Weathering of granitic rocks

JOHN K. RAJ

Kesimpulan (Summary)

In the Glossary of Geology of the American Geological Institute, weathering is defined as being "the destructive process or group of processes by which earthy and rocky materials on exposure to atmospheric agents at or near the earth's surface are changed in colour, texture, composition, firmness or form, with little or no transport of the loosened or altered material". More specifically, weathering is considered to be "the physical disintegration and chemical decomposition of rock that produce an *in-situ* mantle of waste and prepare sediments for transportation. Most weathering takes place at the surface, but it may take place at considerable depths, as in well-jointed rocks that permit easy penetration of atmospheric oxygen and circulating surface waters. Some authors restrict weathering to the destructive processes of surface waters occurring below 100°C and 1 kb; others broaden the term to include biologic changes and the corrosive action of wind, water and ice" (Bates and Jackson, 1987).

Basically, if artificially, processes of weathering can be subdivided into two broad groups, i.e. Mechanical (or Physical) Weathering, and Chemical Weathering, though sometimes a third group of Biological Weathering can also be distinguished.

Mechanical or Physical Weathering involves the disintegration of rock into smaller fragments with little or no change of the chemical composition.

Chemical Weathering, however, involves decomposition of rock with a change in its' chemical composition. The chemical reactions involved are usually exothermic ones with the new compounds formed being of greater volume and lower density than the original minerals. Water and air are agents involved in processes of chemical weathering.

As weathering occurs *in situ*, the weathered materials gradually accumulate at the site of formation and eventually give rise to a mantle of weathered materials over bedrock. This mantle or cover of weathered materials shows variable patterns and thicknesses that are dependent upon several factors, including lithology (bedrock type) and geological structures (bedding, joints, faults etc.), as well as the past and present climatic settings, biological factors and geomorphic processes operative at the site.

For geological and soil science as well as other agricultural purposes, the morphological zonation is an end-all for this serves the purpose for which it was originally designed, i.e.

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defining zones or layers of different features.

In the case of engineering projects in general, and civil engineering in particular, however, the morphological zonation needs more quantification, in particular the need for generalization of physical and mechanical properties. In civil engineering furthermore, there is a need to identify the scale of discussion for definitions of earth materials can be considerably different. For instance in civil engineering, rock material would be material that on the scale of the hand specimen would not disaggregate when agitated in water, whereas soil material would be disaggregated. This is perhaps the most commonly used definition to distinguish between soil and rock materials on the scale of the hand specimen, i.e. as Material. The uniaxial compressive strength, however, has also been proposed to distinguished between soil and rock material (0.25 MPa).

On the other hand, however, when large bodies of earth materials are considered, then different definitions are involved. The terms Rock Excavation and Soil Excavation are normally used in civil engineering projects and need to be properly defined in contract documents as economic costs are involved, Soil Excavation being some RM10 per cubic metre, whereas Rock Excavation is some RM35 per cubic metre. Various ways opfg definitions, as Rock excavation will need explosives (blasting) for economical excavation and so on. However, will dependent upon contract documents and specifications listed.

Here it must be pointed out the importance of the scale of investigation or scale of definition, a feature not often considered in geology.

Furthermore, homogenous and heterogenous rock masses come into play and this therefore influences the description of weathering profiles.

In view of the need for quantification, it therefore becomes necessary in civil engineering works to define more clearly what is implied or meant by the term rock as well as soil, as well as the scale of definition.

To look at weathering from the point of view of hand specimens or samples i.e. material scale, it is best to identify the mineralogical changes that occur with progress of weathering.

These mineralogical changes are in reality very gradual, though for ease of reference may be termed Stages of Weathering.

Stages of weathering also reflected by differences in various physical and mechanical properties, including bulk, dry and saturated densities and porosity.

When the distribution of the stages of weathering of rock material within the weathering profile is determined, a pattern emerges which coincides with the morphological zones.

These morphological zones can then be assigned Grades of Weathering which have mainly connotations that are of use for excavation purposes.

Morphological Zone I (or Rock Mass Weathering Grade 6) is up to some 12 m thick and consists of completely weathered bedrock material that indistinctly preserves the textures, but not the structures, of the original bedrock.

Morphological Zone II (comprising Rock Mass Weathering Grades 5, 4 and 3) is up to 30 m thick and consists of slightly to highly weathered bedrock materials that indistinctly to distinctly preserve the minerals, textures and structures of the original bedrock; the degree of preservation increasing with depth.

Morphological Zone III (comprising Rock Mass Weathering Grades 2 and 1) is separated by a distinct boundary from Zone II and consists of continuous bedrock that shows effects of weathering along, and between, structural discontinuity planes.

There are, however, variations to this generalized weathering profile and result from differences in the textures, structures and mineralogical compositions of the original bedrock mass as well as geomorphological histories.