

***An Assessment about the Effect of Mineralogical Composition  
of Alvand Pluton Rock Units on Outcrops Resistance  
against Weathering and Erosion***

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**Extended Abstract**

**Introduction**

In general, strength of rocky outcrops is associated with two factors, feature lithology that includes mineralogical composition, texture and rock Structure and environmental factors that is the area stones are located in (Hafezy moghadas, 2011, 229 after Ulusay, 1994). The mineralogical composition determines sensitivity of rocks against physical, chemical and biochemical attacks (Mahmoodi, 2010). Rocks because of containing different minerals show various stability against the degradation factors (Nikoodel, 2011). This is the first time research to use classification system of in geology for naming rocks to determine the degree of resistance of the stones against weathering and erosion.

**Methodology**

The Alvand Pluton is one of the largest intrusive masses in Sanandaj- Sirjan metamorphic zone (Sepahi, 2008). The exposed area of this mass are approximately 362.92 square kilometers (excluding Quaternary deposits). Alvand Plutonism was started from middle Cretaceous and continued till early Tertiary (Paleocene) (Sepahi & Moeen vaziry, 2000).

Alvand plutonic rocks have been marked on the geological map (Tuyserkhan and

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Hamadan 1:100,000 scale) in 100 limited areas with 8 different symbols. That usually has light grey to white color and fine to coarse grains (2-5mm in diameter). About 9 square kilometers of cordierite andalusites and cordierite hornfelses (metamorphic rocks) in the 23 areas with different extent are over the surface of porphyroid granite which mostly matches top heights (especially Heights Gavboreh). This shows diapirism in placement of the mass.

In this research, library and field observation have been used as the methods of data collection, (sampling and observation) and the research method has been descriptive and analytical. For evaluating the effect of mineralogical composition of the Alvand pluton rock on outcrop resistance some steps have been taken. In next step, the classification was proposed by the International Union of Geological Sciences (IUGS), and diagram (QAPF)<sup>1</sup> associated with it, was selected with range diagram, according to the mineralogical composition. Numerical values are determined for the degree of outcrop resistance of each area against weathering and erosion. In order to determine the degree of Alvand plutonic outcrops resistance we have specified surface of QAPF diagram. The resistance specified as numerical value is ranged from 1 to 10 classes started from foidolites with least degree of resistance and with ratio of decreasing F and P and increasing A and Q. It is the most sensitive igneous rocks against chemical weathering considering mineralogical composition. Thus, quartz-rich granitic-rocks are in 9 areas and finally quartzolit (silexite) which is the most resistant intrusive igneous rock against weathering.

To test the proposed method, 10 types of Alvand plutonic rocks which gathered by Zarian et al., 1972 with Modal analysis method was studied and selected by using diagram QAPF for resistance range. In addition, finding equivalent name in classification system of IUGS, the degree of the resistance against weathering and destruction in terms of mineralogical composition is given in.

### **Results and Discussion**

Naming Alvand plutonic rock units on geological maps is based on IUGS classification. Thus, based on provided method, relative strength of the rock outcrop in terms of the effects of mineralogical composition on the resistance against weathering and erosion have been identified and presented in Table 1. Specific degree of resistance for Alvand plutonic rock units are presented on Table 4. Rock units of this mass can be classified in four groups, the least of resistance is related to Olivine gabbro outcrops with 2 degree which cover 14.8% of the mass area. The most resistant rock outcrops are the unit pegmatitic granite, pegmatic- aplite granite, tourmalin granite and granite bearing garnet with a resistance degree of 8. Among other units this later covers just 3.15% of surface area. Degree resistance was determined for different rock units in Alvand pluton and it shows 6 degree resistance differences between them. This difference can be affected by weathering and differential erosion between different units. Average weighted degree rock units outcrop resistance of Alvand in terms of mineralogical

1. Q = Quartz, A = Alkali Feldspar, F = Feldspathoids, P = Plagioclase.

composition is obtained for total mass about 6.59. It shows resistance of the mineralogical composition of the outcrops and the results can be found in relation to high percentage of quartz and alkali feldspar, and the approximate homogeneity in mineralogical composition of the rock mass. In order to determine the applicability of the results obtained from the proposed method in geomorphological and hydrological analyses, the Digital Elevation Model (DEM) of Alvand pluton was provided.

### **Conclusion**

In this paper, the effect of mineralogical composition of Alvand plutonic outcrops against the weathering and erosion with the numeric range 1-10 and using QAPF diagrams have been determined. In this method, Surface of QAPF diagram between Q and F has been divided into ten areas with in numerical range of 1-10. The range of values represents the effect of the mineralogical composition on degree of resistance of outcrops of rock units. According to degree resistance designated for Alvand pluton rock units in terms of the effects, this mass can be classified in four groups. In this classification the least resistance is related to Olivine gabbro outcrops with degree resistance of 2 and the most resistant rock outcrops with resistance degree of 8 are the units including pegmatitic granite pegmatitic– aplite granite, tourmaline granite, and granite bearing granite. According to average weighted degree granitic outcrop resistance of Alvand in terms of mineralogical composition, the degree is obtained 6.59 for total mass.. Determining resistance of Alvand rock units in quantitative mineralogical composition and the properties of texture and structure characteristics can be used for geomorphological analysis and explanation of predominant form over Alvand mass.

**Keywords:** *Alvand Pluton, Mineralogical Composition, Outcrops, QAPF Diagram, Resistance Degree.*