

Pioneers of concrete petrography in Canada

International Cement Microscopy Association

Toronto, 2017

Chris Rogers



Jack Gillot, Ludmila Dolar-Mantuani, Ed Swenson, PK Mukherjee,
AAR conference 1986 (photo Doug Hooton)

Ed Swenson

- Born 1911
- Assistant Prof of chemistry at University of Saskatchewan before going to Division of Building Research in Ottawa in early 1950's
- Head of cement and concrete research in Division of Building Research Nat. Res. Council Ottawa, 1955
- Famous paper in Bulletin of ASTM in 1957 "A Canadian reactive aggregate undetected by ASTM tests" (ASTM Bull 226)
- Miron cement in early 1960's
- By 1967 was back at NRC



E. G. SWENSON, associate research officer, Materials Section, Division of Building Research, National Research Council of Canada, and formerly assistant professor in chemistry at the University of Saskatchewan, is currently in charge of cement and concrete research and the author of several papers in this field.

ASTM BULLETIN

(TP 85) 67

Basis for Classifying Deleterious Characteristics of Concrete Aggregate Materials*

By E. G. SWENSON† and V. CHALY‡

SYNOPSIS

Deleterious characteristics of concrete aggregate materials are reviewed, and a simplified arrangement for their classification is proposed. This arrangement is based on a recognition of harmful properties rather than on types of materials, thus providing the testing engineer with a more systematic basis for laboratory evaluation of aggregates. Harmful properties that involve chemical action are given the same emphasis as those involving the physical nature of the material. These properties are discussed in relation to the limitations of conventional methods of test and the need for supplementary testing based on petrographic and chemical techniques.

First Canadian paper on the topic in 1955

Ed Swenson

- Developer of concrete prism expansion test for AAR because mortar bars would not work with ACR - now in many standards.
- Highly regarded within NRC – studied many other topics and visited USSR (paper “Construction in the USSR” 1967) Impressed by number of women heading up Depts

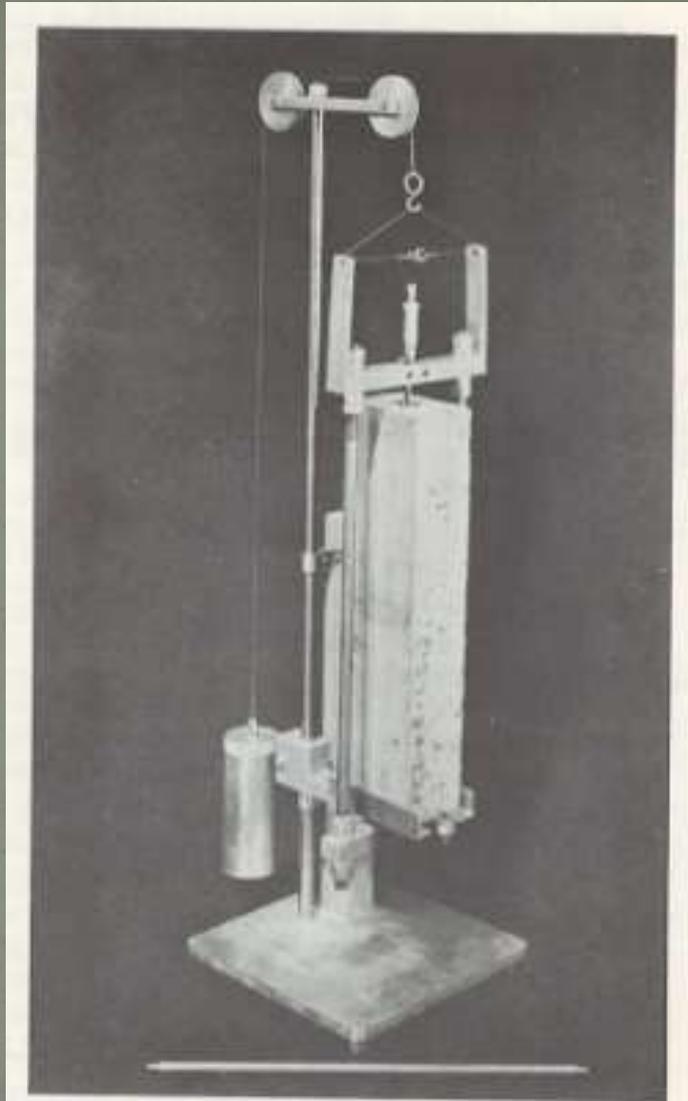


Figure 2. Comparator assembly for measuring length change of concrete prisms.

Ed Swenson

- Extensive work in late 1960's on AAR in Nova Scotia with Gillott, Duncan and others
- In his report (cover note to CR on right) he recommended low-alkali cement or use of fly ash to prevent the extensive damage that was occurring.
- The advice was not adopted and report was buried because of politics. Only in late 1980's was the use of fly ash tentatively adopted but only in small amounts.
- Editor of book 'Performance on Concrete' - U of Toronto press 1968

→ Chris.

Copy of ~~Final~~ report on Nova Scotia Research program. If you already have copies in your AAR subcommittee, please ignore.

"Ancient history" but may be pertinent in many respects ^{to present-day} procedures in studying a given field case.

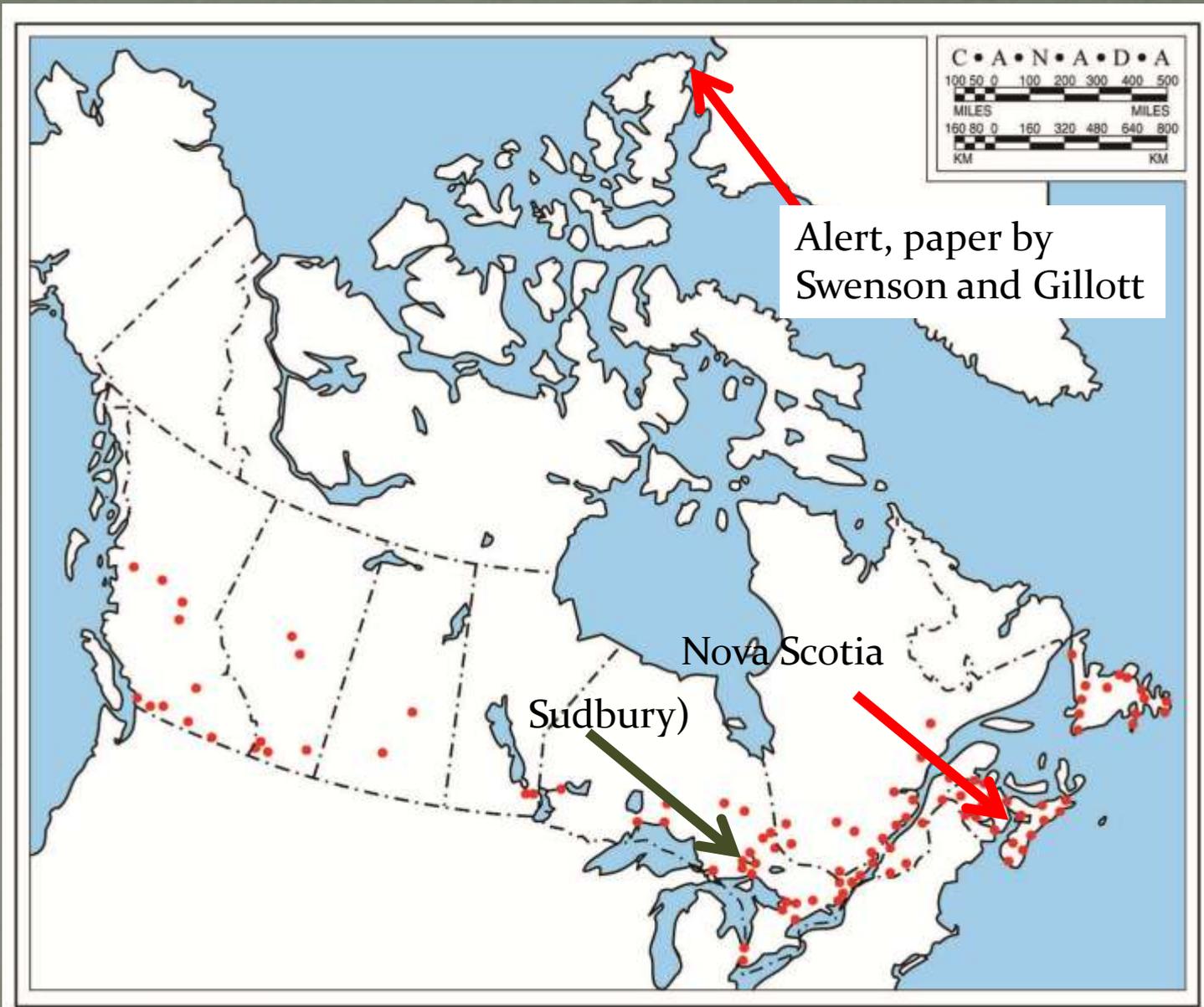
Greetings to AAR subcommittee members, et al.

Ed Swenson

Jack Gillott

- Jack Edney Gillott- born Birkenhead (Liverpool) Jan 9 1927 - May 30 2008 Calgary
- Degrees from University of Liverpool in early 50's in geology and DSc (London)
- Joined Div of Bldg Res at NRC in Ottawa in 1958
- Worked with Ed on Alkali-carbonate rock reaction problem until the early 70's
- Moved to University of Calgary Dept Civ Eng in 1970
- Author of book "Clay in Engineering Geology" 1987
- Published 100's of papers and active in research into retirement in early 2000's
- Jack and Kitty at 1986 AAR conference (photo Benoit Fournier)

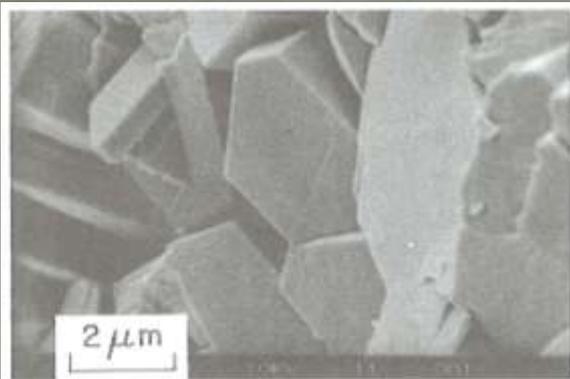




Areas of occurrence of AAR in Canada

Jack Gillott

- Jack had a huge interest in anything unusual and was meticulous in his lab work and writing.
- We worked together on problems caused by Dawsonite $[\text{NaAl}(\text{CO}_3)(\text{OH})_2]$ found in Montreal concrete aggregate quarries.



Gibbsite $\text{Al}(\text{OH})_3$

**CEMENT AND
CONCRETE
RESEARCH**

Cement and Concrete Research 33 (2003) 471–480

The behavior of silicocarbonatite aggregates from the Montreal area

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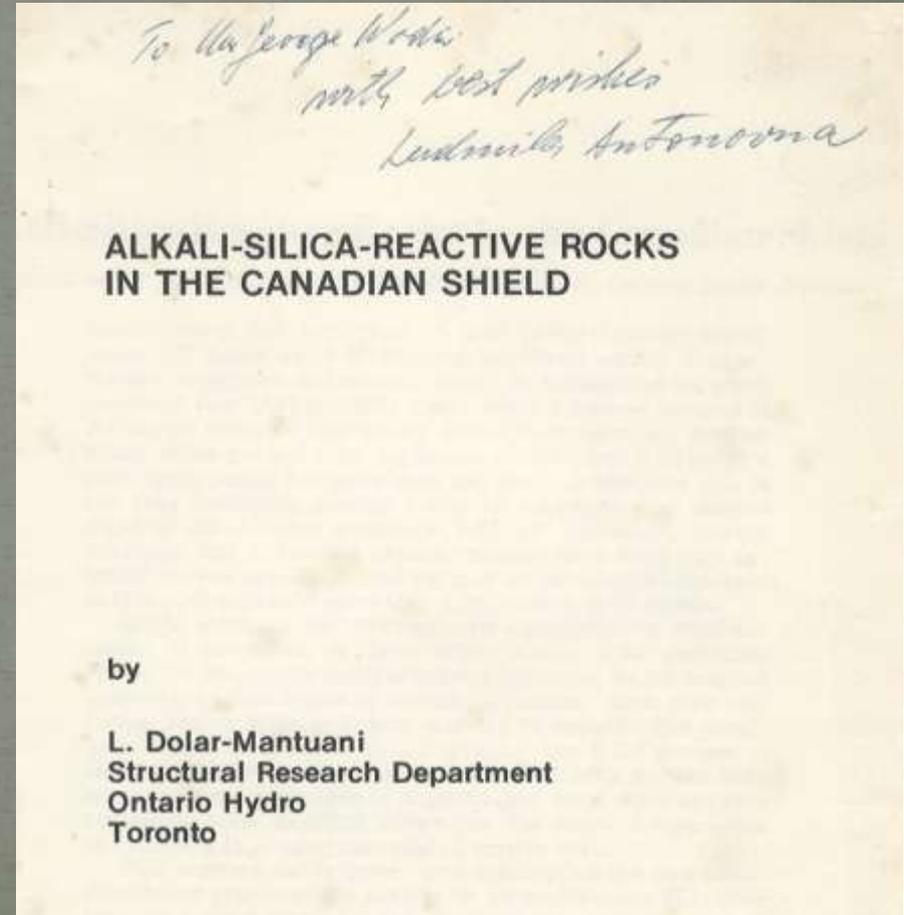
^bThe Ministry of Transportation, Ontario, Canada M3M 1J8

Received 6 July 2001; accepted 31 July 2002

Ludmila Dolar-Mantuani - Antonovna

- Born in Serbia? about 1905
- Degrees at Belgrade? before WW2?
- Earliest NA paper on “Distinction between the different members of the potash feldspar group only using the microscope” (Geol Soc Amer Bull 62, p. 1431, 1951)
- Joined Ontario Hydroelectric Power Commission in 1950’s as their petrographer and retired early 70’s
- Work on “slow/late expanding” alkali-carbonate reactive carbonates.
- One of the first to recognize ASR associated with argillite /greywacke/sandstone group of rocks

• The title page of one of her most notable papers



Ludmila Dolar-Mantuani

- Her work in N Ontario led her to advise the use of preventive measures to prevent ASR in Mactaquac Dam in New Brunswick in late 1960's. This advice was not adopted with dire consequences.
- She was trained as classical microscopist and was meticulous in her work.
- After retirement in early 1970's worked at Ontario Geological Survey and used their labs.

- Benoit Fournier and Dolly - AAR field trip 1986



Ludmila Dolar-Mantuani



Left with K and B Mather (US Army corps of Engrs)

Below with Alan Eddy (Lafarge) in 1986



Photos: D. Hooton above and B Fournier left

Ludmila Dolar-Mantuani

- By the early 80's working on her book. Received a lot of assistance from Paddy Grattan-Bellew at NRC
- “Handbook of Concrete Aggregates” 1983
- Working using universal stage on measurement of angles of strained extinction for different rocks – a little secretive about it – never returned samples!

HANDBOOK OF CONCRETE AGGREGATES

コンクリート骨材ハンドブック

L. Dolar-Mantuani 著

洪悦郎 訳
鎌田英治

Handbook of Concrete Aggregates

A Petrographic and Technological Evaluation

by

Ludmila Dolar-Mantuani, Ph.D., P.E., F.G.A.C.
*Consulting Petrographer
Toronto, Canada*

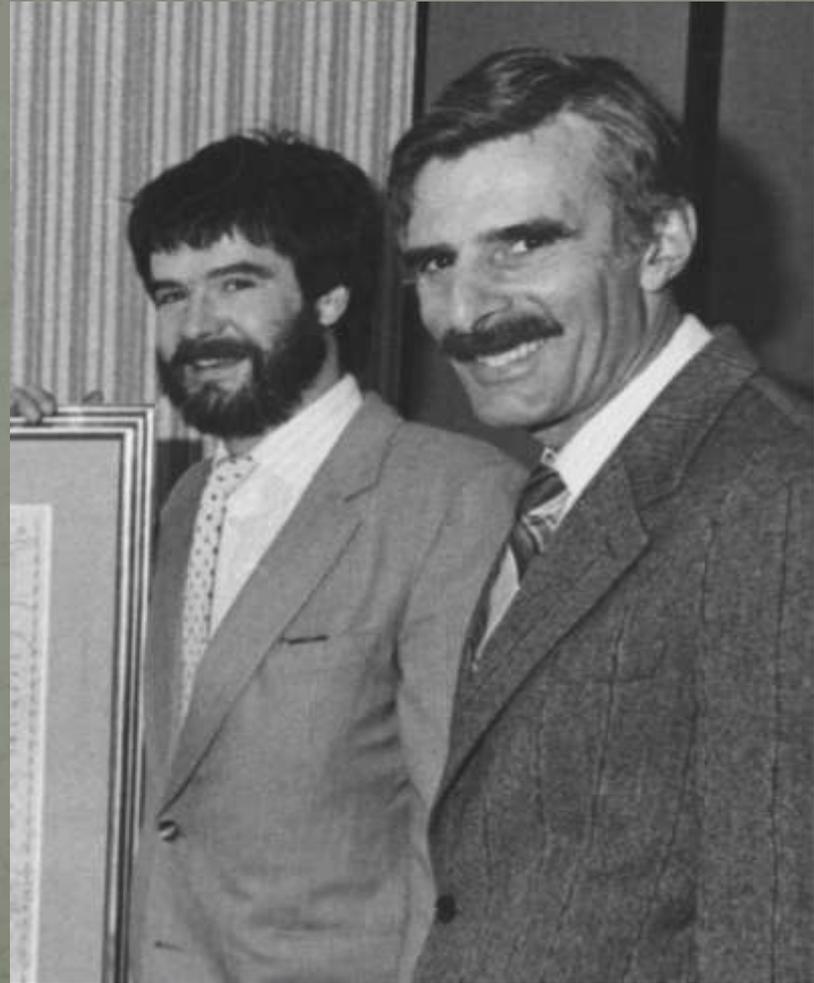
Ludmila Dolar-Mantuani

- Leitz microscope from 1930's, Ex Ontario Hydro
- Probably used by Ludmila



Paddy Grattan-Bellew

- Born Dublin 1934
- University college, Dublin (fencing)
- 3 years in Africa (Zambia, Namibia and SA) 1957-60
- MSc McGill early 60's on kimberlite garnets
- PhD Cambridge on High T/P phase transitions early 60's
- SA for DeBeers -Liberia and Mali
- Canada for base metal explor. in N. Ontario and NRC in 1971
- Encouraged by Ed Swenson to look into ASR issues in N Ontario (Sudbury)
- Photo C Rogers and Paddy 1987



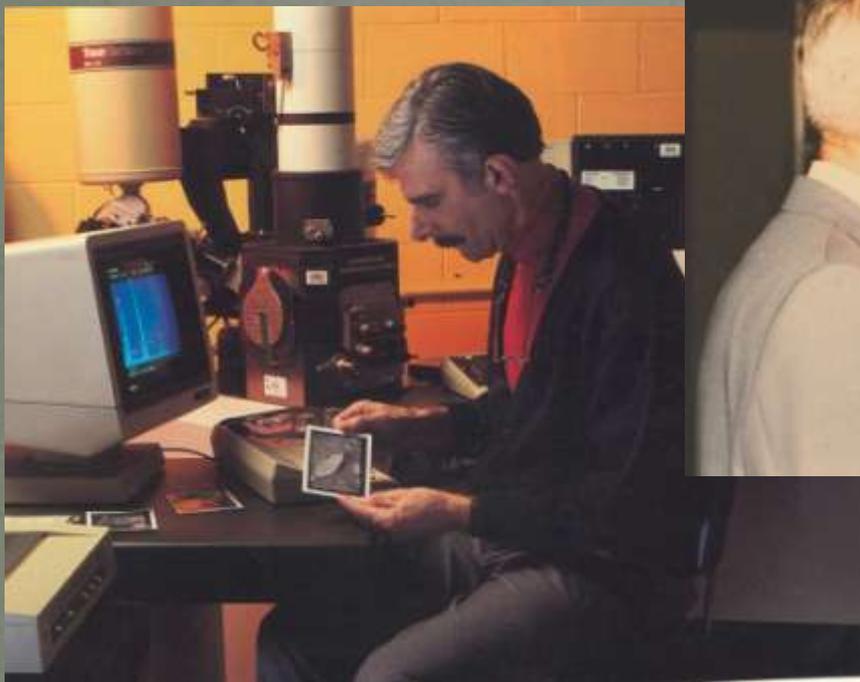
Paddy Grattan-Bellew

- Many papers since early 80's on AAR in concrete
- Regular attendance at Internat. Conf on AAR
- Member Can. AAR committee since 1982
- Damage Rating Index developed for petrographic rating of AAR concrete - Grattan-Bellew, P, A. Danay, 1992, *Comparison of laboratory and field evaluation of alkali-silica reaction in large dams.*
- On right with his sewer pipe test to evaluate expansive concrete mixtures by placing concrete in the pipe and visually evaluating cracking
- Retired NRC in late 90's
- Followed by consulting work and astronomy



Photo B. Fournier c 2000

Paddy Grattan-Bellew



Above, Jim Soles, Paddy and Marc-André Bérubé, 1986 (photo B. Fournier)

Left, a publicity photo for Division of Building Research, 1992

James (Jim) Albert Soles



James Soles Skipton-On-Swale 1944 age 19

- Jan 11, 1923 – Sept 9, 2013
- Bomber pilot, RCAF, Yorkshire UK
- Undergrad – Univ. British Columbia?
- PhD McGill, 1960 on sulphide mineral formation at high T/P
- Retired from CANMET 1994

60-056 **Soles, James A.** (British Columbia) Ph.D.: "Experimental studies of transportation and deposition of some sulphides in an open system at high temperatures and pressures." (Geological Sciences: Saull, V.)

Jim Soles

- Jim mainly worked in mineralogy at CANMET and not concrete.
- Published an excellent paper on oxidation of sulphides found in Dolostone – only occurred with concrete stored above about 120°C.

J. A. Soles¹

Canwell

Thermally Destructive Particles in Sound Dolostone Aggregate from an Ontario Quarry (ARMBRO, OTTAWA) OXFORD DOLOSTONE

REFERENCE: Soles, J. A., "Thermally Destructive Particles in Sound Dolostone Aggregate from an Ontario Quarry," *Cement, Concrete, and Aggregates*, CCAGDP, Vol. 4, No. 2, Winter 1982, pp. 99-102.

orated aggregate particles, (2) selection and petrographic study of both apparently sound and possibly deleterious particles from the aggregate supply, (3) heating of halved particles of the selected aggregate at 150°C to test its stability alone in different atmospheres.



Jim Soles 2nd from left looking at ASR bridge in E. Ontario, others are (L to R)- Doug Hooton, Bob Newell, Paddy Grattan-Bellew, ?, and Tony Inderwick discoverer of alkali-carbonate reaction in Kingston Ontario in about 1954 when working for Canadian Army Engineers

Jean Bérard

- Professor, École Polytechnique de Montréal
- First researcher in Québec to work on AAR (especially siliceous limestone)
- Also worked on sulphide issues in concrete aggregates Pyrrhotite near Montreal

La viabilité des bétons du Québec: le rôle des granulats

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ET

RICHARD ROUX

Département de génie civil, École Polytechnique, Montréal (Qué.), Canada H3C 3A7

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Performance of Concrete Containing a Variety of Black Shale

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Received August 19, 1974

Accepted December 23, 1974



Richard Mielenz on left with staff of Ontario Dept of Highways in 1956 at Cayuga Quarry
In the Niagara area – a big discussion was taking place on harmful behaviour of leached
chert in concrete surfaces. John Corkhill, Frank Brownridge?, Bernard Glassford

Dan Bragg



Photo B. Fournier



*A CSA AAR Sub-Committee meeting in Fredericton, New Brunswick at John King's house Sept 1992. They have been debating the revised Concrete Prism test for 2 days. Standing: Benoit Durand (Quebec hydro), Lorne Robinson (Manitoba hydro), Daryl De Merchant (Fredericton), Paddy Grattan-Bellew (NRC), Dan Bragg (Newfoundland Geol survey), Jack Holley (Lafarge), Michelle Rivest (Quebec hydro), Ken Murdock (Lafarge), Marc-André Bérubé (Laval University), Mike Thomas (Ontario hydro)
Kneeling: Tetsuya Katayama (guest), Chris Rogers (MTO), John King (NBDOT), Benoit Fournier (CANMET).*

Sulfate attack – possible early petrography in Canada

- A recent report* from State of Connecticut on damage to basement concrete;
- “In 1921 a Committee on the Deterioration of Concrete in Alkali Soils was established by the Council of the Engineering Institute of Canada [10] and financially supported by the Research Council of Canada, the Canada Cement Company, the Canadian Pacific Railroad and the three Prairie Provinces of Canada [11]. After the inspection of field exposed specimens in 1927 [12], it was stated that:”
- *The results obtained from the field exposure tests are quite in accord with those obtained in other field investigations. The main effort should be centered upon research in the chemical laboratory was the original decision of the Committee, and this has proven sound. Few new data or idea have been brought by the field, but the chemical research has greatly extended our knowledge of the behaviors of cements when exposed to sulfate solutions.*
- [10]Williams, G.M., Review of investigation into the deterioration of concrete in alkali soils. *Canadian Eng.* 1922, 42: 209-210. Note presumably supervised by Dr. Thorvaldson
- [11]Shelton, G.R., Action of sodium and magnesium sulfates on constituents of Portland cement. *Industrial and Engineering Chemistry* 1925, 17: 589-592.
- [12]Williams, G.M., The condition of field specimens of concrete exposed to alkali soils and waters examined in December 1927. *Eng. Jour.* 1928, 184-187.
- *The quote is from Wille, K, R. Zhong Investigating the deterioration of basement walls made of concrete in CT, Dept Civ Eng. University of Connecticut August 2016.