Pergamon

Cement and Concrete Research 32 (2002) 1003

CEMENT AND CONCRETE RESEARCH

Discussion

A discussion of the paper "Deteriorated pavements due to the alkali–silica reaction: A petrographic study of three cases in Argentina" by S.A. Marfil and P.J. Maiza☆

Bryant Mather*

Structures Laboratory, U.S. Army Engineer Research and Development Center, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199, USA

Received 26 September 2001

The paper by Marfil and Maiza is interesting, welcome, and valuable; and in my opinion could be even more valuable if a few clarifications were made. It is the purpose of this discussion to elicit those clarifications.

1. In the Abstract and later in the paper, the term "volcanite" was used. I have been unable to establish that this word exists in English in geology. I assume it means "volcanic rock(s)" but perhaps it "glassy volcanic rocks." An explanation would help.

2. Also, mention was made of volcanic glass generally altered to argillaceous material; as being reactive. Volcanic glass of relatively high silica content, i.e., volcanic glass as found typically in rhyolites andesites, and dacites is a well-known reactive constituent. However, when such glass is altered to clay, the clay is not reactive. Again, clarification would help.

3. The three concretes were 3, 15, and 18 years old but no speculation or information as to the alkali content of the cements used or whether or not the concretes contained a pozzolan or slag.

4. No mention was made under methods of ASTM C 295, C 856, or C 294. Had reference been made to these, questions that remain unanswered would have been answered about the aggregate, the concrete, and the terminology.

5. In the report of the XRD findings, ettringite was, of course, found but was referred to as "reaction product." Since there was no sulfate attack, there is no product of sulfate reaction. The ettringite is the recrystallized normal primary ettringite that forms naturally and beneficially in all concrete very early in its life, that dissolves, reprecipitates as crack and void fillings in all concrete that gets severely cracked and left out in the rain. It is not a product of ASR.

6. In Section 3.4, it was reported that those aggregate in Concrete A included microcrystalline quartz with undulatory extinction. This causes a problem for me since I understand "microcrystalline" to mean tiny crystals that never were any longer than they now are and are too small to be measured for undulatory extinction, which is a characteristic of larger quartz crystals (grains) in a rock that has been bent during metamorphism and the quartz crystal strained. Some people, including me, have wondered whether strained quartz undulatory extinction was actually, itself, reactive or whether its presence was an unfailingly accurate indication of very finely divided crushed quartz in the rock—which is really the reactive constituent—a material similar to ground quartz used in autoclaved concrete products. Again, clarification would help.

7. I think it might help, as it has helped me, to recall that the alkalis (Na, K) do not cause "alkali" reaction. When a material such as K_2SO_4 goes into solution, it does not raise the pH—thus making a more concentrated OH solution that could be enough above the pH of 12.6 of a saturated $Ca(OH)_2$ solution that is not reactive to start making gel of thermodynamically metastable silica; also it has helped me to recall that is not the occurrence of the reaction that damages the concrete (if all the reactive aggregate particles were tiny particles the size of cement grains, there would be no expansion even if they all reacted because the product would be calcium alkali silica gel), it is only when the product is alkali silica gel (no calcium) that it is capable of taking up lots of water, swelling, and exerting very large swelling pressured in the concrete.

8. The last word in the paper is "unknown". It is used to refer to the role of ettringite. I believe it could be replaced by "innocuous".

☆ Cem Concr Res 31(7) (2001) 1017–1021.

* Tel.: +1-601-634-3264; fax: +1-601-634-3242.
E-mail address: matherb@wes.army.mil (B. Mather).

PII: S0008-8846(02)00730-5