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Assessing the Aptitude of Vesicular Volcanic Rocks as Pozzolanic Sources for Supplementary Cementitious Materials

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Abstract : The research was conducted to verify two vesicular basalt deposits identified for pozzolanic sources. The Wejerat site, in southern Tigray, has been the major source of vesicular basalt for cement production, and the other is Adisherafo site found near Hagerselam, central Tigray. Rock samples were collected from both sites to undergo major oxides analysis, a possolanacity test and compressive strength measurement of 2 & 28 days as well as polished surface observations. A field survey in the Wejerat site revealed the presence of varieties of basalts vesicular, scoriaceous, doleritic, porphyritic and Aphanitic in decreasing order of vesicularity. The Adisherafo site has dominantly vesicular basalt intermingled with intravolcanic diatomite units. The Wejerat vesicular basalts are best fit for pozzolan source with mean 2- and 28-days compressive strength of 14.9 and 34.0MPa, exceeding the minimum limits of 10.0 and 32.5MPa respectively. Their mean [OH-] and [CaO] values in the pozzolanicity test are 43.0 and 11.4mmol/l, respectively falling on the pozzolanic area of the Frattini curve. Dolerite samples turned out to be promising sources in all tests. The scoriaceous, as well as Adisherafo's vesicular basalt and diatomite units show marginal pozzolanic characteristics. The total sum of oxides (SiO_2+Al_2O_3+Fe_2O_3) minimum, 70%, is met with samples from all but weathered basalt units. The research has indicated the effect of vesicularity on the pozzolanic nature of volcanic rocks as well as the importance of relying on more methods than conventional ones to characterize pozzolanic materials.

Keywords : Pozzolan, Vesicular basalt, compressive strength, cement additives
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