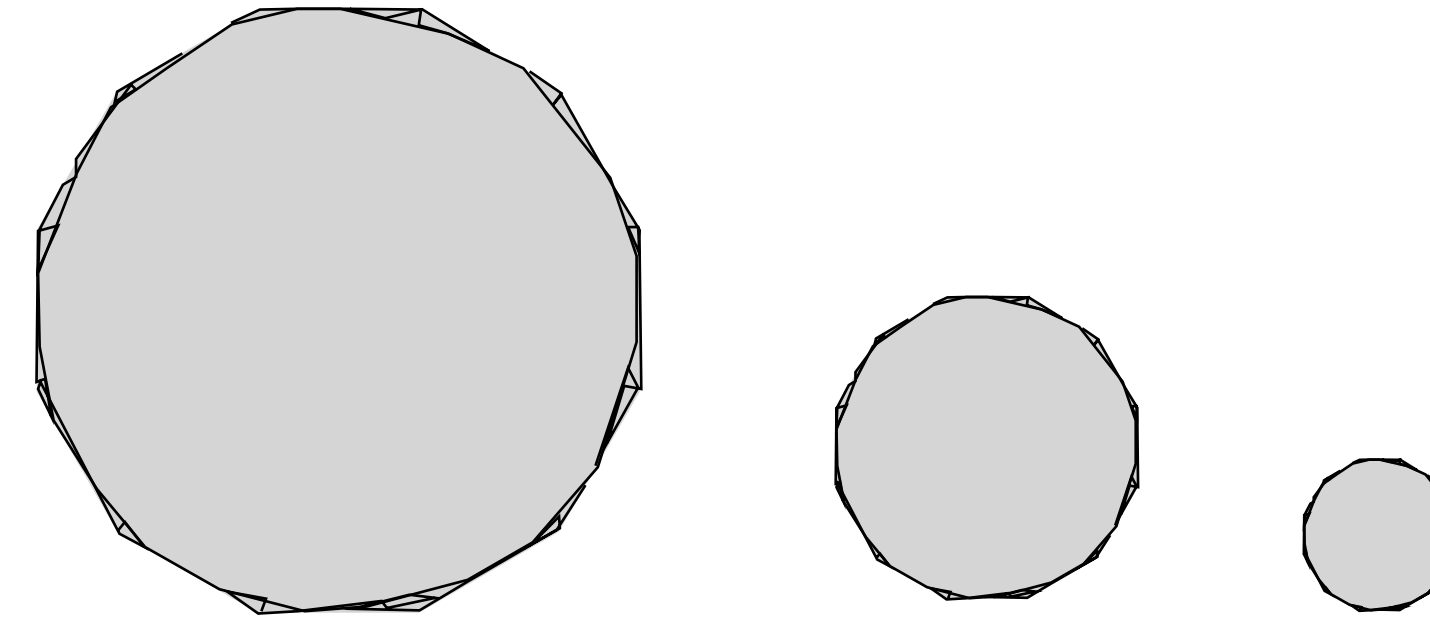
+ 100 kg Aitik samples

Prototype evaluation (various rock types)

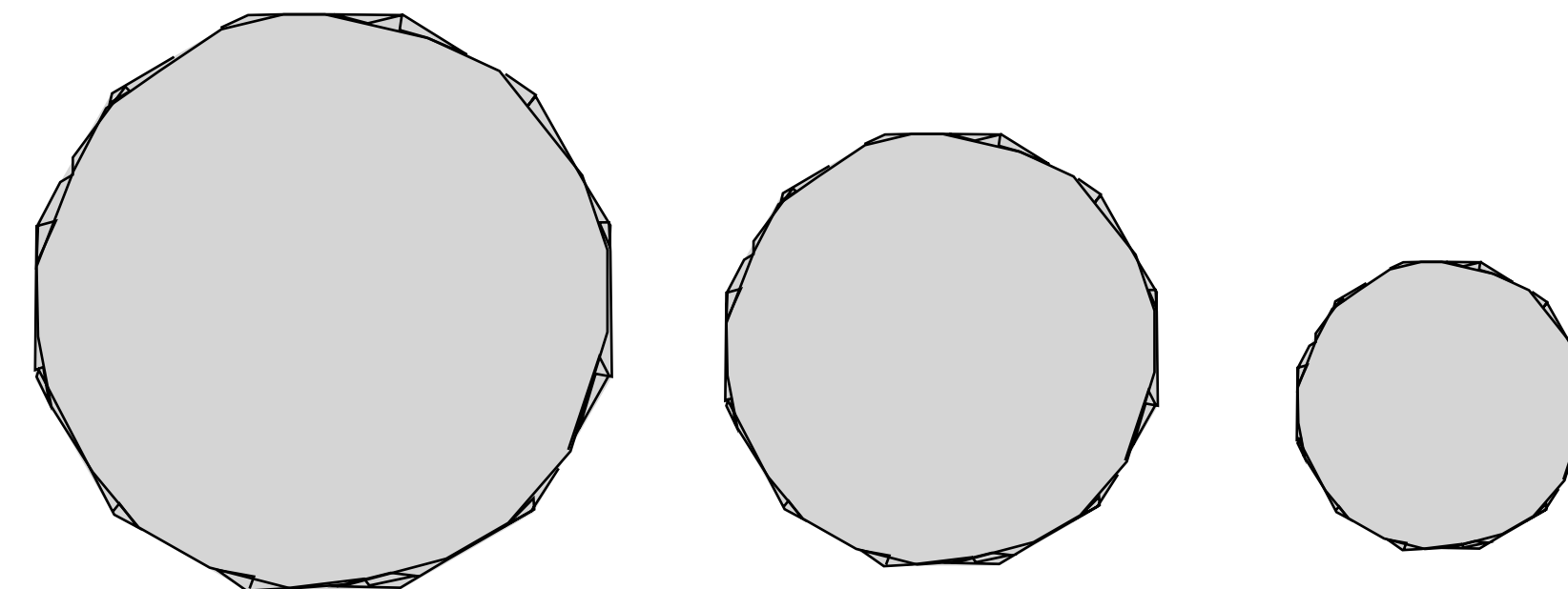




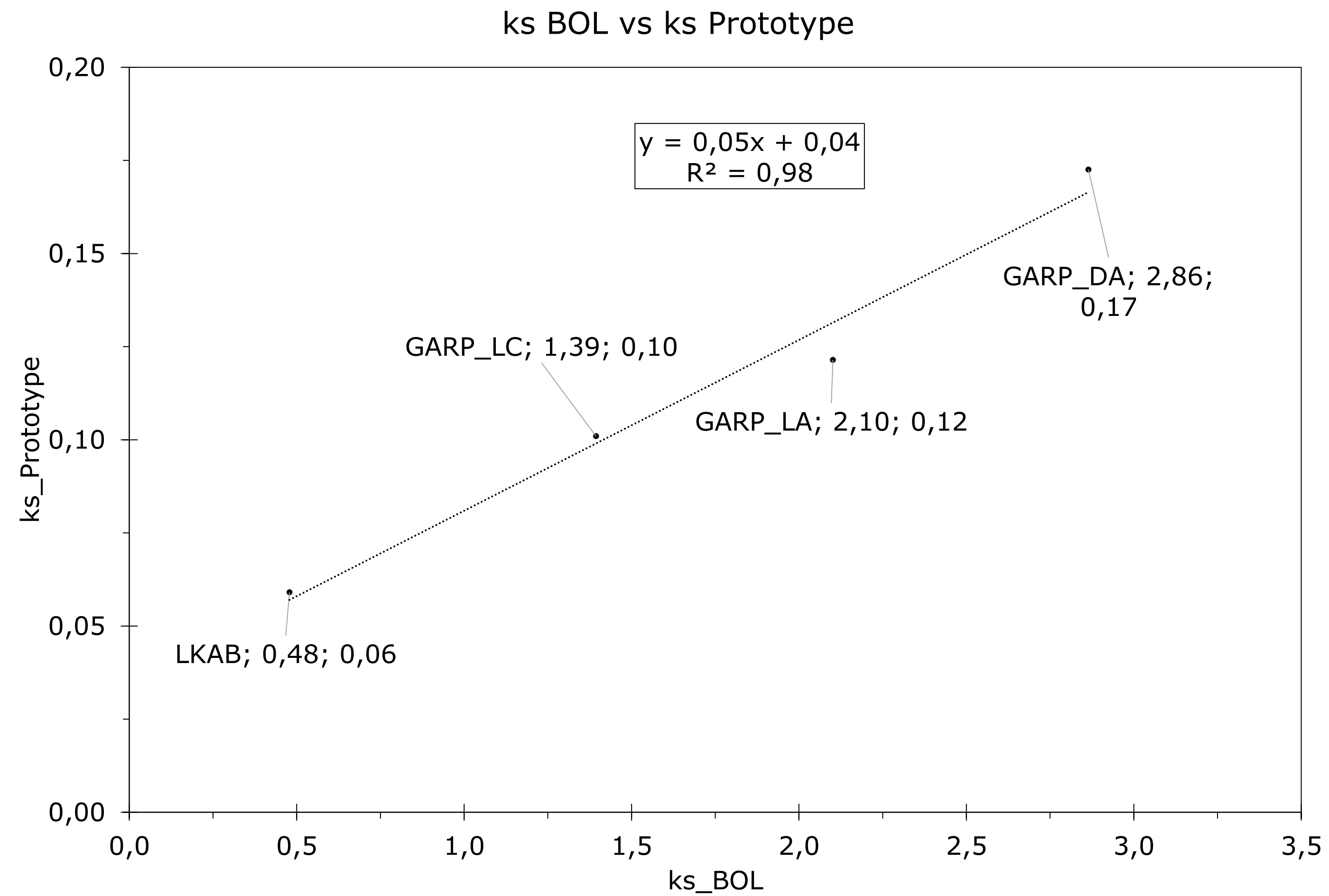
High wear rate

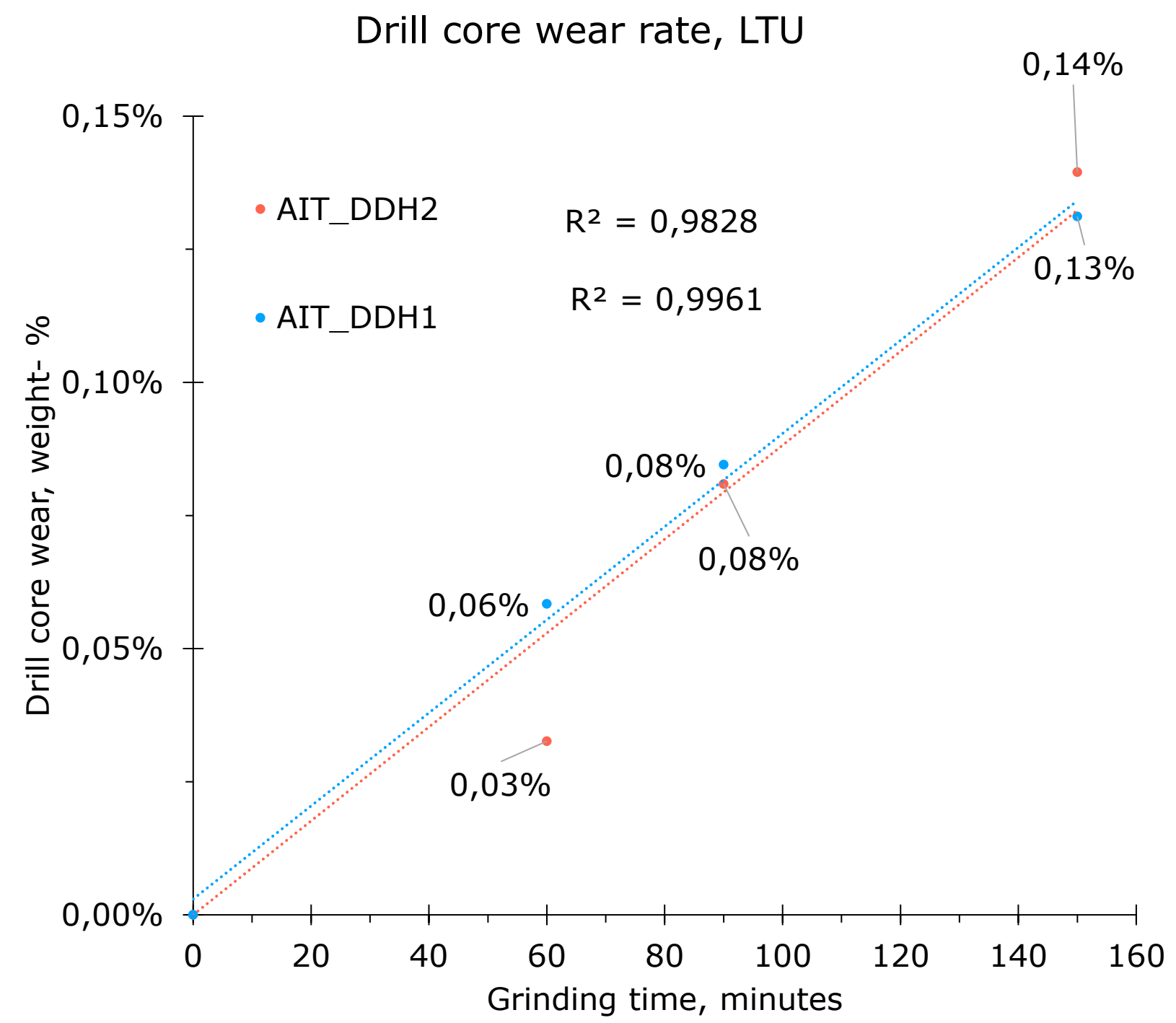


Low wear rate



Grinding time





Mining innovation for a sustainable future