Probable Impact of the Geology, Mineralogy and Chemical Composition of Rocks on the Stability of Lambata – Minna Road

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Abstract.

The geology, chemistry and mineralogical composition of the rocks along Lambata-Minna road were investigated with the view of understanding the probable impact of the rocks on the perforance of the road. The methodology included geological field mapping and laboratory analyses that involved x-ray diffraction and X-ray fluorescence. The study reveals that the road is underlain by migmatite, marble, schist, granodiorite, gneiss and poorly fractured granite. The diffractograms show that the minerals that make up the rocks are albite, cristabalite, siderophylite, graphite, nacaphite, cancrinite, wulfrenite, muscovite, vallerite, berlinite, ferroselite, cristabalite, annite-syn, sodalite, quartz and aluminium silicate minerals. The banded gneiss (around Bunu) and granodiorite (around Pago) show very little presence of quartz and highly rich in mafic minerals. The abundant oxides in the rocks are in the order SiO_2>AlO_3>TiO2>Fe_2O_3>CaO >K_2O> MgO>Na_2O. Most of these minerals are susceptible to weathering and leaching. The leaching could lead to the removal of the bases from the weathering system and the formation of clay minerals such as kaolinite, illite and montmorillonite. These secondary minerals are liable to swelling and shrinkage during the wet and dry seasons that could lead to the poor performance of the road.

Keywords: geological field mapping, mafic minerals, weathering, leaching

Introduction

The mineral assemblage and therefore the rock type plays an important role in determining the type of soil developed in an area. For example, granites and gneisses that occur in the study area are made up of three major minerals namely quartz, feldspars and mica (often replaced by or associated with hornblende). Rocks when expose to favorable conditions, rocks weather into soils. Some of the minerals that constitute these rocks weather into secondary minerals that might not be good for road construction (*Gidigasu,74)* and (*Townsend et al 1969)*. Works by (Weinert, 1960), (Farquhar, 1980), (*Okogbue,1988*) and[*Okogbue and Uma 1988)* have shown that geological conditions along a highway route are important factor to the proper performance of the highway. Since roads are built on and with geologic materials (rocks and soils), a good knowledge and understanding of these materials is therefore vital for the successful construction of roads. (Malomo et al 1983) carried out the engineering geological mapping of Abuja, the Federal capital of Nigeria. Their investigation involved field mapping comprising the determination of lithology, structures, weathering character and laboratory tests such as particle size distribution, Atterberg limits and compaction. An appraisal of the area in terms of land-use was carried out by (Malomo et al,1983). Particular emphasis was placed on housing sites, heavy building structures, highways, tunnels and underground structures. The Lambata-Minna road is part of the road linking most of the northwestern states to Abuja, the Federal Capital of Nigeria. This gave rise to the need to investigate the mineralogy of the underlying rocks with the view of understanding the probable effect of these rocks on the stability of this road. This is because roads are constructed on and with geologic materials and has continued to fail on some specific locations despite the frequent remedial works on the road.

The Study Area

The study area covers longitude 07° 00' 08.5" and longitude 06°34'55.0" to latitude 09° 21' 28.7" and latitude 09° 31' 28.3" along Lambata-Minna road. The topography of the study area is largely controlled by the geology that comprises of migmatite, marble, schist, gneisses,