Properties of bricks produced from Greenlandic marine sediments

This study investigated the possibility of a local brick production from fine grained marine sediments (MS) near Sisimiut, Greenland. The assessment is based on the physical and mechanical properties of clay bricks concerning the resistance to the harsh, Arctic weather conditions, together with an identification of a suitable production method. Samples of MS were collected near Sisimiut, Greenland, and tested with respect to the geological properties, which revealed a fine grained, low plasticity silty clay with evenly distributed grain sizes. By a screening of the mineralogy of MS by X-ray diffraction, the major mineral phases were seen to be dominated by quartz and feldspar. Chemical investigations of MS showed low contents of both sulphur and carbon, whereas an unexpectedly high content of chlorine was found. A laboratory-scale study was made on fired brick pellets \((d \sim 20 \text{ mm}, h \sim 3 \text{ mm})\), and of fired miniature bricks \((54 \times 54 \times 60 \text{ mm}^3)\) of MS from Sisimiut. Brick pellets were prepared in order to determine an optimal composition and production method, based on investigations of the firing temperature and time, forming pressure, initial forming water content, and content of granite waste (CR). Miniature bricks were then prepared according to the optimal conditions and formed at a pressure of 20 MPa, fired at 1020 °C for 3.5 days at the brickwork Wienerberger Tegl in Helsinge, Denmark. The durability properties such as porosity, water absorption, bulk density, linear shrinkage, and compressive strength (only miniature bricks) of both pellets and miniature bricks were investigated and the results were compared with ASTM requirements for building bricks to classify their resistance to damage by freezing. The study of miniature bricks showed that the water absorption was too high after 24 h of submersion in cold water to fulfill the requirements for severe weathering according to ASTM-C62 (2013). It was concluded that the firing temperature needed to be increased in order to obtain a more durable brick-type, suitable for the Arctic climate.