Towards a rock mass characterisation map for Stockholm

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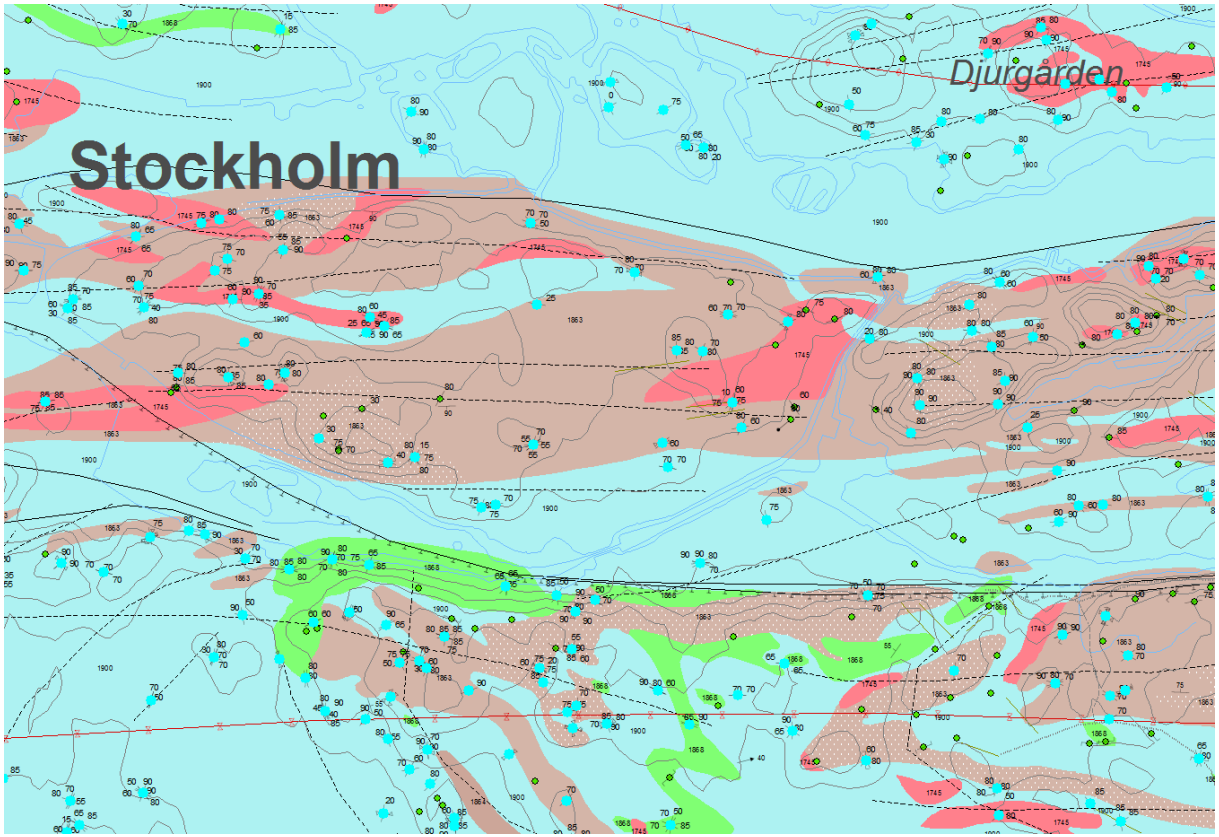
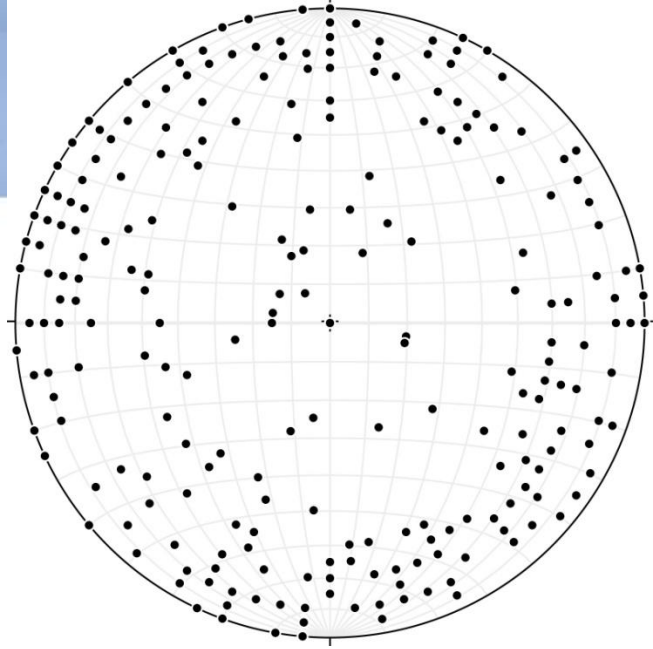
Background – National fracture database (BeFo report 142):

- Knowledge of **brittle structures** is important for understanding the **deformation history** even in the brittle regime; and important for **civil engineering** and **subsurface building**
- Documentation of **brittle deformation at SGU very limited and non-systematic**
- **External data** collected during large infrastructure projects are **not stored in a standardised manner**
- Data are **not easily accessible**, and quite often the **raw data are lost**

Brittle deformation:
Fractures/Joints – Example from SGU's bedrock observations database*



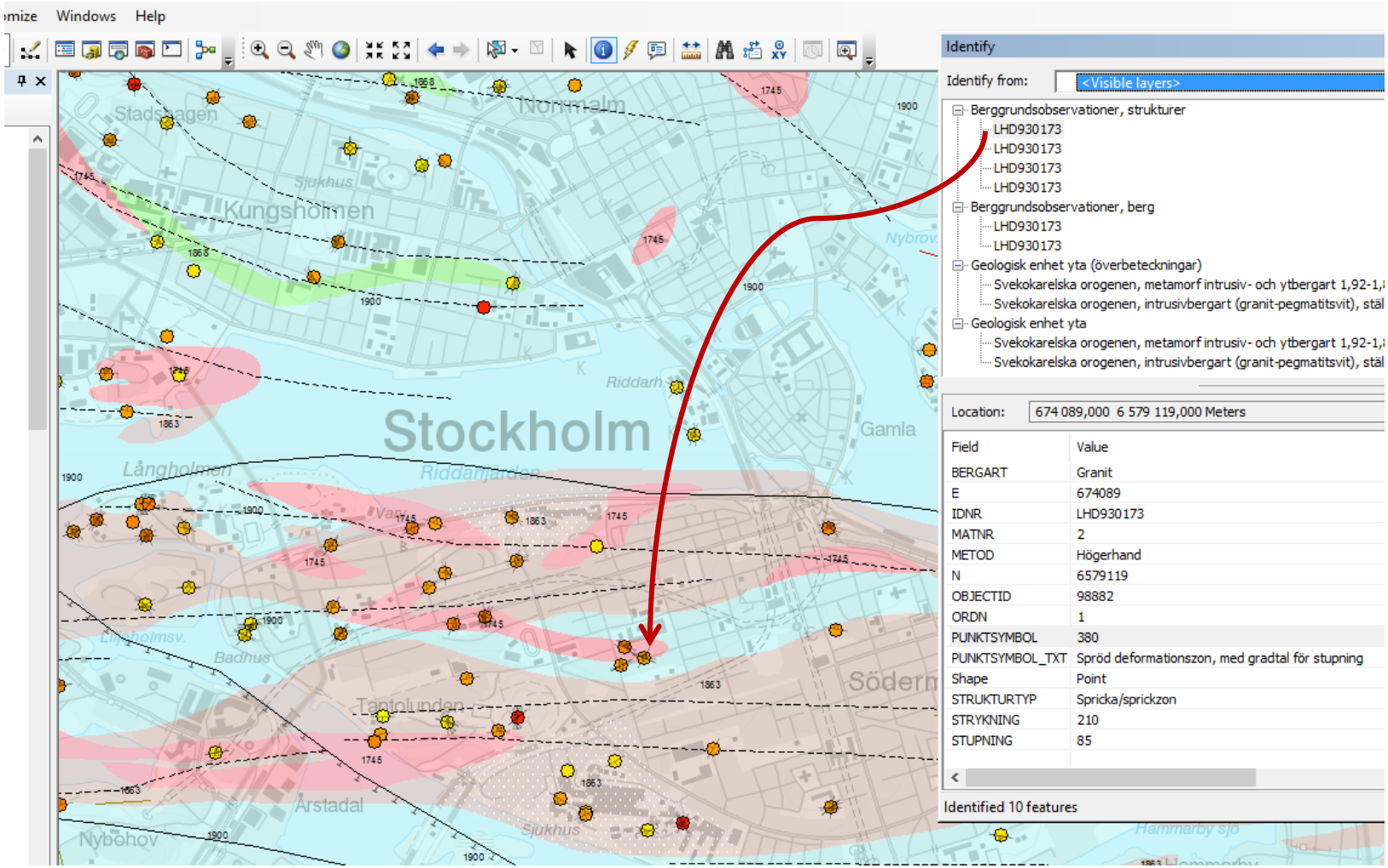


Some information about fracture attitudes exists

No information* about spacing, aperture, roughness, relative age etc.

Goal: RMC map

+ spacing (~RQD)
+ number of fracture sets (~J_n)
+ filling, aperture, etc. (~J_r, J_a)
+ kinematics



How do we reach this goal?

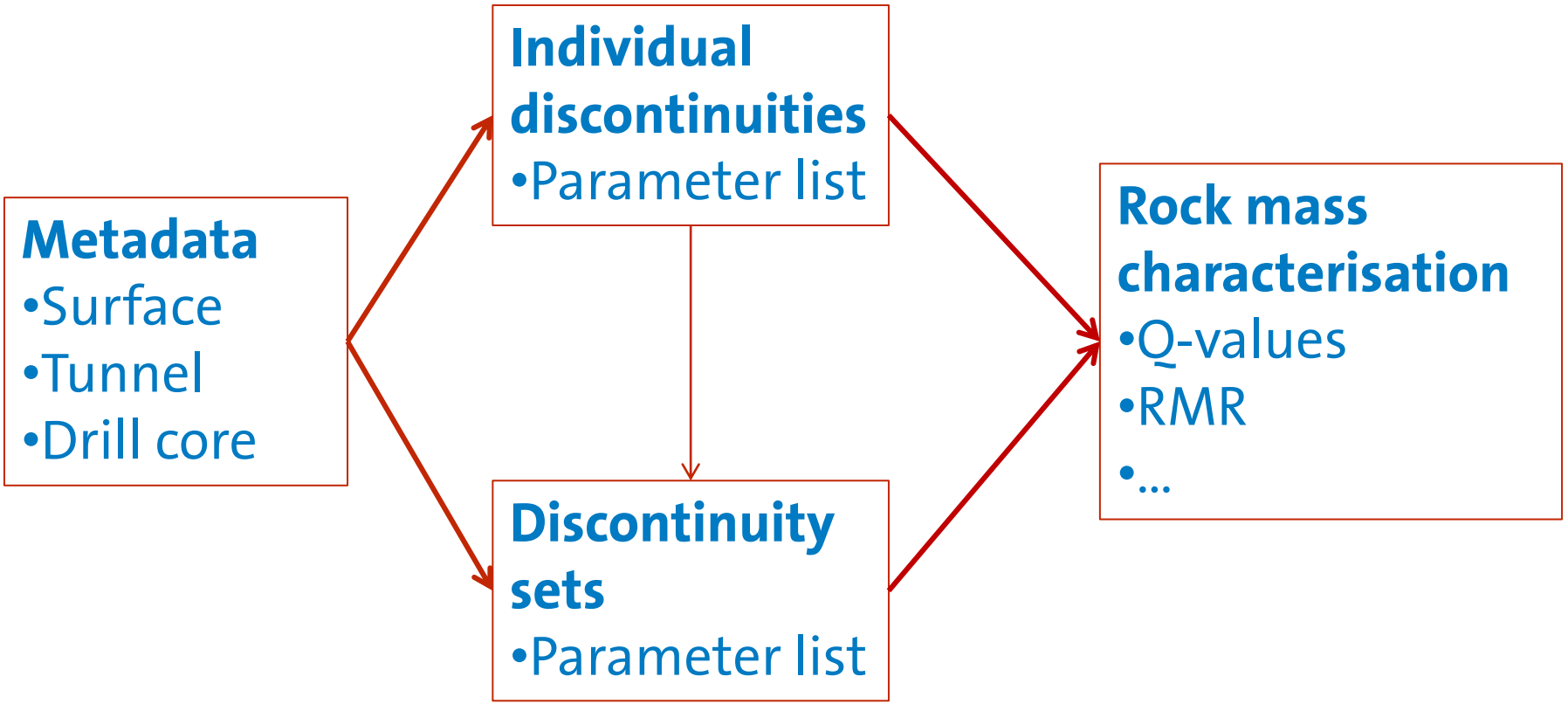
Currently ongoing SGU projects:

- Geometries of large deformation and weakness zones
  - Collect and recycle data from major infrastructure projects
  - Field work
- Rock mass characterisation (mostly from an outcrop perspective)
  - Existing external/internal data, field work, photogrammetry
  - *Development of a standardised data collection method*

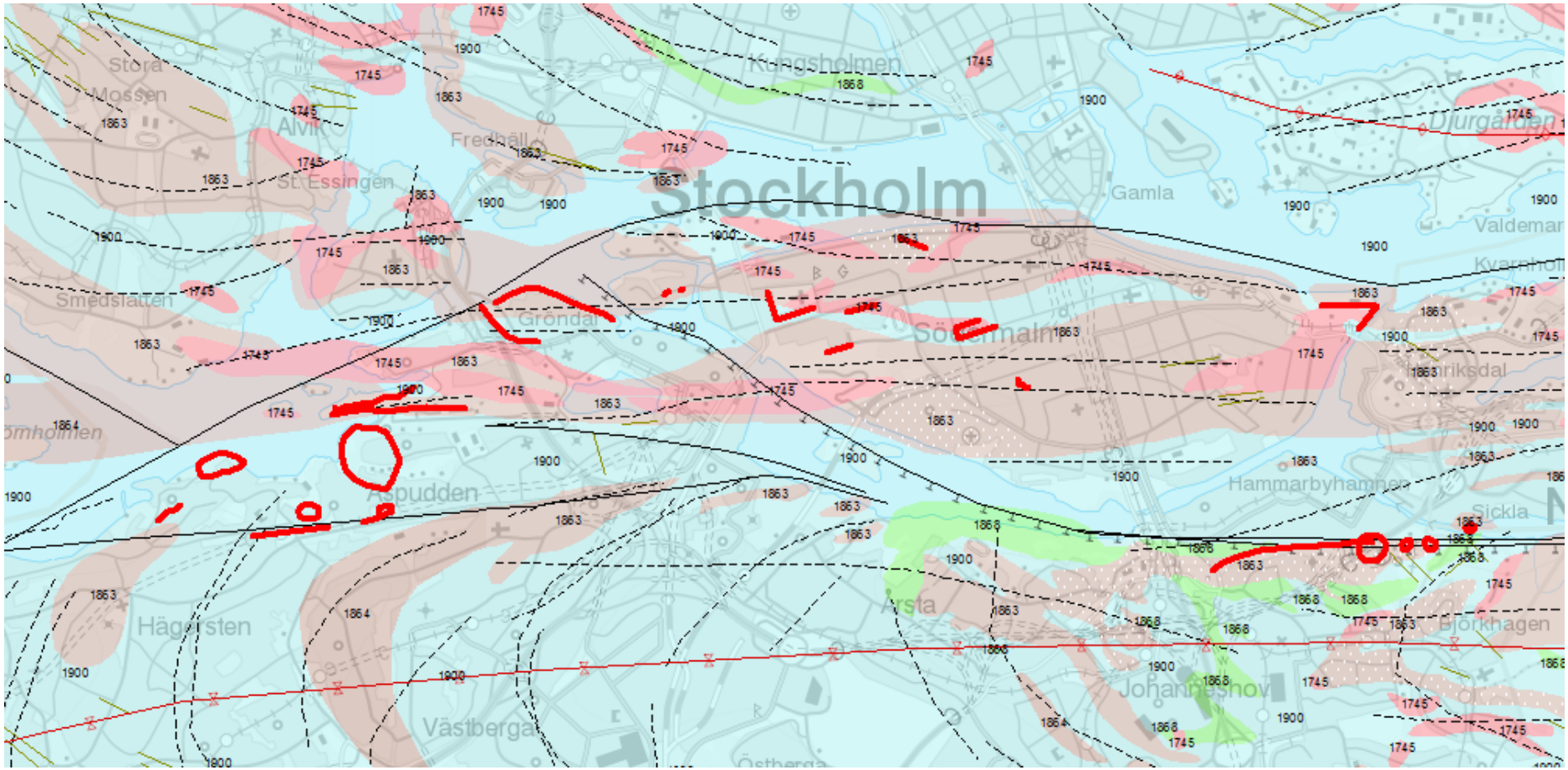
Standardised data collection method

- Database development (vocabulary, parameter list, methods…)
- SGU field-testing proto-database
- BeFo application (with Ann B.) submitted to test and adjust applicability of data collection method for road cuts, tunnels, drill cores
  - Create a useful tool for both structural AND engineering geologists

Simplified database structure

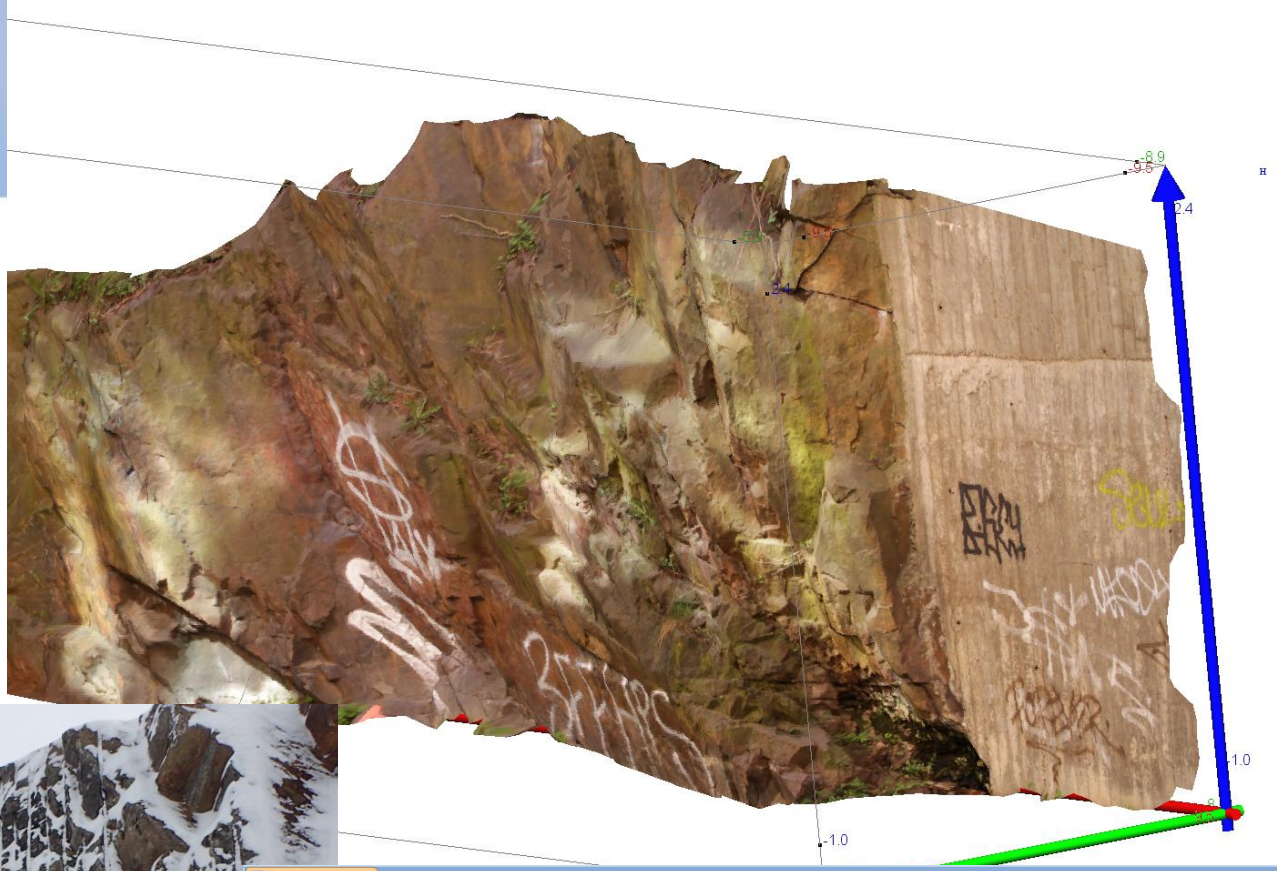


Some strategically chosen locations



SGU
Sveriges geologiska undersökning
Geological Survey of Sweden

Ongoing activities



Individual discontinuities

Fältnamn	Datatyp	Beskrivning
ID	Räknare	
DiscontinuityID	Text	Identification number of discontinuity; e.g. SGL170010DC03
Rock type(s)	Text	Indicates rock type(s) that discontinuity disects
Discontinuity type	Text	Specifies discontinuity type; options: joint, fault (ISRM), shear fracture (e.g. Twiss & Moores), fracture zone
Discontinuity strike	Tal	Strike of discontinuity (right-hand-rule, measured clockwise from North, 0-360 degrees), <NULL> = not measureable
Discontinuity dip	Tal	Dip of discontinuity (0-90 degrees), <NULL> = not measureable
Discontinuity strike range	Tal	Min-Max strike in case of curved discontinuity, default is <NULL>
Discontinuity dip range	Tal	Min-Max dip in case of curved discontinuity, default is <NULL>
Lineation type	Text	Type of lineation: striae, slickenlines, mineral fibre, <NULL>, default is <NULL>
Lineation pitch	Tal	Pitch (or rake) of lineation observed on discontinuity surface; measured clockwise from strike (0-180)
Lineation trend	Tal	Trend of lineation (0-360; right-hand-rule; calculated automatically when using pitch of lineation and strike/dip of discontinuity)
Lineation plunge	Tal	Plunge of lineation (0-360; right-hand-rule; calculated automatically when using pitch of lineation and strike/dip of discontinuity)
Kinematic indicator type	Text	Type of kinematic indicator; Slickenline, fibre lineation, displaced marker, Riedel shear, horsetail, duplex etc. (check out SKBs PARAMETER LIST)
Kinematics	Text	None, dextral, sinistral, normal, reverse, dextral-reverse, dextral-normal, sinistral-reverse, sinistral-normal, <NULL> = unclear
Kinematics confidence	Text	high, moderate, low
Displacement	Tal	Observed apparent displacement of a marker across a shear fracture, fault or fracture zone
Discontinuity length	Tal	Length of fracture in outcrop
Tightness (?)	Text	"Closed", "Gapped", "Open" (ISRM)
Minimum aperture	Tal	Minimum perpendicular distance separating adjacent rock walls of an open or gapped discontinuity which is air or water filled
Maximum aperture	Tal	Maximum perpendicular distance separating adjacent rock walls of an open or gapped discontinuity which is air or water filled
Average aperture	Tal	Average perpendicular distance separating adjacent rock walls of an open or gapped discontinuity which is air or water filled
Filling	Text	Material separating the adjacent rock walls of discontinuities; e.g. quartz, calcite, chlorite, clay, silt, fault gouge, breccia (ISRM)
Filling width	Tal	Minimum and maximum widths of simple filled discontinuities or of complicated fracture zones, shear zones, crush zones (ISRM)
Alteration halo	Ja/Nej	Indicates wall rock alteration close to the discontinuity
Width alteration halo	Tal	Width of altered wall rock zone mostly parallel to discontinuity
Width fracture zone	Tal	Width of fracture zone including fracture core and damage zone (cm)
Width fracture zone core	Tal	Width of fracture zone core (cm)
Width damage zone	Tal	Width of damage zone surrounding fracture zone core (cm)
Other structures	Text	Specifies if other, e.g. ductile structures exist at the location; e.g. foliation, fold axis, ductile shear zone, migmatitic banding
Other structures strike	Tal	Strike of other structure
Other structures dip	Tal	Dip of other structure
Other structures trend	Tal	Trend of other structure
Other structures plunge	Tal	Plunge of other structure
Photographs	Räknare	PhotoID; e.g. SGL17000301

Fältegenskaper

Why did I make you listen to this?

- Standardised method of data collection makes it possible for SGU to receive and manage data from external projects
- SGU becomes a natural data source for infrastructure and building projects, especially during the early project planning phase
- We need your cooperation


Tack. Frågor?