

**AGGREGATE POTENTIAL OF THE CARBONATE UNITS IN THE KHYBER FORMATION, KHYBER AGENCY, PAKISTAN**

**Muhammad Naveed Anjum<sup>1</sup>, Nowrad Ali<sup>1</sup>, Zaif Ur Rehman<sup>1</sup>, Muhammad Ghayas,<sup>1</sup> Gohar Rehman<sup>1</sup>, and Waqas Ahmad<sup>2</sup>**

*<sup>1</sup>Department of Geology, University of Peshawar*

*<sup>2</sup>National Centre of Excellence in Geology, University of Peshawar*

**Abstract**

This study is aimed at evaluating the Precambrian carbonates of the Khyber Formation in terms of their mineralogical, chemical and physico-mechanical properties for assessing their suitability as an aggregate source both in asphalt and concrete works. The Khyber Formation is extensively exposed in the eastern and central parts of the Khyber Agency. The Limestone units of the Khyber Formation dominantly comprise of Calcite ( $\text{CaCO}_3$ ) with minor to trace concentration of dolomite, undeformed quartz and ores, classified as Algal laminated micritic mudstone. They are light to dark-grey, fine to medium-grained, hard, compact and thin to medium-bedded and at places thick-bedded. The algal stromatolites and laminations are the common features. The stylolites, calcite-filled veins and neomorphism are the common diagenetic modifications. The limestone of the Khyber Formation is composed of 54.72-58.4 wt. %  $\text{CaCO}_3$ , 0.5-0.9 wt. % MgO and based on 0.02-0.22 wt. % combined values of  $\text{K}_2\text{O}$  and  $\text{Na}_2\text{O}$ , it is classified as low to high alkali limestone. Massive outcrops of dolomitized-limestone have also been identified sporadically along the exposed outcrops of the Khyber Formation e.g. in Besai area and along Khyber Pass. The petrographic and chemical investigations reveal that the limestone units of the Khyber Formation are innocuous in terms of Alkali Silica Reactivity (ASR) and Alkali Carbonate Reactivity (ACR). However, the dolomitized horizons must be avoided, owing to the ACR potential when selecting a quarry site for aggregate extraction. The physical properties of the limestone units of the Khyber Formation as an aggregate material (i.e. soundness, water absorption, Los Angeles abrasion and specific gravity) are in accordance with the ASTM standards. The petrographic, geochemical and geotechnical details of the limestone units in Khyber Formation approve their suitability as an aggregate source in both concrete and asphalt construction works.