Introduction to Rock Mass Classifications

OUTCROP DESCRIPTION

1. Spacing
2. Persistence
3. Roughness

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SPACING

Discontinuity spacing is the distance between one discontinuity and another. Discontinuity spacing determines the dimensions of the blocks of rocks in a slope which influences the overall stability of the rock slope. Therefore, it is an important parameter in designing appropriate stabilization measures for rock slopes such as rock bolts and rock fall barriers. Similarly, discontinuity spacing is one of the most important parameters to describe the quality of a complete rock mass. It is widely used in the rock mass classification system such as the rock mass rating system

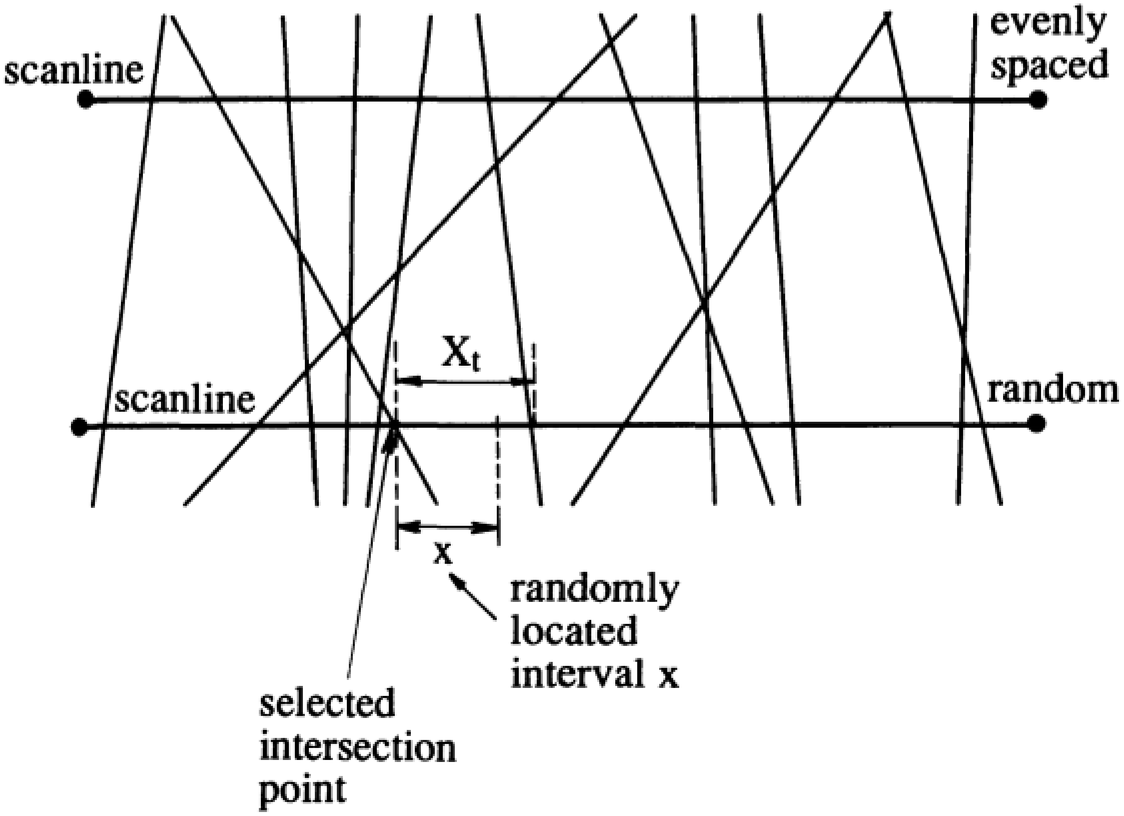
(i) Total spacing is the distance between two adjacent discontinuities, measured along a sampling line but with a specified location and orientation.

(ii) Set spacing is the distance between adjacent discontinuities from a particular discontinuity set measured along a sampling line but with a specified location and orientation.

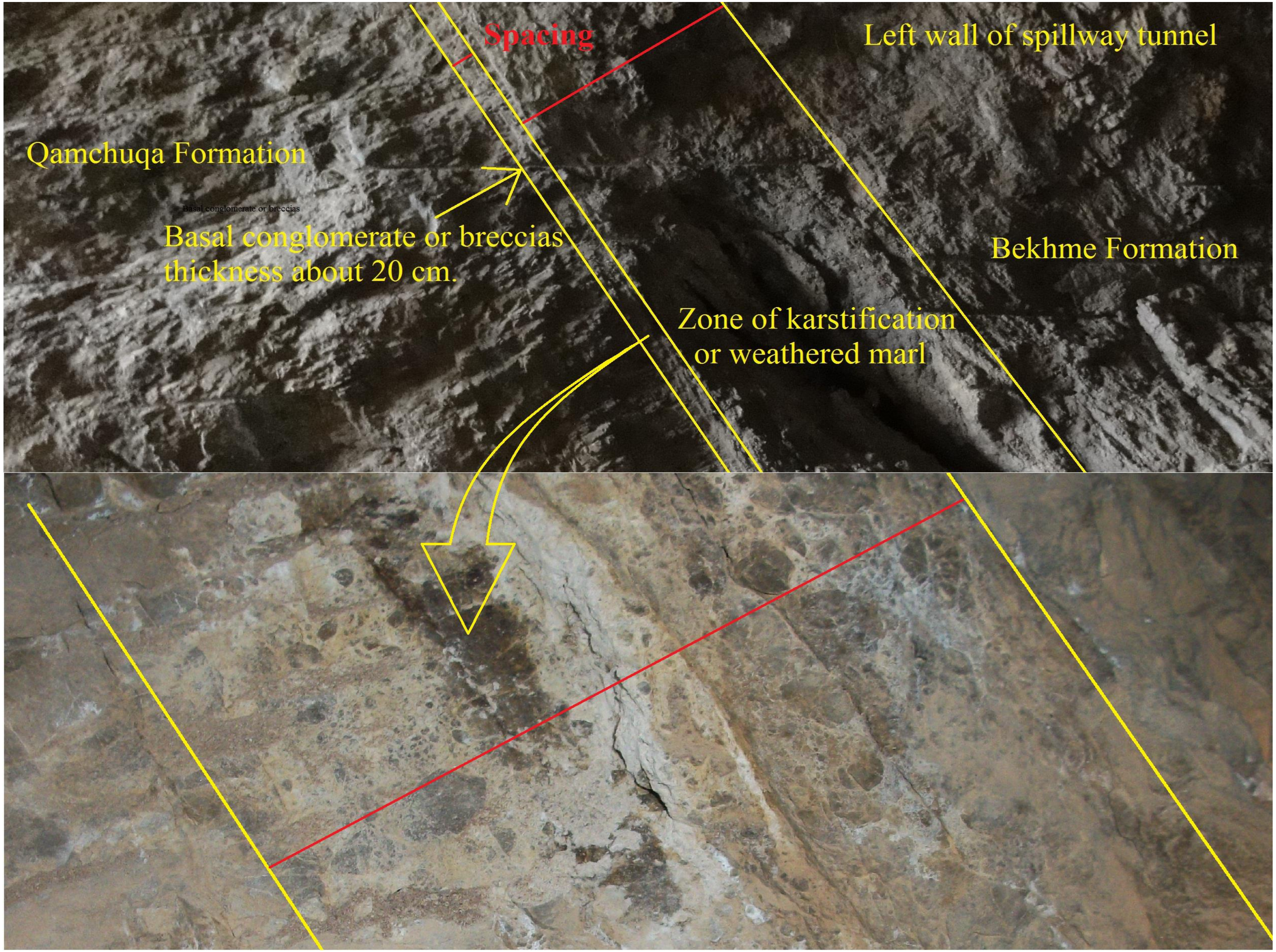
(iii) Normal set spacing is the set spacing measured along a sampling line that is normal to the mean orientation of a particular set

Discontinuity set spacing can be estimated by selecting only those discontinuities in a scan line sample that have an orientation within some specified range. If X_d is a random value of set spacing for a set whose normal makes an acute angle δ with the sampling line, then the normal set spacing X_n is given by:

$X_n = X_d \cos\delta$



Random intersections along a line produced by variable discontinuity orientations.

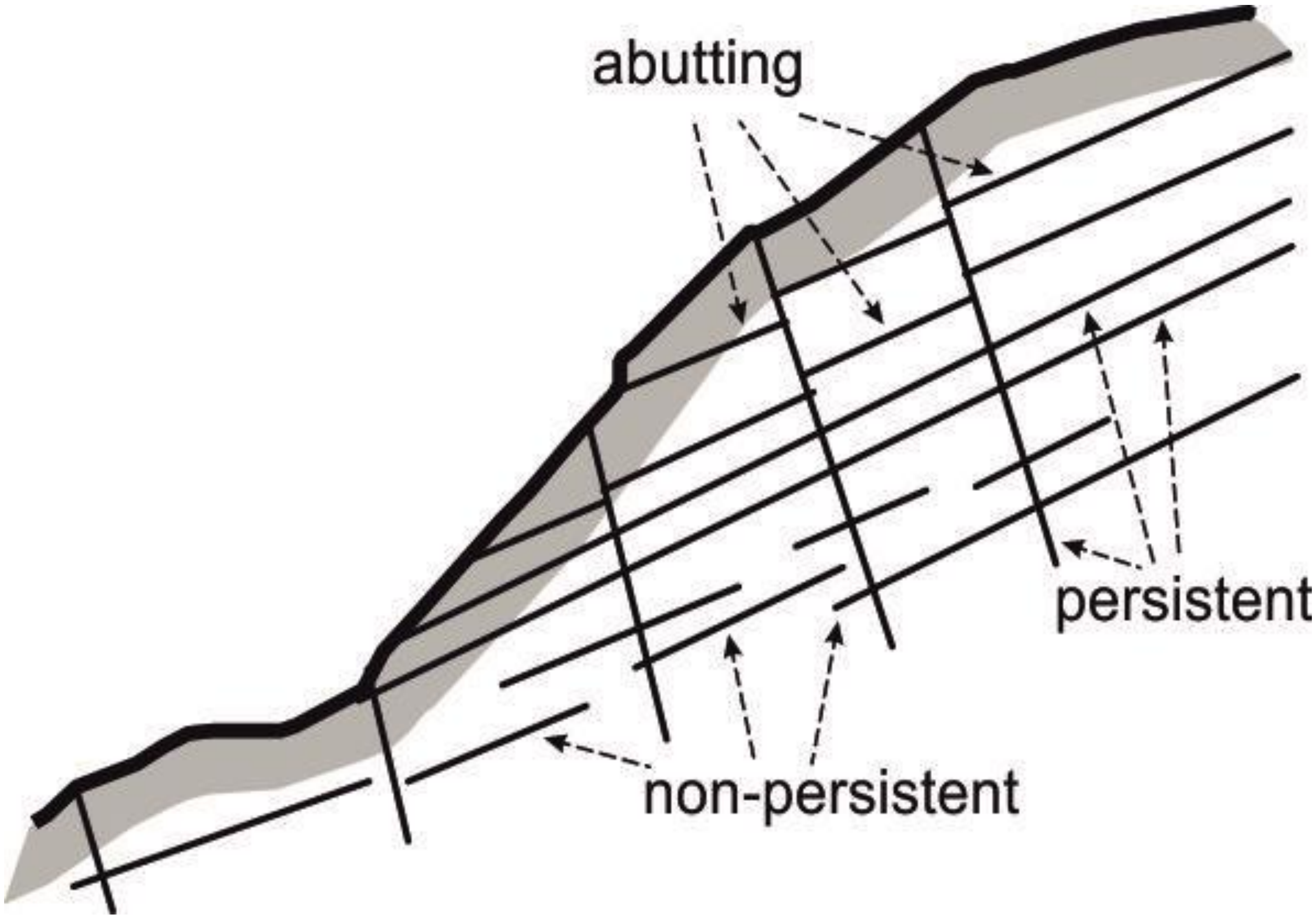

Spacing
Left wall of spillway tunnel
Qamchuqa Formation
Basal conglomerate or breccias
Basal conglomerate or breccias
thickness about 20 cm.
Bekhme Formation
Zone of karstification
or weathered marl


Estwing

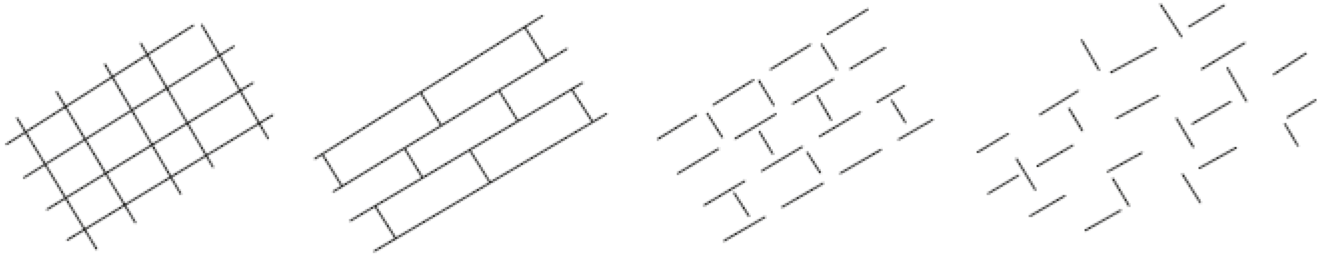
PERSISTENCE

The persistence of geological discontinuities is of great importance for many rock-related applications in earth sciences and geotechnical engineering, both in terms of the mechanical and hydraulic properties of individual discontinuities and fractured rock masses. Although the importance of persistence has been identified by academics and practitioners over the past decades, quantification of areal persistence remains extremely difficult; in practice, trace length from finite outcrop is still often used as an approximation for persistence. Discontinuities are usually differentiated in persistent, non-persistent, and abutting discontinuities.

Discontinuity persistence has a major effect on rock mass resistance (strength) but, as direct mapping of discontinuities internal to a rock mass is not possible, persistence is a difficult parameter to measure. As a result, the conservative approach of assuming full persistence is often taken.



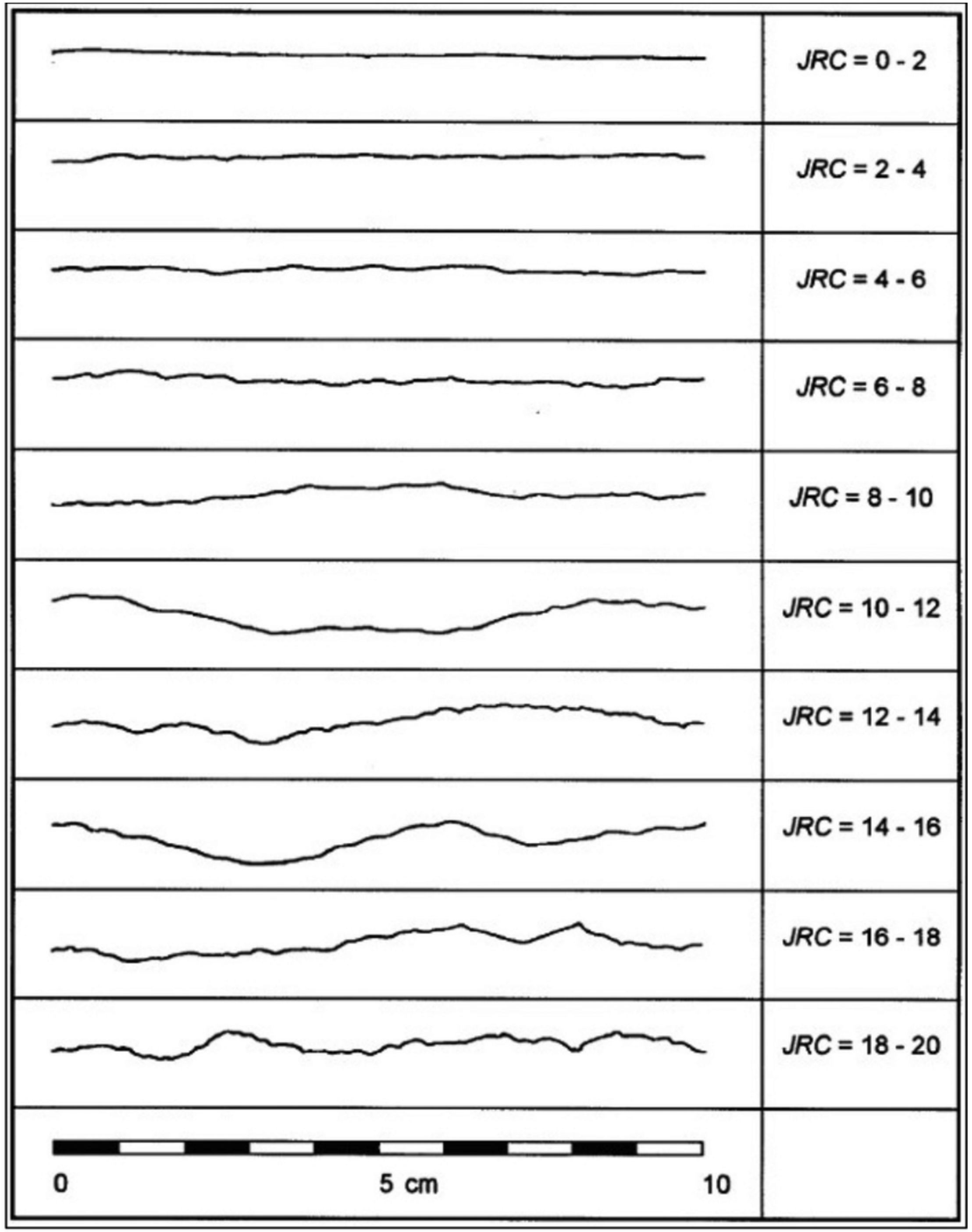
Persistence of discontinuities in a soil or rock mass.



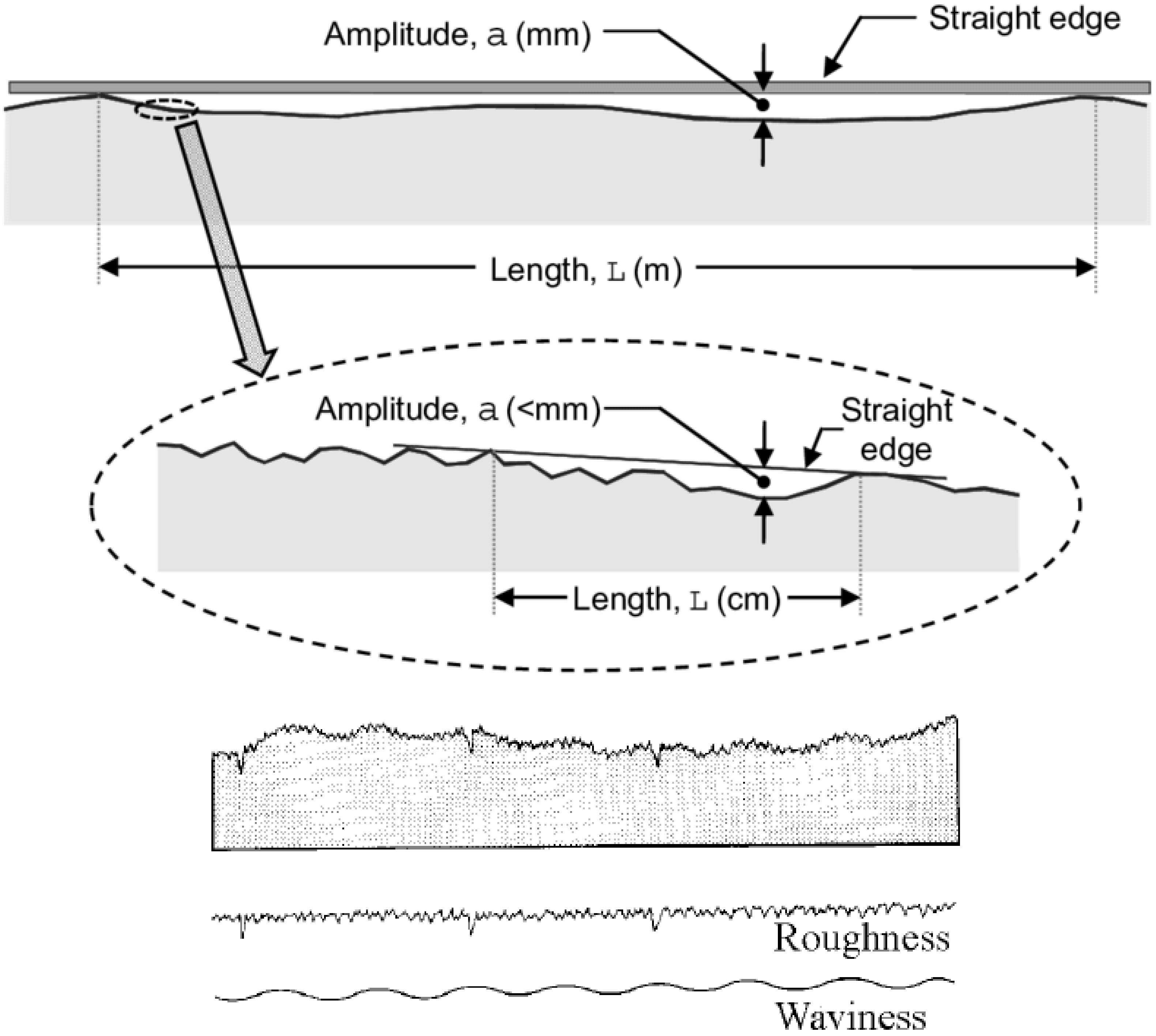
Influence of persistence of discontinuity on the degree of fracturing and interconnectivity

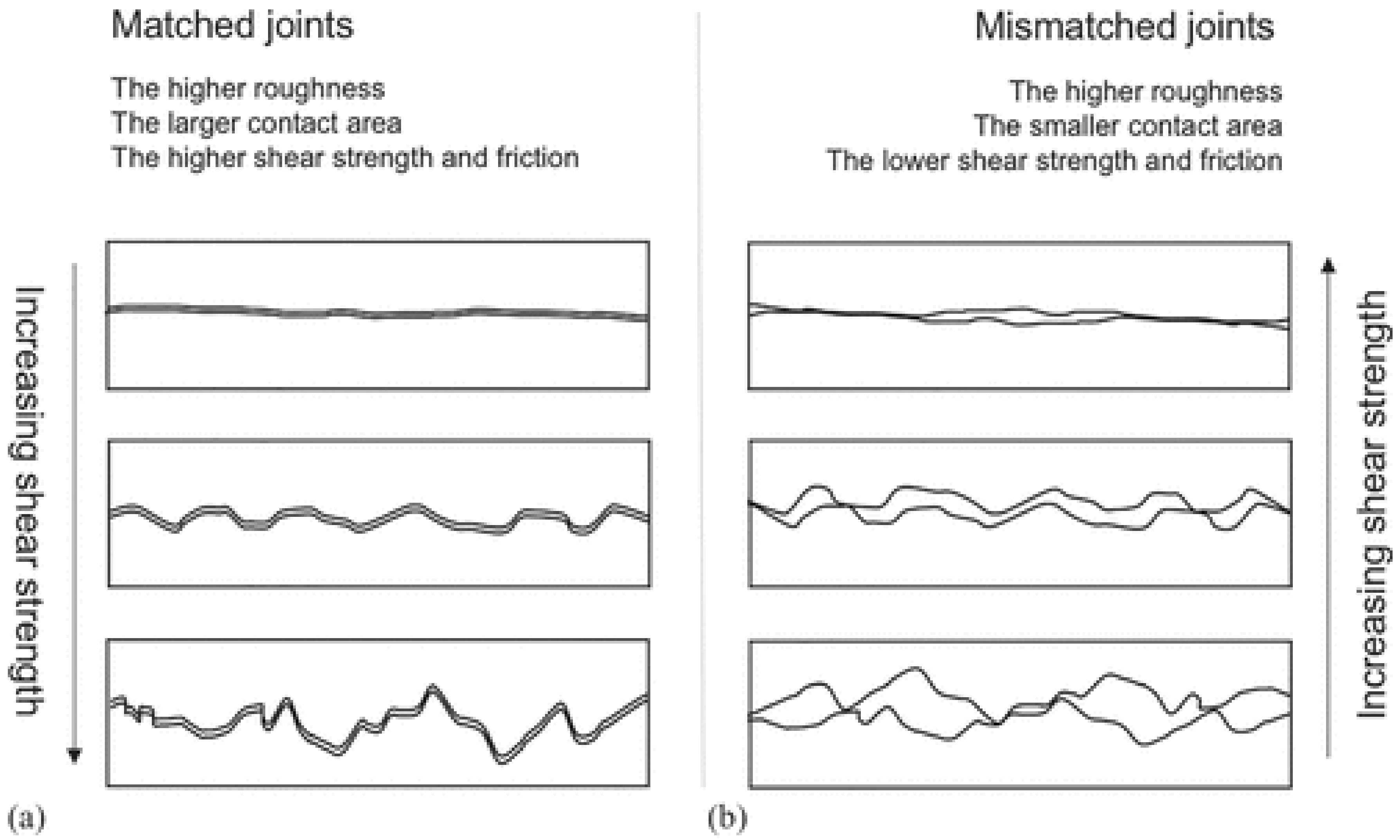
ROUGHNESS

Roughness: Surface irregularities with a wavelength less than about 100 mm are here referred to as roughness and can be expressed in terms of Barton's Joint Roughness Coefficient (JRC). Roughness can be measured by taking an impression or profile of the surface then digitizing and quantifying the result in the form of a JRC value. For most practical purposes, however, it is sufficient to assess RC visually by reference to the example profiles. Before embarking on the assessment of discontinuity roughness on a particular site it can be advantageous to obtain specimens of discontinuities with a wide range of roughness and to conduct the simple block sliding test, to determine the respective JRC values. The specimens can then be retained to provide examples to assist with the visual assessment of roughness. The resulting JRC values provide a basis for predicting the strength and deformability of the discontinuities.

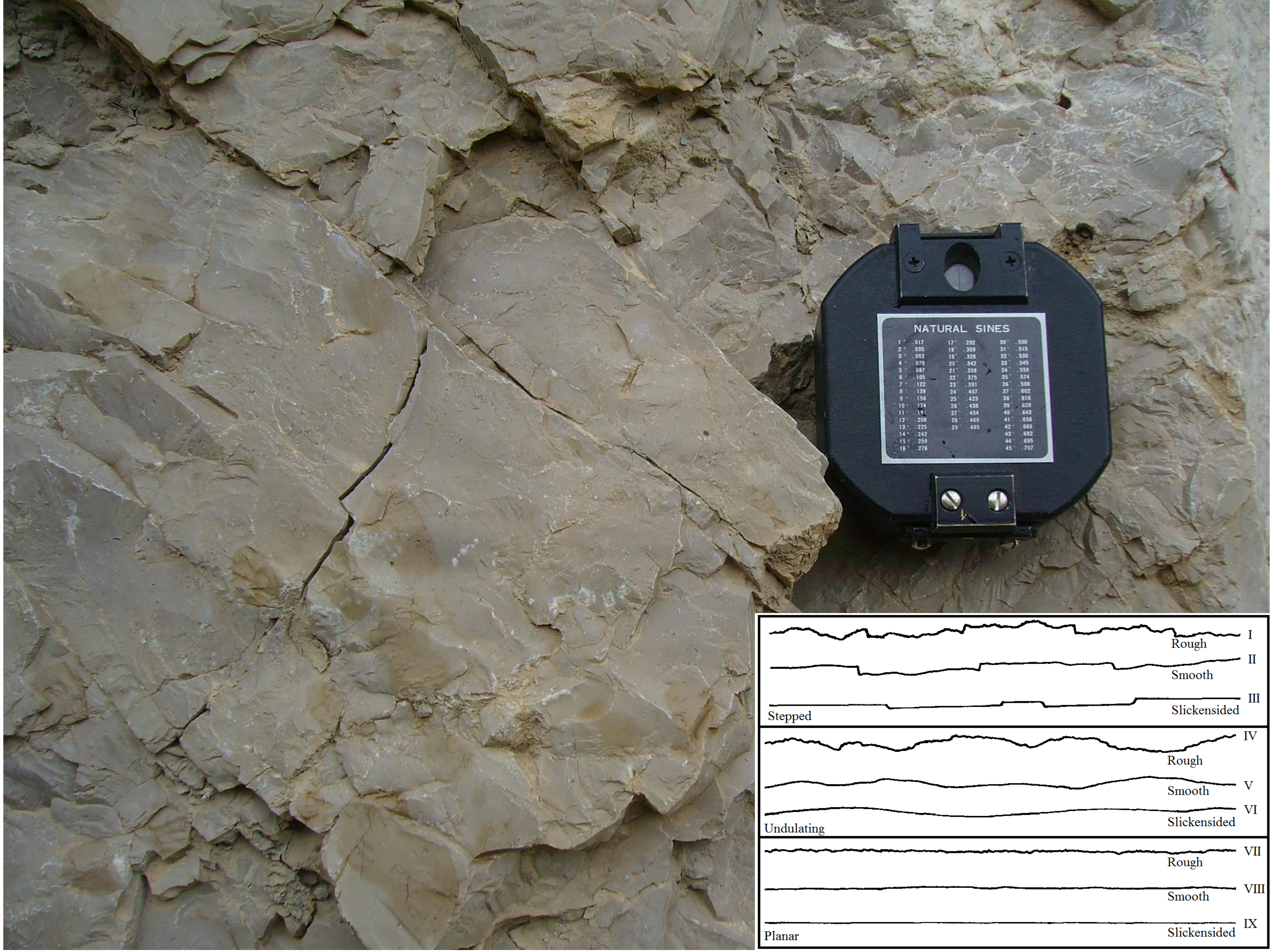


Typical discontinuity roughness profiles and associated *JRC* values


Amplitude, a (mm)
Straight edge
Length, L (m)
Amplitude, a (<mm)
Straight edge
Length, L (cm)
Roughness
Waviness



Matched joints
The higher roughness
The larger contact area
The higher shear strength and friction
Mismatched joints
The higher roughness
The smaller contact area
The lower shear strength and friction
Increasing shear strength
Increasing shear strength
(a)
(b)


NATURAL SINES
I
Rough
II
Smooth
III
Stepped
Slickensided
IV
Rough
V
Smooth
VI
Undulating
Slickensided
VII
Rough
VIII
Smooth
IX
Planar
Slickensided


THANK
YOU