

What can the geochemistry and mineralogy of the 2 Ma natural cements at Maqarin, Jordan, tell us about the likely long-term behaviour of cementitious wastes?

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The precise implications of cementitious waste leachate/repository host rock interaction has been studied in the laboratory, underground research laboratories (URLs) and in natural analogues (NA), in particular by the study of natural cements in Jordan. These 2 Ma cements have been produced by the combustion of organic-rich clay biomicrites and are very close NAs of the industrial OPC (Ordinary Portland Cement) which is currently used for the encapsulation of lower activity radioactive wastes. Following interaction with groundwaters, natural alkaline leachates (maximum observed pH of 12.9) are produced and these move out of the cement into the surrounding host rock, subsequently interacting with and altering it.

The novel data from the sites studied in Jordan have now been used in a raft of assessments of the impact of cement leachates on the long-term behaviour of a waste repository including assessment of alteration of the bentonite buffer and bentonite repository and borehole seals, evaluation of changes to the host rock flow system and estimation of the longevity of cementitious waste forms (among other topics).

Despite this wide range of uses of the Jordan natural cement data, there remain areas where further work could be carried out. Currently, most repository safety assessments (SA) do not include potentially positive processes such as carbonation of the cementitious wastes. This would act to 'armour' the cement against leaching, so increasing waste form longevity. To date, it has been ignored on the basis that no long-term evidence for carbonation exists – but preliminary data from Jordan indicate that carbonation has occurred and that the carbonated cement appears to be very stable.

The potential impact of the carbonation process on repository SA will be examined here along with the currently available data from Jordan. Gaps in the database will be identified and appropriate sites in Jordan where these can be studied will be presented.