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**Petrochemical studies of the rocks of the Ushiri Valley, Upper Dir,  
North Pakistan**

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The study area, as a part of the Ushiri Valley, is located in the western part of the Kohistan Island Arc, which is comprised of three distinct rock types such as (i) amphibolites, (ii) granodiorites, and (iii) granites. The amphibolites are exposed in the northern part while granodiorites and granites occupy the southern part of the study area. These rocks display intrusive contacts and exhibit local shearing and faulting in certain places. The amphibolites are usually massive but have a banded appearance at places. In areas of extensive faulting and shearing, these are intruded by quartzo-feldspathic and quartz veins. The medium to coarse-grained granodiorites and granites occur as small intrusions within these amphibolites. The amphibolites mainly contain hornblende and plagioclase with a lesser amount of alkali feldspar and quartz, while muscovite, biotite, epidote, chlorite and opaque minerals occur as accessories. The granodiorites are dominantly composed of plagioclase, alkali feldspar and quartz with a lesser amount of sericite, epidote, chlorite, and augite. The granites consist mainly of quartz and alkali-feldspar with a lesser amount of plagioclase. Epidote, biotite, muscovite and opaque minerals are present as accessories. The chemical characteristics of the studied amphibolites are indicative of igneous protolith and are considered as part of the Kamila amphibolites, while that of granodiorites and granites suggest that these are co-magmatic and can be related to the stage-II pluton of the Kohistan batholith. The detailed geochemical analysis of major and trace elements of these amphibolites, granodiorites, and granites and their plotting on the tectonic discrimination diagrams, suggest that these are calc-alkaline in nature related to the arc magmatism within the subduction-related environment.

**Keywords:** Petrography; Geochemistry; Major and trace elements; Calc-alkaline; Arc magmatism.