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# Editorial

Much has been written about alkali–silica reaction (ASR), but much less has been investigated about alkali–carbonate reaction (AC) and the literature on this topic barely covers about 10% of all published work on alkali–aggregate reactivity. Much of the early confusion between alkali–aggregate reactivity and freeze–thaw resistance was partly responsible for this late awareness of ACR — aggregates with poor field performance were initially easily differentiated from those with good performance by freeze–thaw tests and the conclusion was generally reached that deterioration was due to low resistance to frost attack. It was only some time after 1957, when the possibility of reaction between alkali in the cement and the coarse aggregate of fine-grained argillacious dolomite was recognized, that expansion and map-cracking found in concrete structures containing shale and fine-grained soft limestone was realized to be different from that due to alkali–silica reactivity. Since then, many more cases of ACR have been found in various parts of the world.

Several countries in the Far East and China have plentiful deposits of limestone and dolomite which are extensively used in the construction industry, particularly as concrete aggregates. Instances of severe cracking in many of these structures were thought to be due to processes other than ACR, and frost and reinforcement rusting were often considered more probable than AAR. Recent studies have, however, shown that much of the visible cracking arose from the use of high alkali cements together with fairly unreactive fine aggregate but with dolimitic limestone or dolimitic rocks as coarse aggregates. In China, for example, concrete piles and railway ties made and used in Shanxi, an airport runway in Shandong province and a bridge in Tianjing City have all now been recognized as suffering from ACR. There have also been instances where pavements and other airport runways have shown similar signs of distress, and ACR is now suspected as the prime cause of such cracking in real structures.

In practice, ACR shows many of the familiar visual evidences associated with ASR, such as expansion and cracking. The absence of silica gel is a distinct characteristic of ACR, however, and more often than not only coarse aggregates rather than fine aggregates have been found to be responsible for the reaction. Another important finding has been that concrete structures containing low alkali cements (less than 0·6% sodium oxide equivalent) and containing large amounts of cement replacement materials, such as pozzolans, fly ash or slag have, nevertheless, shown deleterious expansion when highly reactive carbonate aggregates have been used.

It is now recognized that only part of the carbonate rocks in reactive and petrographic studies can be correlated with their reaction. However, not all petrographic features can generalize all reactive rocks, and equally, not all carbonate rocks with typical petrographic characteristics will show expansion in some of the conventional laboratory tests. The type of rock, texture, calcite/dolomite ratio, and acid insoluble contents are now generally considered to be major parameters determining the potential reactivity of carbonate rocks. Rocks with similar texture and composition, on the other hand, could be very different in their expansive behaviour. Alkali-reactive carbonate rocks have also been found to involve several rock types from almost pure dolomite to limestone with only detectable dolomite, and, from almost pure dolomitic limestone with very little acid insoluble content to argillacious limestone and even to shale. The common feature is the presence of fine-grained dolomite crystals in the rock.

Recent research in China shows that the minor composition of coarse aggregates found there is different from other typical reactive carbonate rocks, and that these reactive aggregates include limestone containing little or no dolomite or almost pure dolomite. Another noticeable feature of these aggregates is that very little clay is involved in these reactions. It has also been found that silica can be involved in the deleterious interfacial reaction of many carbonate rocks, and that ACR and ASR can occur simultaneously in the expansion mechanism of some reactive aggregates. These are new and novel findings that need to be confirmed to enhance our understanding of the mechanisms involved in alkali–aggregate reactivity.