

Properties of weathered and moderately weathered rhyolite tuff: what cause changes in mechanical properties?

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Miocene rhyolite tuff forms extended steep cliffs in NE-Hungary, at village of Sirok. The unique geomorphology and the presence of stable and unstable cliff faces are supposedly associated with the different rate of weathering of tuff. To understand the weathering characteristics, and the changes that lead to various degrees of preservation, block samples of tuff were taken for laboratory analyses. Samples were chosen to represent various grades of weathering. Density, porosity, mechanical properties, mineralogy and geochemical composition of tuffs were tested by using standardized methods. A strong correlation was found between the dry density and dry uniaxial compressive strength of the tuff. Systematic trends were also observed in porosity: an increase in pore volume and an increase in dominant pore size were both recorded as samples become weaker and less dense. To the contrary, no significant differences in mineralogy (XRD) or elemental composition (XRF) were found between apparently slightly and strongly weathered tuff, suggesting that no major clay mineralization had taken place with increasing weathering. Micro-fabric analyses (SEM) suggest that glass shards and vitreous particles are present in all samples but more corroded in samples of tuff which appeared intensively weathered. The differences in density, porosity, strength and appearance seem to correlate well with a difference in weathering intensity, but the lack of variation in chemical and mineralogical composition do not support this idea. Another and more probable explanation is that the differences in density are inherent in this type of tuff, even when it is fresh, and that more dense material is inherently stronger. The apparent correlation to weathering may simply be due to the more porous, less dense material being more susceptible to moisture infiltration, and hence, to freeze-thaw weathering and visible staining, and thus they appear to be more weathered.