
SIGNIFICANCE OF CHERT IN LIMESTONE AND DOLOMITE USED AS CONCRETE AGGREGATE

WILLIAM A. KNELLER

Department of Geology, University of Toledo, Toledo, Ohio

A considerable range of composition exists in rocks that have been described as chert, jasper, or flint. Their composition may be opaline, chalcedonic, quartzose, or mixed. Certain cherts, when incorporated in concrete, are known to possess nondesirable thermal and chemical properties. The inability of chert to withstand thermal shock above the freezing temperature of water is an example of such a property. Cryothermal reactions may cause disintegration of concrete, due to repeated cycles of freeze and thaw. Thermal properties are significant because small temperature changes may cause inordinate expansion and resultant fissuring of concrete. Freezing of entrained water in chert may cause excessive physical failure in concrete. Some cherts react chemically with alkalis liberated during the hydration of the cement, with resultant cracking and deterioration.

Sources of concrete aggregate in Ohio have been viewed with suspicion because they contain considerable chert derived from Middle Devonian and Pennsylvanian carbonate rocks. Light-colored porous cherts from the Middle Devonian Columbus Limestone exhibit the least freeze-thaw durability of the samples studied. Denser cherts may also yield to freeze-thaw stresses, but tend to be more susceptible to thermal shock. Cherts rich in opaline and chalcedonic silica usually exhibit alkali-aggregate reactivity.

Comparison of occurrence, petrography, geochemistry, electron microscopy, X-ray diffraction, and origin of the two major rock groups studied reveals many differences. The most important of these are degree of weathering, specific gravity and porosity, opaline and chalcedonic content, surface chemistry, and degree of fracturing. Correlation of highway laboratory tests with techniques of electron microscopy and X-ray diffractometry shows great promise in predicting potential service records of cherty aggregates.