onBalance

Case History
#oB–00005M

onBalance Case History #oB–00005M

The (homeowner name) pool on (homeowner address) in Tracy California was built by Aqua Pool and Spa, and plastered by Burkett Pool Plastering. According to the records of Aqua Pools and Spas, the pool was built and plastered in April of 1998, and turned over to a service company, Aqua Chlor, who started the service on 4/20/98. On 4/21/98 the service company documented that the pool surface was "mottled" and "faded."

This pool was involved in legal activity between the owner of Aqua Pools and Spas, and Aqua Chlor. To date, the pool has yet to be replastered. However, the litigation is now completed. To summarize, the litigation involved a suit instigated by Aqua Chlor (plaintiff) on multiple counts, including breach of contract, trademark infringement, and slander issues. The slander issue included the contention that the builder and/or plasterer were blaming the poor appearance of pool surfaces on the quality of service provided by Aqua Chlor. Aqua Chlor's position was that the statements constituted slander, especially in light of their contention that the damage to the pools was actually a result of construction defects.

Two years into the lawsuit, the owner of Aqua Pools and Spas counter-sued, contending that they were due damages based upon the damage they felt Aqua Chlor caused to a list of specific pools.

Aqua Chlor engaged onBalance as expert witnesses in the actions, and Aqua Pools and Spas engaged Rob Burkett and Greg Garrett as expert witnesses.

During the course of the litigation, this pool was core sampled four times:

- Two cores taken by Greg Garrett and submitted to RJ Lee Group (Dr. Boyd Clark) for analysis
- Two cores taken by onBalance and submitted to RJ Lee Group (Niels Thalow) for analysis
- One core taken by onBalance and used as a court exhibit
- One core taken by Rob Burkett for use as a court exhibit, but which was not entered into evidence due to failure to follow rules of disclosure

Also, the builder was required as part of the litigation to provide a list of plaster components. That listing declared that the pool plaster was composed of cement, aggregate, water, calcium chloride, and Davis dye. It was also brought out in deposition that the plastering crew used wet tools or wet finishing techniques, as well as engaging in hard troweling.

The resolution of the lawsuit and counter-suit were as follows:

- The counter-suit was dismissed on summary judgement, meaning that the court dismissed the Aqua Pools and Spas allegations without hearing evidence, determining that the legal action was without merit.
- The original suit was decided by a jury in favor of the plaintiff (Aqua Chlor), and monetary damages were awarded. Additionally, legal fees were paid by the defendant (i.e., the owner of Aqua Pools and Spas and/or his insurance company).

It is important to note that neither the judge nor the jury actually made a ruling as to specifically who was responsible for the condition of the pool plaster surfaces. The verdict rendered was a general verdict on all causes of action. However, the general verdict was for the plaintiff (Aqua Chlor), and against Richard

Townsend, owner of Aqua Pools and Spas. No defendant in this case was awarded any monetary judgement, legal fees or costs.

Hundreds of pages of testimony, both in deposition and in open court, were generated by this lawsuit, as well as the generation of several lab analyses. The gist of the evidence presented is that:

- The primary characteristic of the surface problems in this pool can be characterized as excessive porosity and the leaching of calcium (Clark)
- The surface did not display the characteristic evidence of acid etching (Thalow)
- The pattern of the leaching may have been associated with the finishing process, with local areas of higher water:cement being more susceptible to leaching (Thalow)
- There was a high concentration of chloride… and it is known that this may influence the color of concrete surfaces (Thalow)
- There is a known incompatibility between calcium chloride and Davis color dye, which can result in blotching and discoloration (Davis)
- There is a known correlation between the use of wet finishing tools and surface paling (Davis)
- There is a known correlation between over-troweling and surface discoloration (Davis)
- There is a specific causal chain of events evidenced in this pool, which includes the use of incompatible admixtures, prohibited finishing practices, and an overall disregard for professional workmanship practices which, in this pool, led to the severe discoloration seen on the pool surface (onBalance)
- It is permissible to violate manufacturers recommendations if the contractor believes they do not apply (Garrett & Burkett)
- Dr. Boyd Clark's statements mean something other that what Dr. Clark says they mean (Garrett & Burkett)
- Plaster is, indeed, composed of portland cement, aggregate, and water, but it is not really a version of concrete, so accepted concrete practices, rules, and guidelines such as those from the Portland Cement Association and the American Concrete Institute do not apply (Garrett & Burkett)
- In spite of the lack of any hard evidence, and in spite of hard evidence to the contrary, this pool was discolored by aggressive water chemistry (Garrett & Burkett)

Attachment A	Written report by onBalance
Attachment B	Written report by Dr. Clark
Attachment C	Written report by Mr. Thalow
Attachment D	Scanned image of the Davis Color Chart (note injunctions against wet finishing and overworking, and the statement that the use of calcium chloride is the only known incompatibility, which causes blotching and discoloration)
Attachment E	Photograph of a Davis Powder Color tint package (note injunctions against wet finishing, overworking, and use of calcium chloride)
Attachment F	Photograph of a Davis Liquid Color tint package (note injunctions against wet finishing, overworking, and use of calcium chloride)

Mr. Jerry Wallace
General Manager, Aqua Chlor

Re: onBalance Project oB-00005M

Mr. Wallace:

You engaged onBalance to diagnose the cause(s) for discolorations on the surface of the swimming pool plaster located at [homeowner's address] in Tracy California, at the residence of [homeowner's name]. The onBalance partners visited the pool on a number of occasions, including two visits to obtain core samples of the pool for analysis. The following is a summary of the observations and results of the analysis.

Methods

Visual/Tactile

The pool was inspected when filled with water and when drained.

The grey plaster pool exhibits a spotted discoloration pattern, and the pattern coincides with fan patterns of discoloration, smeared material at surface, smeared plaster up onto the grout, driplines, etc. (see attached photo and microphotographs).

At these inspections, it was noted that the plaster surface was predominantly very smooth to the touch and to visual analysis (with the exception of the smeared areas).

Optical Photography

Photographs were taken of the pool. The photographs document the spotting, the distribution of the spots, driplines, fan patterning, etc.

Document Review

onBalance performed a review of start-up and weekly chemical maintenance records maintained for this pool. The chemical ranges were maintained within accepted industry standards, and the documentation does not show any incidences of aggressive water conditions.

Core Analysis

Photography – The pool was core sampled, and the cores were photographed both in situ and in the lab.

Photomicrography – The surface of a core sample was photographed at 40X magnification, with care taken to document the level of surface cement paste erosion as evidenced by the exposure of aggregate (sand) at surface. The surface was found to be smooth, and did not display characteristics of aggressive chemical attack.

Chloride analysis – A sample of the plaster was analyzed for chloride content using ASTM Standard Method C1152 (Standard Test Method for Acid-Soluble Chloride in Mortar and Concrete) and a Hach Quantab titrator variation of ASTM Standard Method C114.19 (Standard Test Methods for Chemical Analysis of Hydraulic Cement – Chloride). The chloride content was found to be 428 ppm, which calculates to 2.4% calcium chloride dihydrate by weight to the cement in standard swimming pool plaster.

Laboratory Analysis

Review of RJ Lee Analysis by Dr. Boyd Clark – We have reviewed the analysis of the pool's plaster by Dr. Clark, which you provided to us (RJ Lee Project #MAH912505). Dr. Clark's report is observational in nature, rather than specifying causation, and states that he is not determining the mechanisms for the artifacts he observes. He finds that the outstanding characteristic of the phenomenon is excess porosity. He also notes the reconstruction of components (calcium and silica phases) into separate microstructures, rather that the combined microstructure that one would normally expect. He notes a degree of carbonation and ionic movement which is facilitated by the fact that the material (plaster) was submerged in fluid (pool water), which makes these things happen at a faster speed than if the cementitious material had been kept relatively dry (such as driveways, sidewalks, and other cement-based cores he is hired to analyze). He notes that the pH of hydration was lower than that of saturated Ca(OH)2. This means that the ponding fluid (pool water) was at a pH lower than 13. In the supplemental report, Dr. Clark reinforces his conclusion that the primary problem is one of porosity. He rules out abnormal calcium depletion.

Commission of Analysis by Niels Thalow of RJ Lee – onBalance cored the pool and sent the two cores (along with two samples from another pool we analyzed for you) to Mr. Niels Thalow of RJ Lee Group for analysis. The two cores from this pool are identified in the report (RJ Lee Group Project #MAH112353) as M1 and M2. Mr. Thalow is an internationally recognized expert in the diagnosis of the various types of aggressive attacks on cement-based surfaces. His finding was that there was no evidence of aggressive attack, and hypothesized that the patterning (fan-shaped sweeps) may be due to the finishing process, which included a technique which left areas or spots of high surface water:cement ratios. He also notes the addition of high concentrations of calcium chloride – an admixture known to cause porosity and color-mottling.

Observations

The presence of calcium chloride is associated with discoloration in cementitious products. Industry-accepted documentation from the Portland Cement Association, the American Concrete Institute, and other authorities indicate that even low levels of calcium chloride (<2%) will cause discoloration. The accepted standard is to not exceed 2% dihydrate to the weight of the cement. However, there is also a provision in the standard that all admixtures must be compatible. Calcium chloride and color plaster admixtures are not compatible. Davis Color was reportedly used in this pool. Attached is a copy of Davis' color chart, stating that there is a known incompatibility with calcium chloride. Also attached are copies of the Davis color powder and liquid packaging which includes the statement of incompatibility. Tests of the this pool plaster show levels of calcium chloride which exceed the industry-accepted maximum even for white plaster. Since there should be no chloride at all in this plaster, exceeding 2% is a particularly serious failure on the part of the plastering contractor.

The microphotographs of the this plaster were compared by onBalance with photographs of other plaster standards (at the same magnification) which had been subjected to known degrees of aggressive chemical attack. There was no indication of an aggressive attack on this surface.

There are indications that the plaster surface was finished with wet tools, or that water was applied to the surface during finishing. This is a poor finishing practice which is prohibited by ACI and PCA. Davis Color also indicates on the attached color chart and on the packaging that water should not be used in finishing. The striped walls of the pool, along with chatter marks, is an indication that water was applied to the finished surface and that the finished surface was then hard troweled after the time such troweling could be safely accomplished.

This plaster coating is thin, as seen in the photographs, which also may have played a role in the discoloration problems.

Conclusion

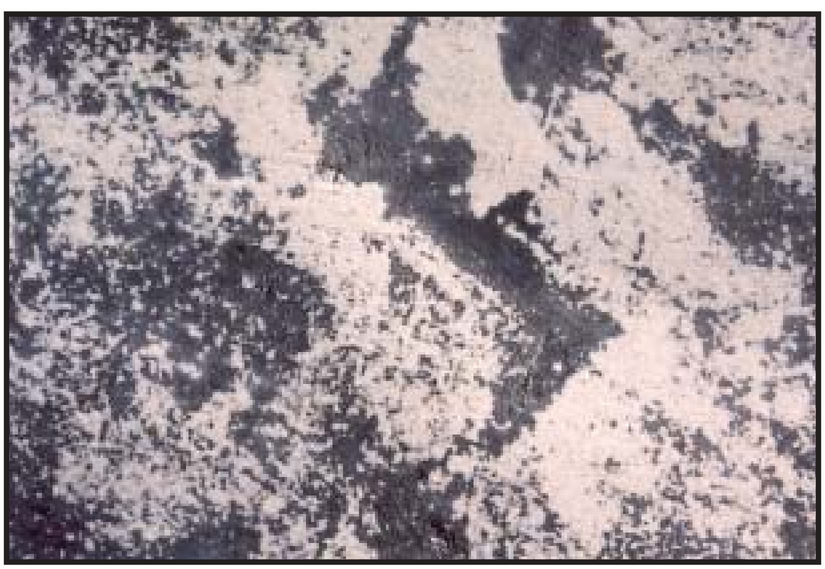
The pool has not undergone an aggressive chemical attack. None of the accepted hallmarks of aggressive attack (such as surface cement paste dissolution and etching of the surface-exposed aggregate) are evident. This is consistent with the chemical history documentation provided onBalance and with the analysis undertaken by onBalance.

Many factors are usually associated with spot discolorations, including excess calcium chloride, wet finishing, and overworking the surface. All of these factors appear to have been contributory to the problems seen in this pool.

Sincerely,
Partner – onBalance Consulting

oB-00005M a – Pattern on wall

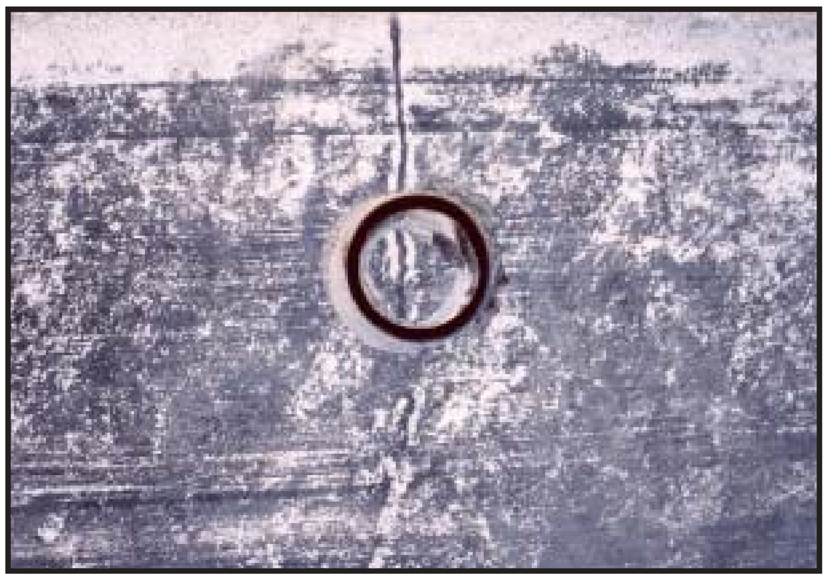
oB-00005M b – Pattern on wall with trowel



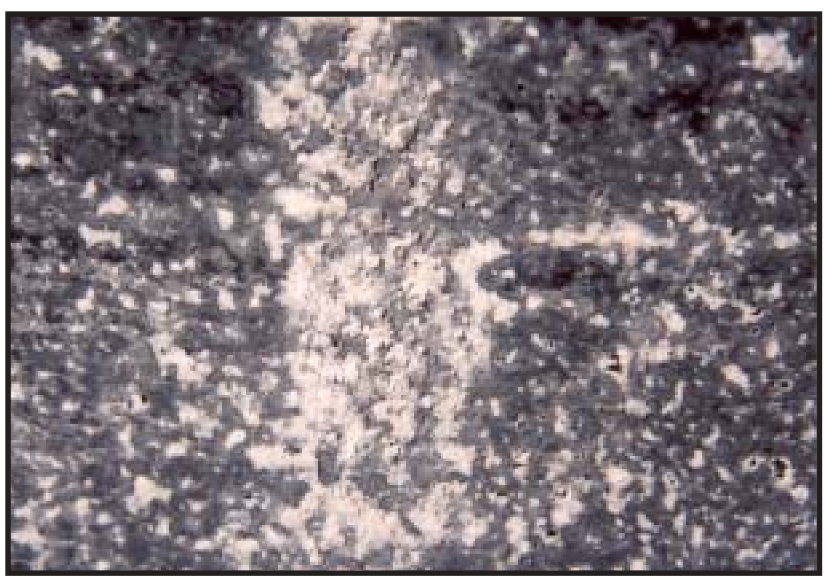
oB-00005M c – Pattern on wall closeup

oB-00005M d – Cores

oB-00005M e – A Core *in situ*



oB-00005M f – Smeared material



oB-00005M g – Chatter marks

RJ Lee *Group*, Inc.

350 Hochberg Road
Monroeville, PA 15146
Tel: (724) 325-1776
Fax: (724) 733-1799

The Materials Characterization Specialists

March 6, 2000

Mr. Greg Garrett
Applied Materials Technologies, Inc.
P.O. Box 7842
Chandler, AZ 85246-7842

RE: RJ Lee Group Project # MAH912505

Dear Mr. Garrett,

Cross sections of two core samples were examined by scanning electron microscopy (SEM). The samples were identified as Core #1 (small spots) and Core #2 (large spots).

Both core samples were a black colored top surface (the surface in direct contact with any swimming pool water) with white "spots" and were coated with an epoxy over the surface, as received by RJ Lee Group. The cores were sectioned through the top surface and then the cross-section was polished using diamond grit abrades.

The results from our manual SEM analyses follow.

PLAINTIFF'S EXHIBIT 2
Burkett
3/8/01

Summary of results, Core #1 (small spots):

- Aggregate particles are observed, generally, directly below each spot.
  - ✓ Four small spots sectioned, three of the four have an aggregate directly beneath the spot.
- Spots consist of two-phase regions, calcium-rich and silicon-rich.
  - ✓ Affected regions appear as silicon-rich "grains" in a calcium-rich matrix.
  - ✓ Two phase region is indicative of carbonation and/or matrix reconstruction.
  - ✓ Silicon-rich grains are "relics" of former cement grains.
- Spot regions are more porous than the surrounding paste matrix.
  - ✓ Affected spot regions are approximately 50 microns in depth.

- Fine voids/pores are evident in affected regions.
- Silicon-rich regions are more porous than the surrounding calcium-rich matrix.

- Two thin, calcium-rich layers are evident in both the unaffected and affected regions.
  - Two distinct layers are evident, one indicative of crystal precipitation from solution.
  - Layers are 5 to 10 microns in total thickness.
  - Layers are indicative of carbonation.

- Cracking due to shrinkage is apparent in the unaffected interior paste.
  - Crack pattern indicative of shrinkage during curing is observed.

Summary of results, Core #2 (large spots):

- Affected spot regions cover most of the surface.
  - Two-phase region is apparent along most of the top surface.

- Spotted region again consists of two-phase regions, calcium-rich and silicon-rich.
  - Again, affected regions appear as silicon-rich "grains" in a calcium-rich matrix. Although some spots have regions where the silicon-rich region is not just grains.
  - Two phase region is indicative of carbonation and/or matrix reconstruction.
  - Silicon-rich grains are "relics" of former cement grains.

- Spot regions are more porous than the surrounding paste matrix.
  - Affected spot regions are between 0.1 to 0.2 millimeters in depth.
  - Fine voids/pores and cracks are evident in affected regions.
  - Silicon-rich regions are more porous than the surrounding calcium-rich matrix.

- Two thin, calcium-rich layers are evident in both the unaffected and affected regions.
  - Two distinct layers are evident, one indicative of crystal precipitation from solution.
  - Layers are 5 to 10 microns in total thickness.
  - Layers are indicative of carbonation.

- Cracking due to shrinkage is apparent in the unaffected interior paste.
  - Crack pattern indicative of shrinkage during curing is observed.

Conclusions:

- The discoloration observed is due to an increased porosity in the affected spot. This increased porosity is due to both the increased number of fine pores/voids and higher porosity in the silicon-rich phase.

- The increased porosity in the affected regions is due to a reconstruction of the paste matrix. This reconstruction of the paste matrix can only be achieved through the movement of material by a solution, most probably the swimming pool fluid, through the already hydrated cement paste. The overall appearance of the reconstructed paste is indicative of a water/solution driven dissolution/carbonation reaction.

- The observed two-phase microstructure, near the top surface, indicates a process other than normal curing hydration of the former cement grains. The decalcification and hydration of former cement grains indicates hydration has occurred at a pH level lower than that of paste saturated with $Ca(OH)_2$.

- The mechanism for this dissolution/carbonation reaction is undetermined at this time. The reaction appears to initiates within paste between an aggregate particle and the top surface and proceeds around the aggregate particle, into the surrounding matrix.

- The thin layers of carbonation along the top surface are both due to movement of material, calcium, either from the cement paste matrix and/or from the swimming pool fluid. The mechanism for this carbonation reaction(s) is also undetermined at this time.

Suggested Additional Analyses:

- Optically thin cross-sections to establish that the thin surface layers are indeed carbonation and whether there are any differences between the two materials.

- Stereo-optical analysis examining the size of aggregate particles versus the spot size. Analysis is intended to determine whether there is a relationship between aggregate size and spot size.

Sincerely,

Boyd A. Clark

Boyd Clark
Senior Materials Scientist
RJ Lee Group, Inc.

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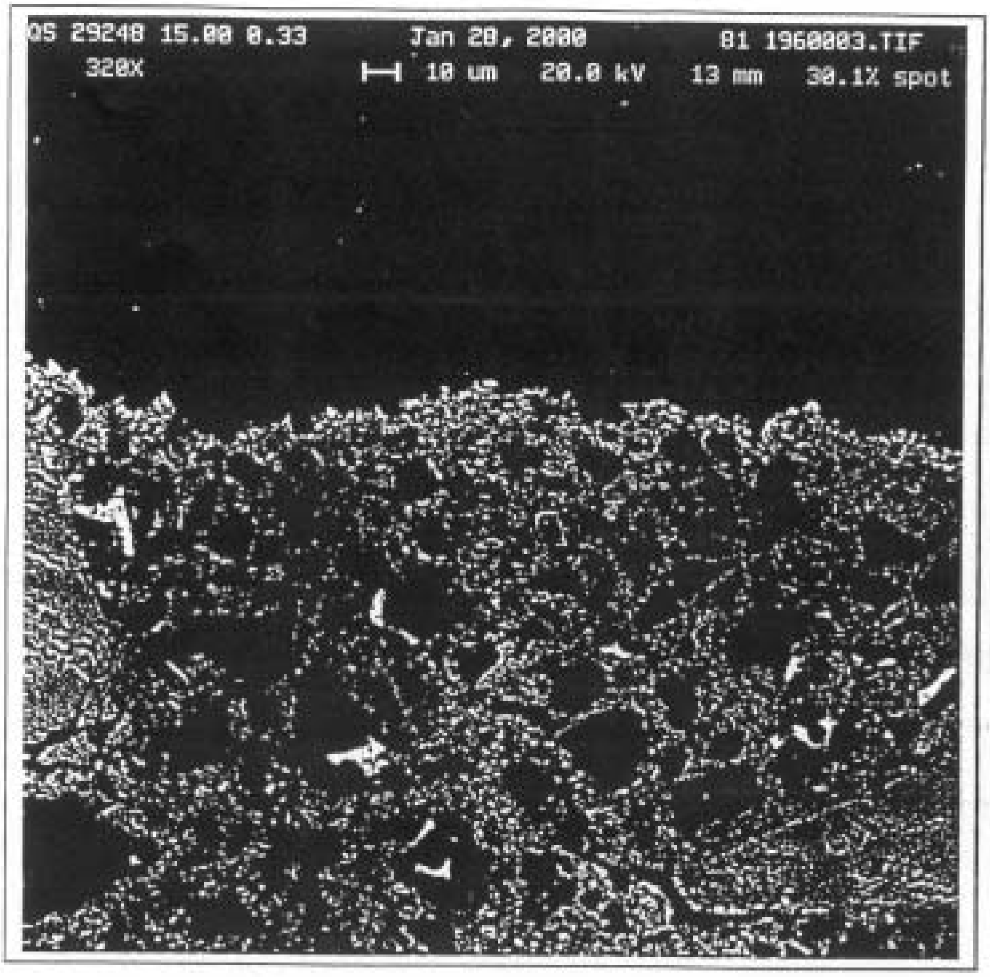
RJ Lee Group, Inc.
Project No. MAH912505

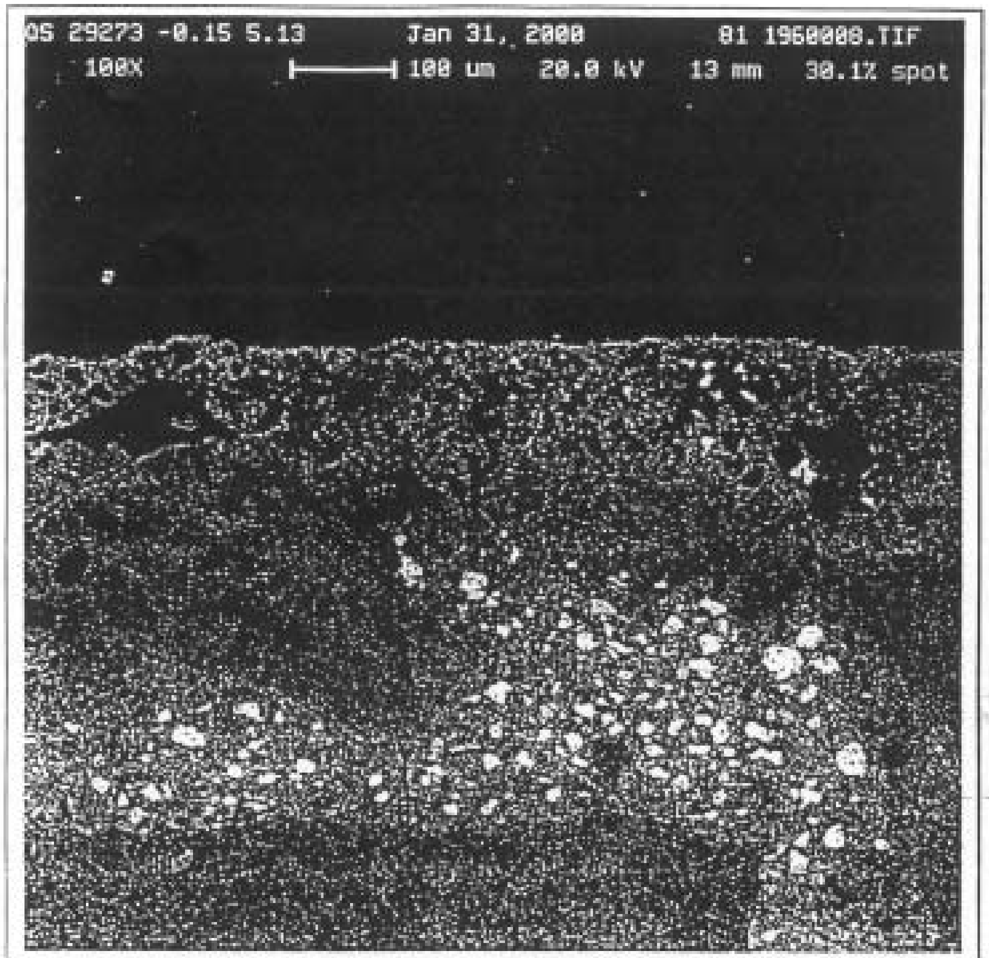
Sample No. 0811960
Client ID Large Spots



Affected Region Along the
Top Surface of the Sample

Page 1 of 10

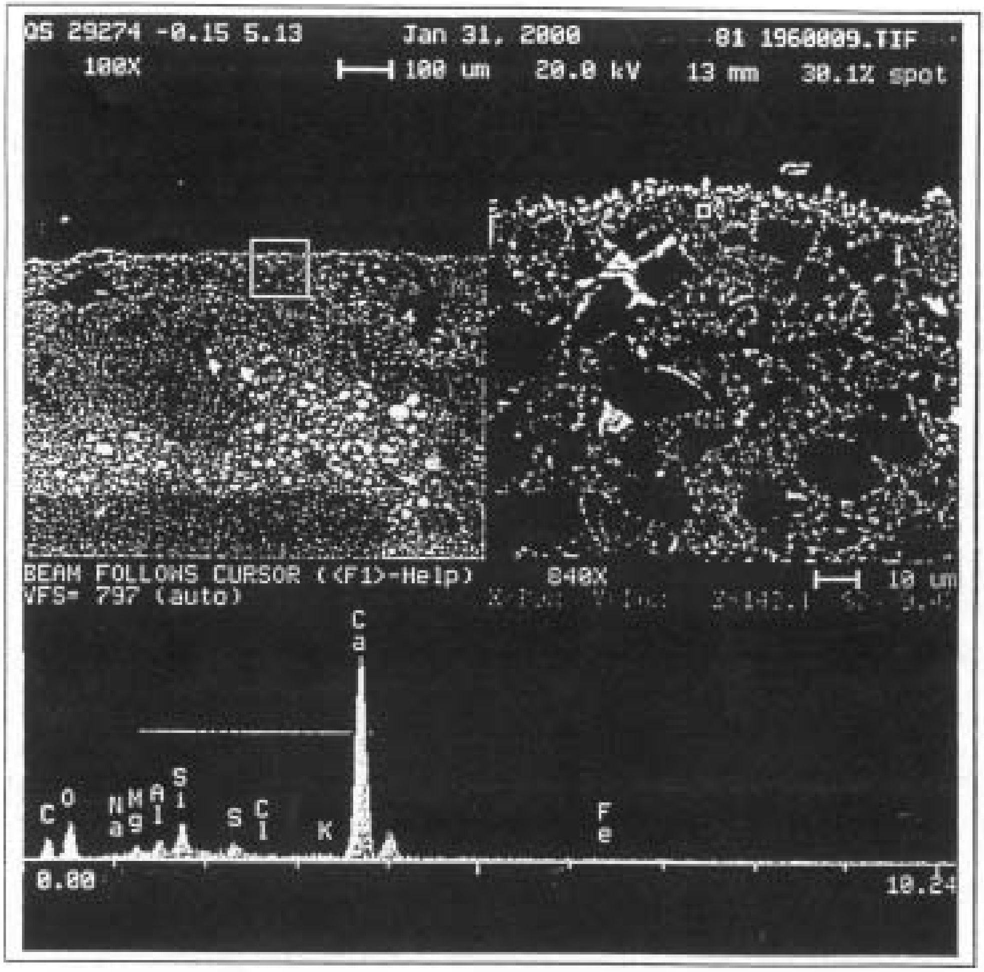
Sample No. 0811960
Client ID Large Spots



Low Magnification of Affected
Region along the Top Surface of the Sample

RJ Lee Group, Inc.
Project No. MAH912505

Sample No. 0811960
Client ID Large Spots

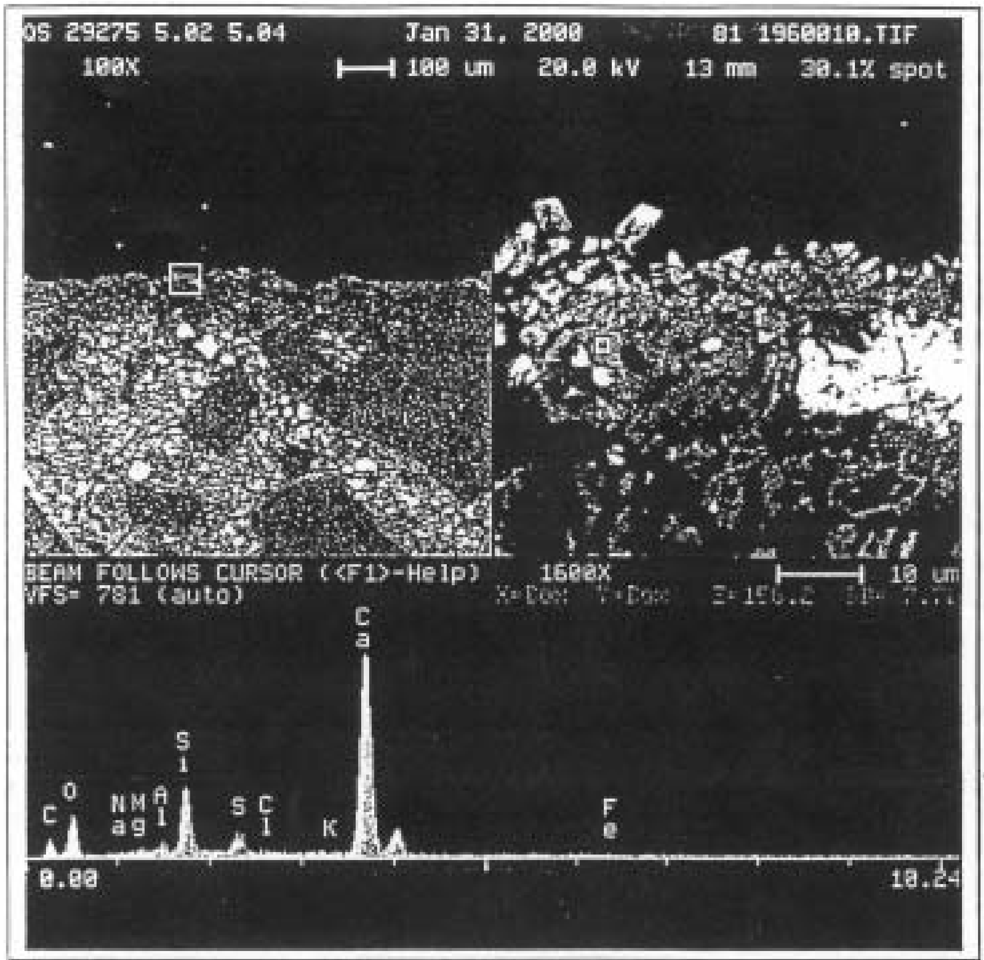


Affected Region
Calcium-rich Layer

Page 3 of 10

RJ Lee Group, Inc.
Project No. MAH912505

Sample No. 0811960
Client ID Large Spots

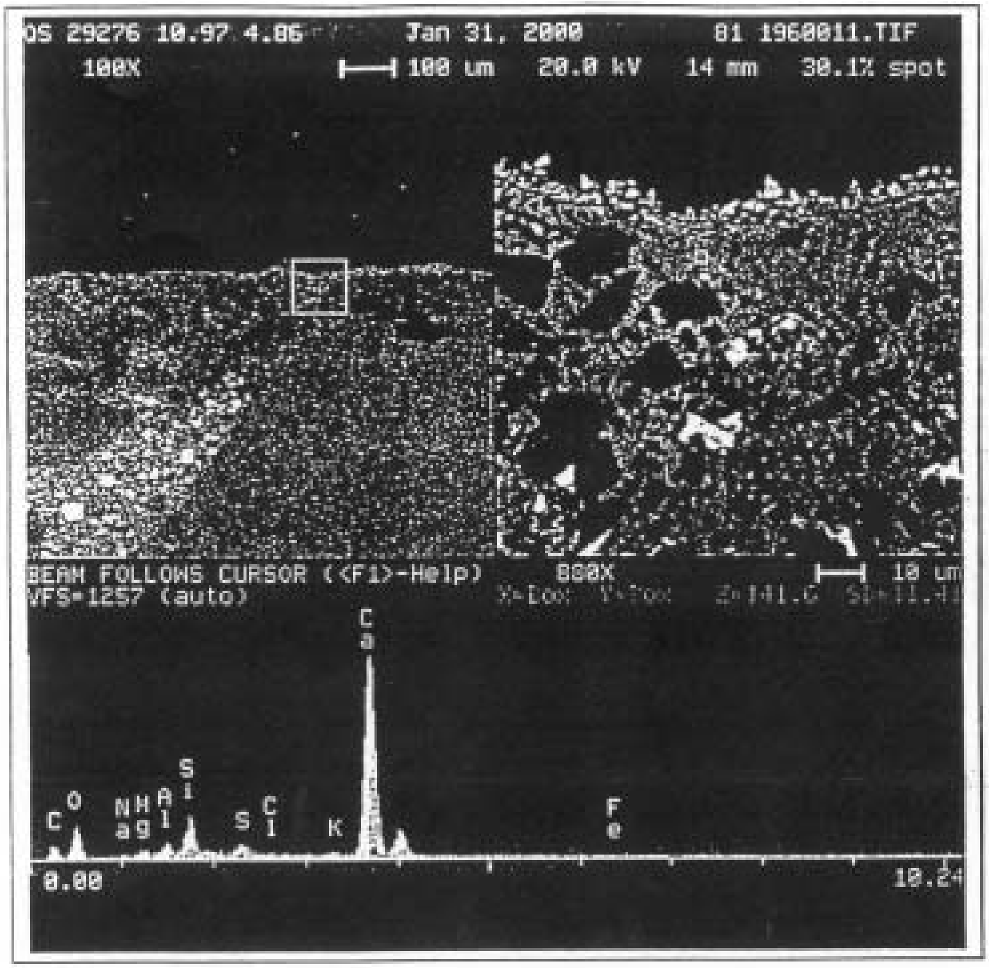


Affected Region
Calcium-rich Matrix

Page 4 of 10

RJ Lee Group, Inc.
Project No. MAH912505

Sample No. 0811960
Client ID Large Spots

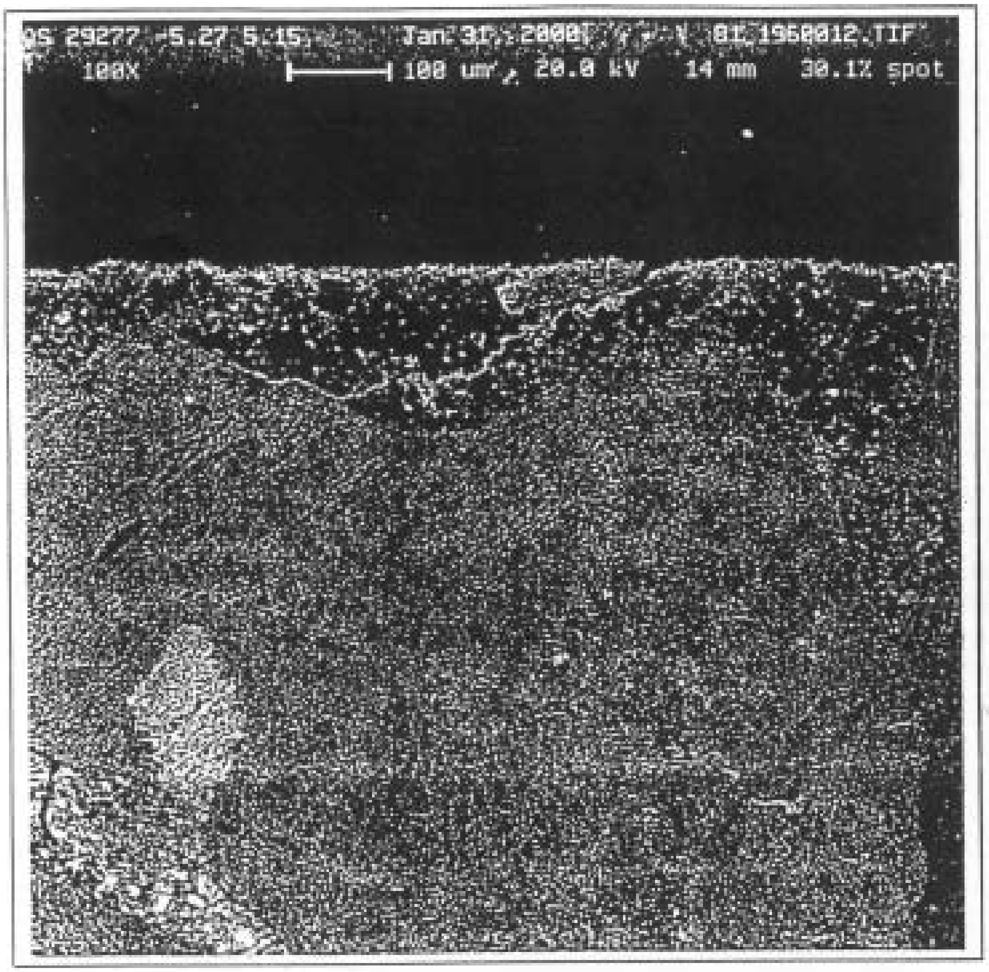


Affected Region
Calcium-rich Layer

Page 5 of 10

RJ Lee Group, Inc.
Project No. MAH912505

Sample No. 0811960
Client ID Large Spots

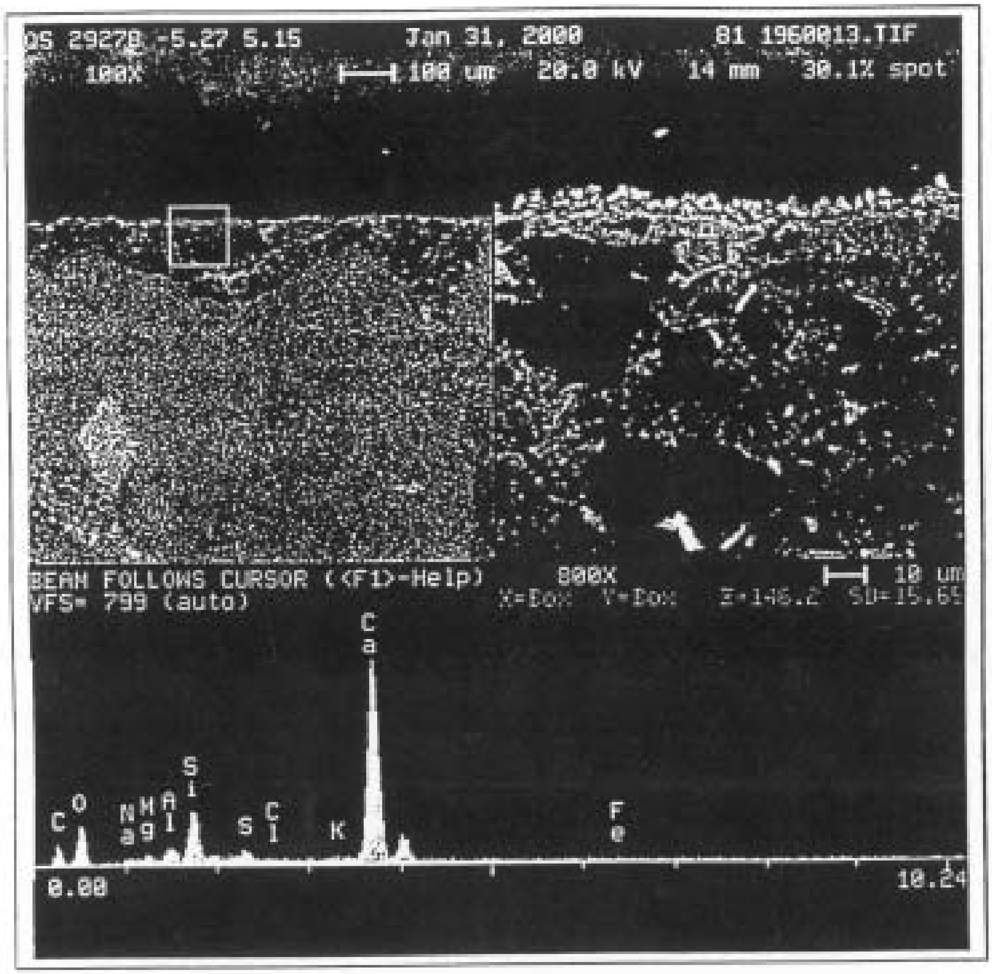


Low Magnification of Affected Region
Along the Top Surface of the Sample

Page 6 of 10

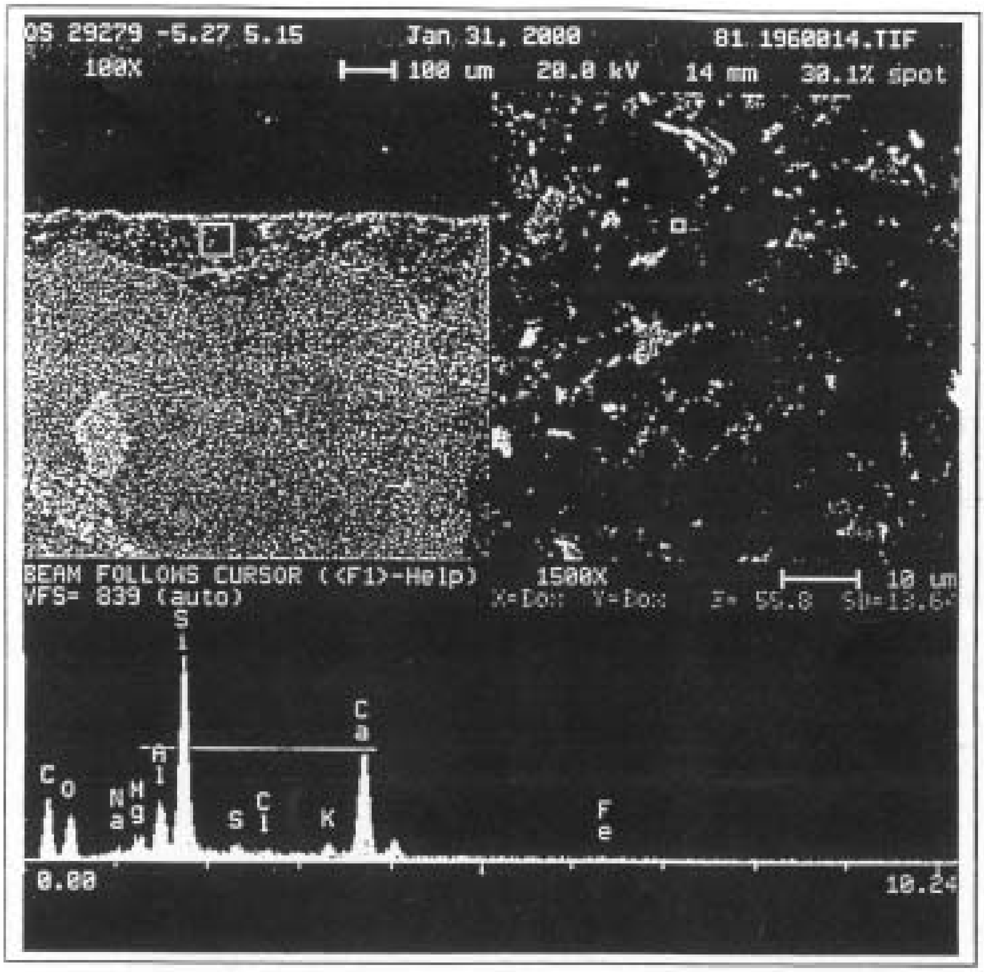
RJ Lee Group, Inc.
Project No. MAH912505

Sample No. 0811960
Client ID Large Spots



Affected Region
Calcium-rich Layer

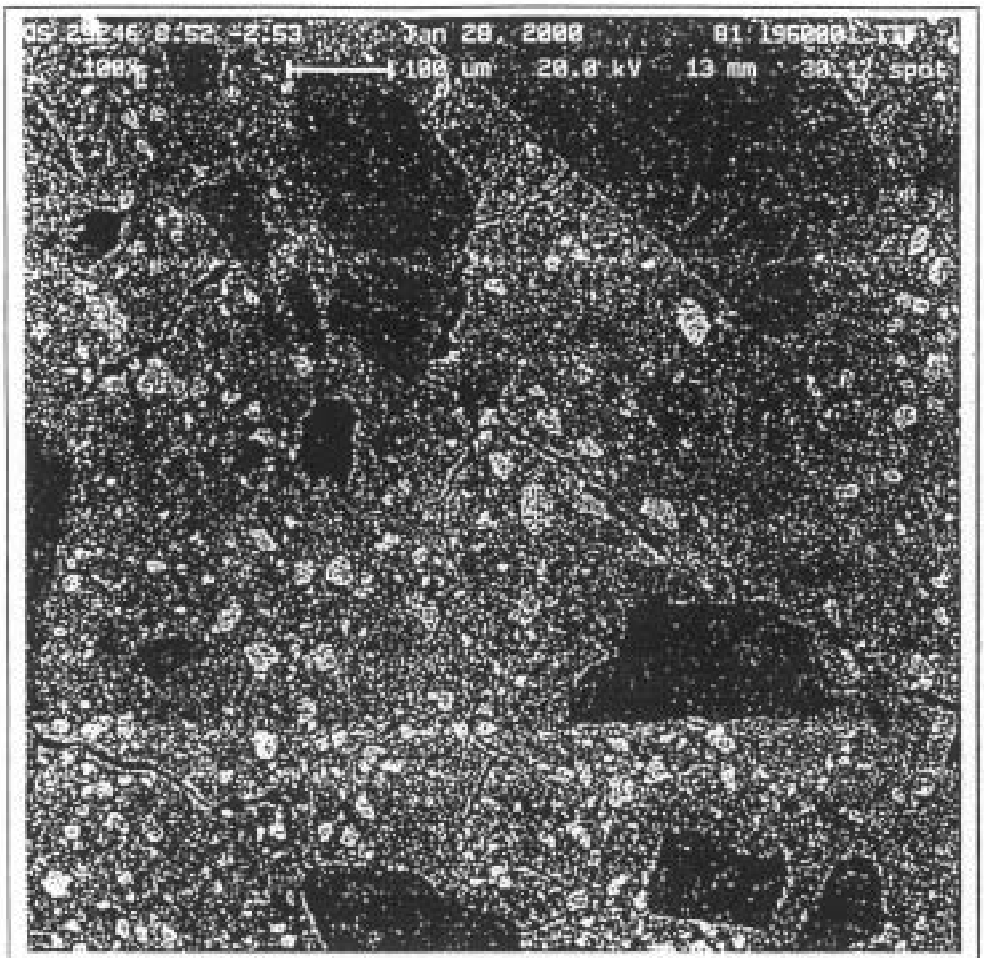
Sample No. 0811960
Client ID Large Spots



Affected Region
Silicon-rich Matrix

RJ Lee Group, Inc.
Project No. MAH912505

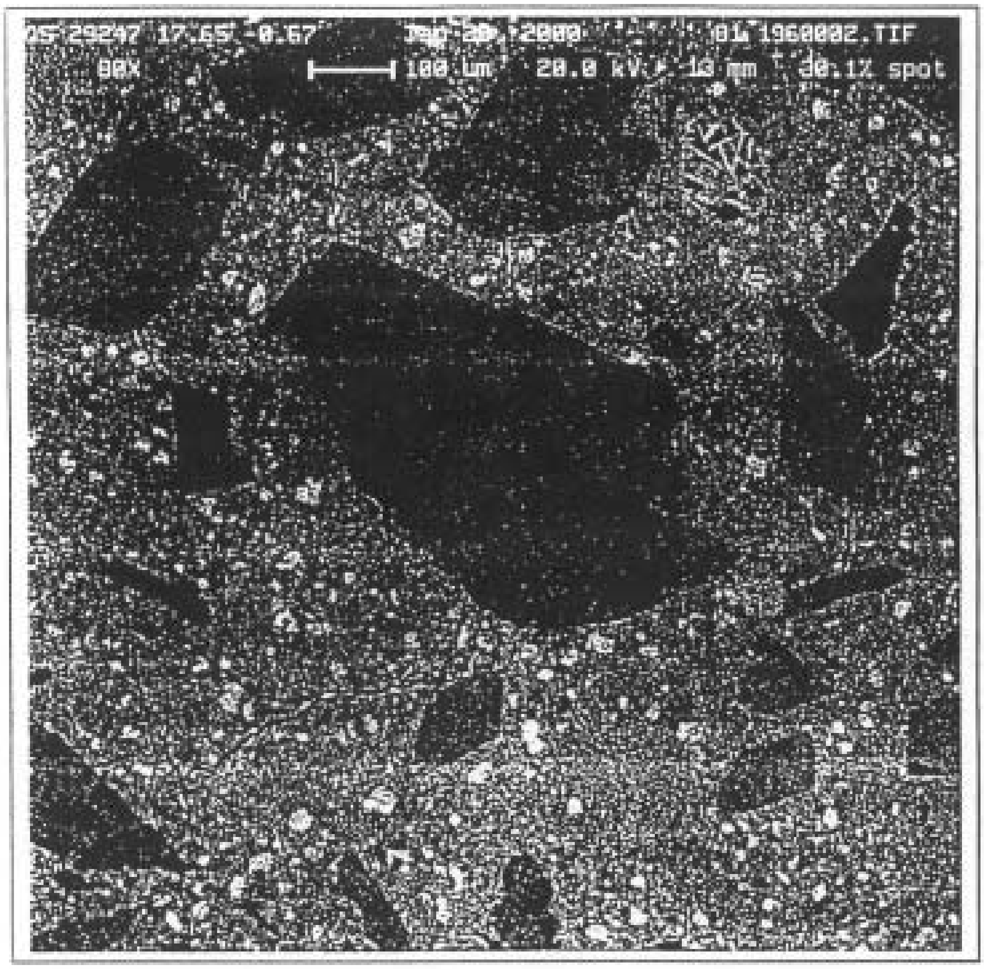
Sample No. 0811960
Client ID Large Spots



Interior Region of Sample
Cracking Indicative of Shrinkage

RJ Lee Group, Inc.
Project No. MAH912505

Sample No. 0811960
Client ID Large Spots

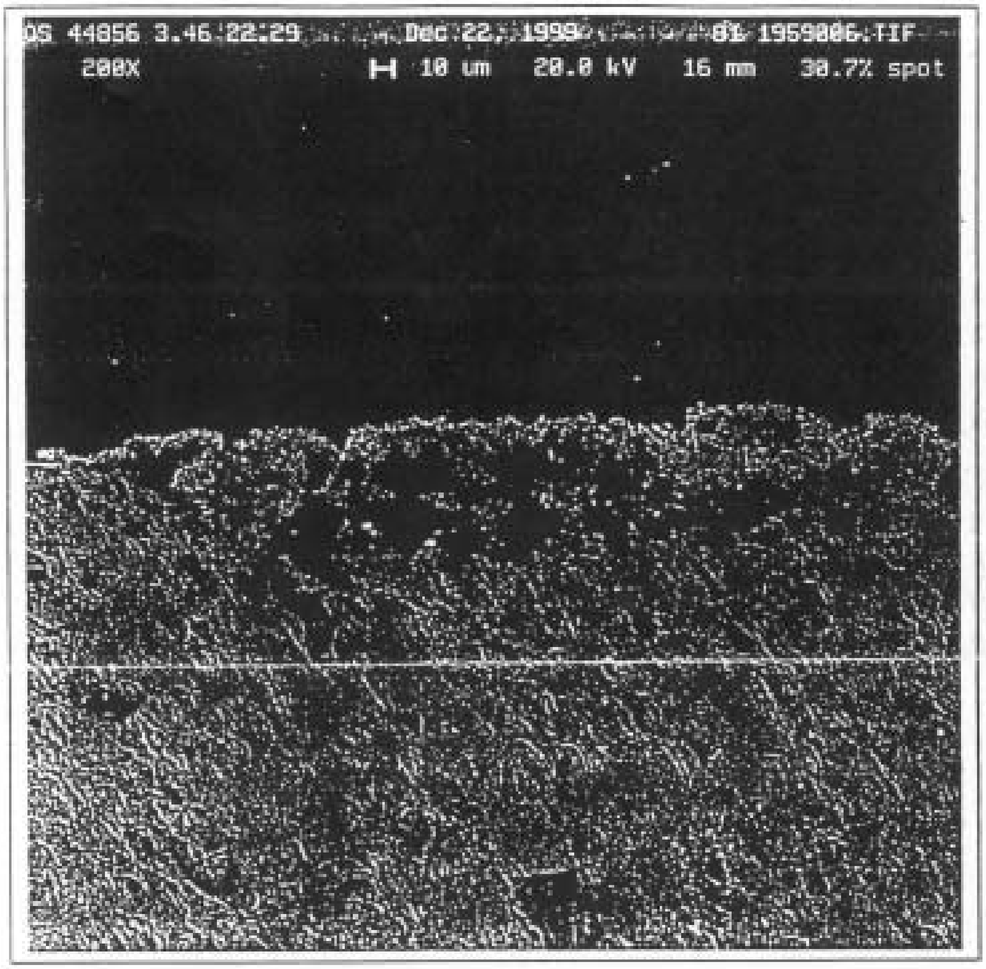


Interior Region of Sample
Cracking Indicative of Shrinkage

Page 10 of 10

RJ Lee Group, Inc.
Project No. MAH912505

Sample No. 0811959
Client ID Small Spots

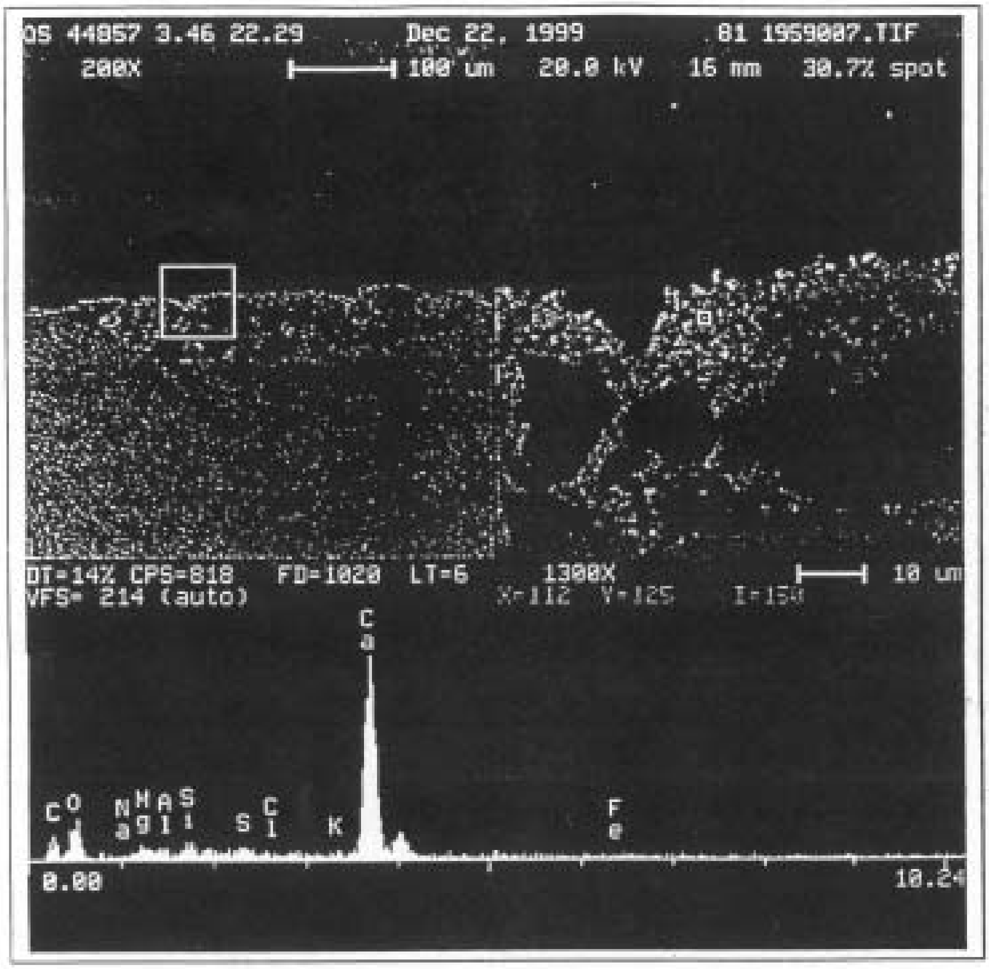


Low Magnification of Affected Region Between
Top Surface and Aggregate Particle

Page 1 of 10

RJ Lee Group, Inc.
Project No. MAH912505

Sample No. 0811959
Client ID Small Spots

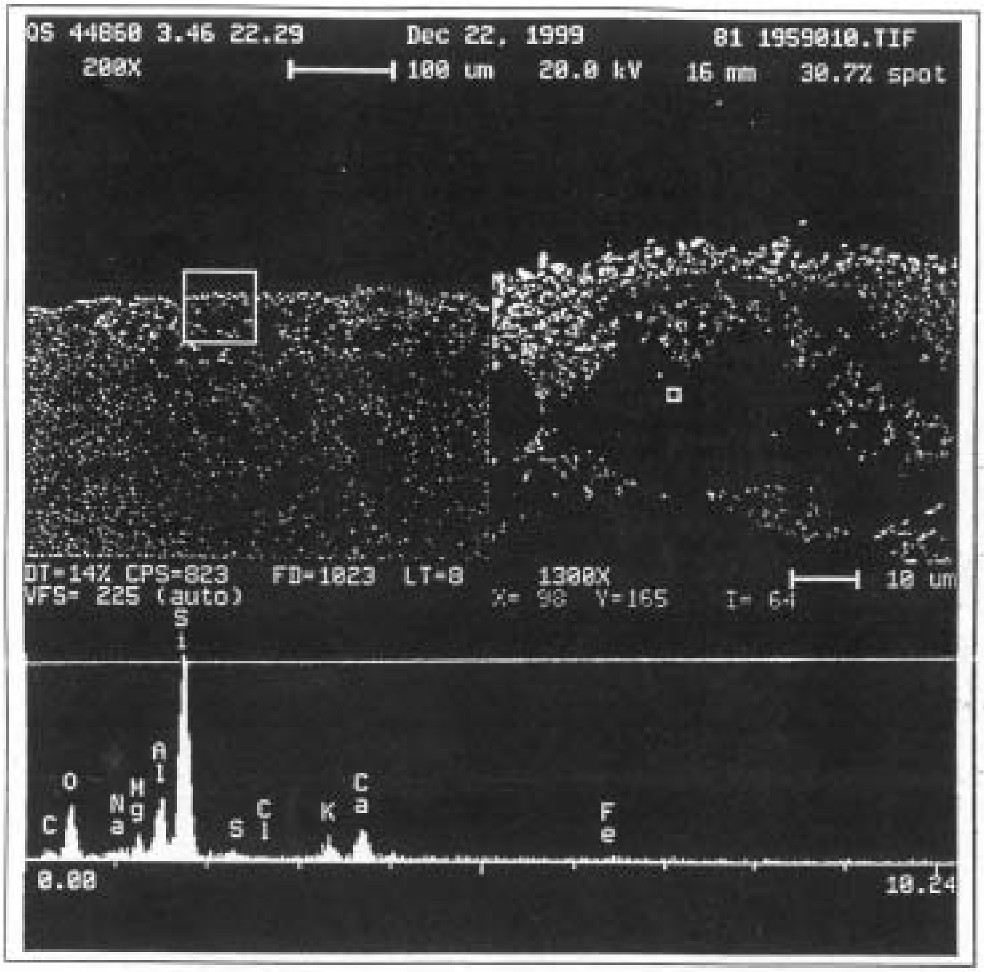


Affected Region
Calcium-rich Layer

Page 2 of 10

RJ Lee Group, Inc.
Project No. MAH912505

Sample No. 0S11959
Client ID Small Spots

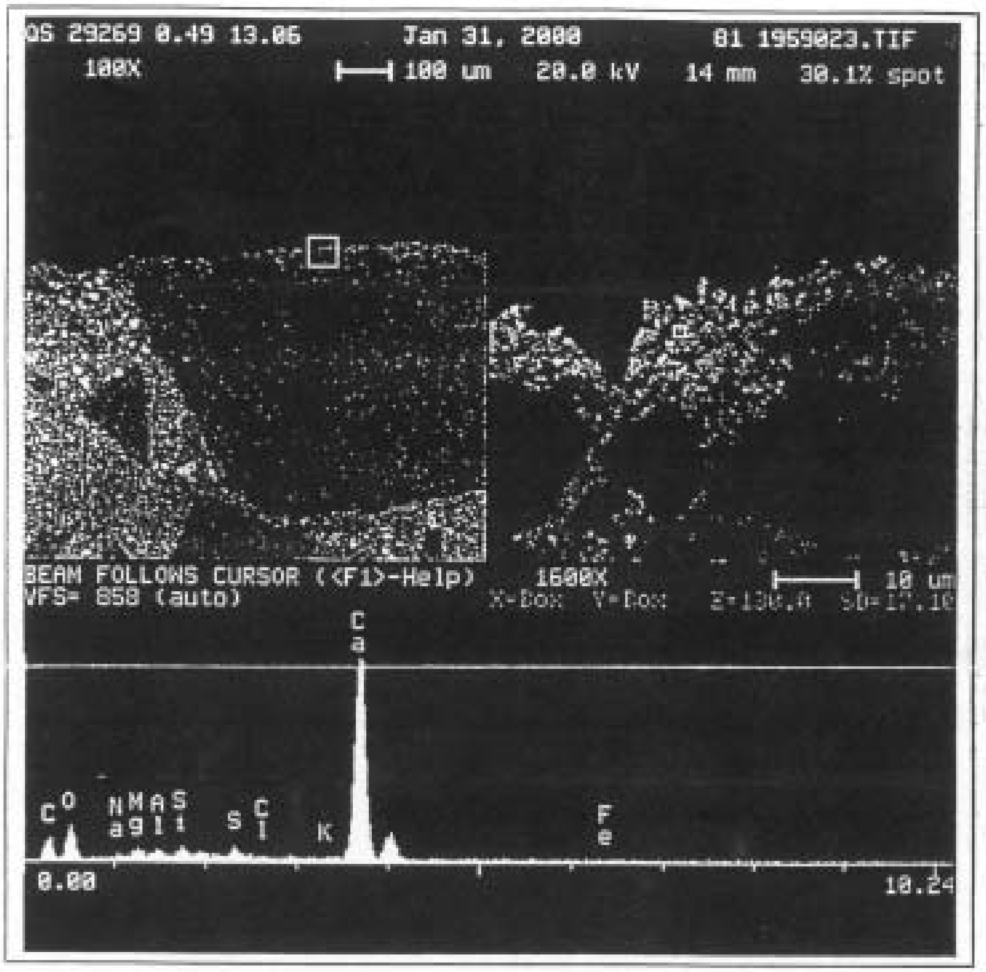


Affected Region
Silicon-rich Former Cement Grain

Page 3 of 10

RJ Lee Group, Inc.
Project No. MAH912505

Sample No. 0811959
Client ID Small Spots

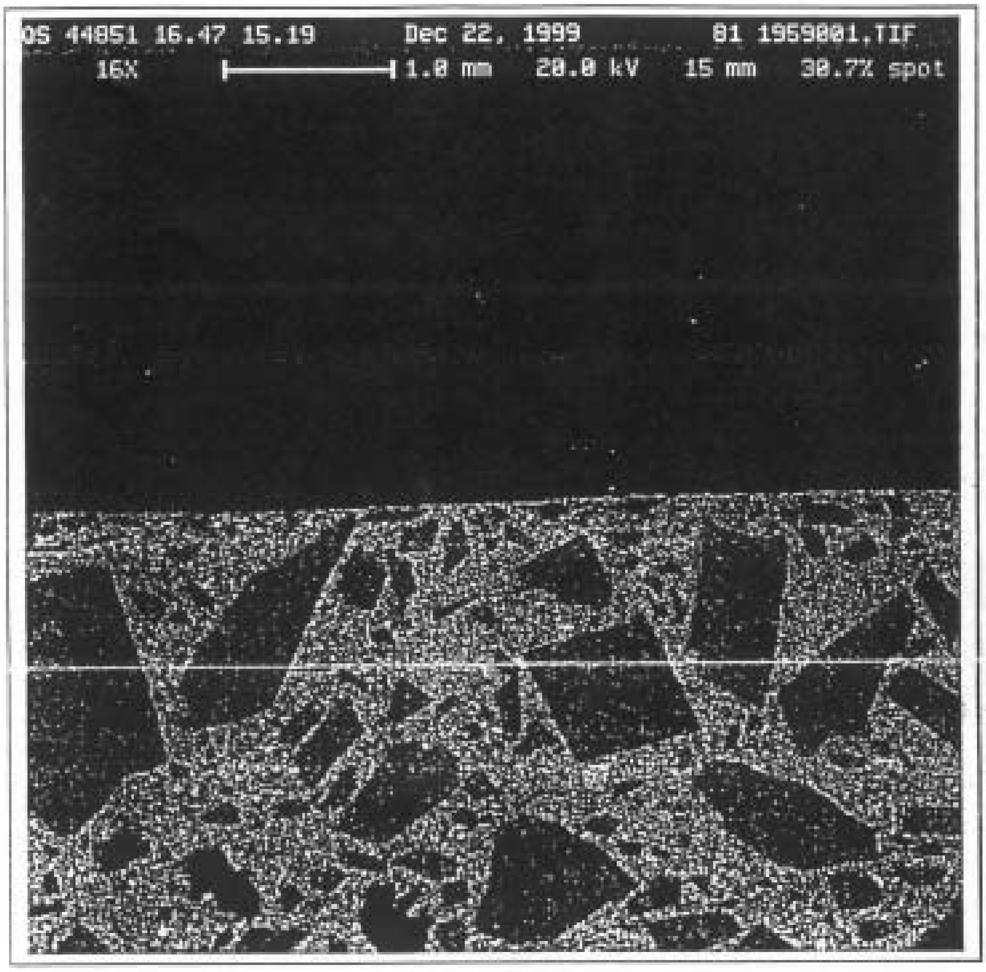


Affected Region
Calcium-rich Layer

Page 4 of 10

RJ Lee Group, Inc.
Project No. MAH912505

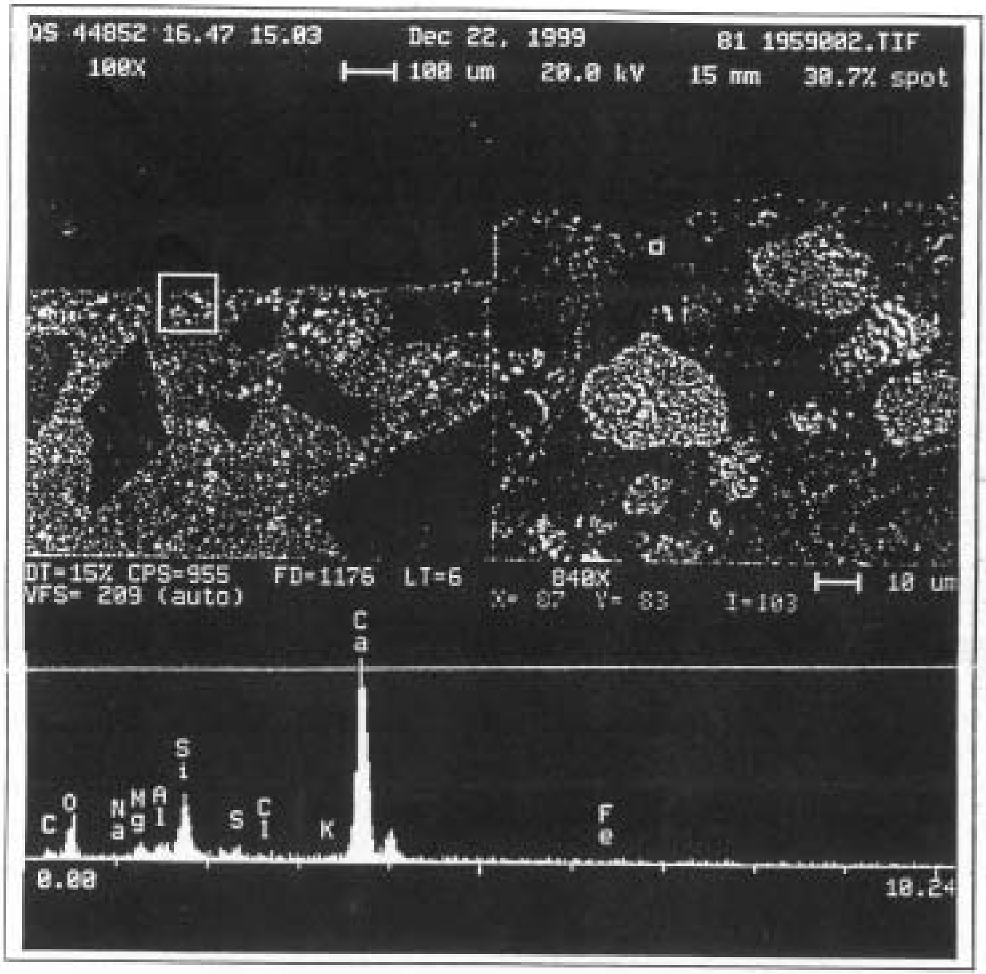
Sample No. 0811959
Client ID Small Spots



Low Magnification of
An Unaffected Region along Top Surface

RJ Lee Group, Inc.
Project No. MAH912505

Sample No. 0811959
Client ID Small Spots



Unaffected Region at Top Surface
Calcium-rich Layer

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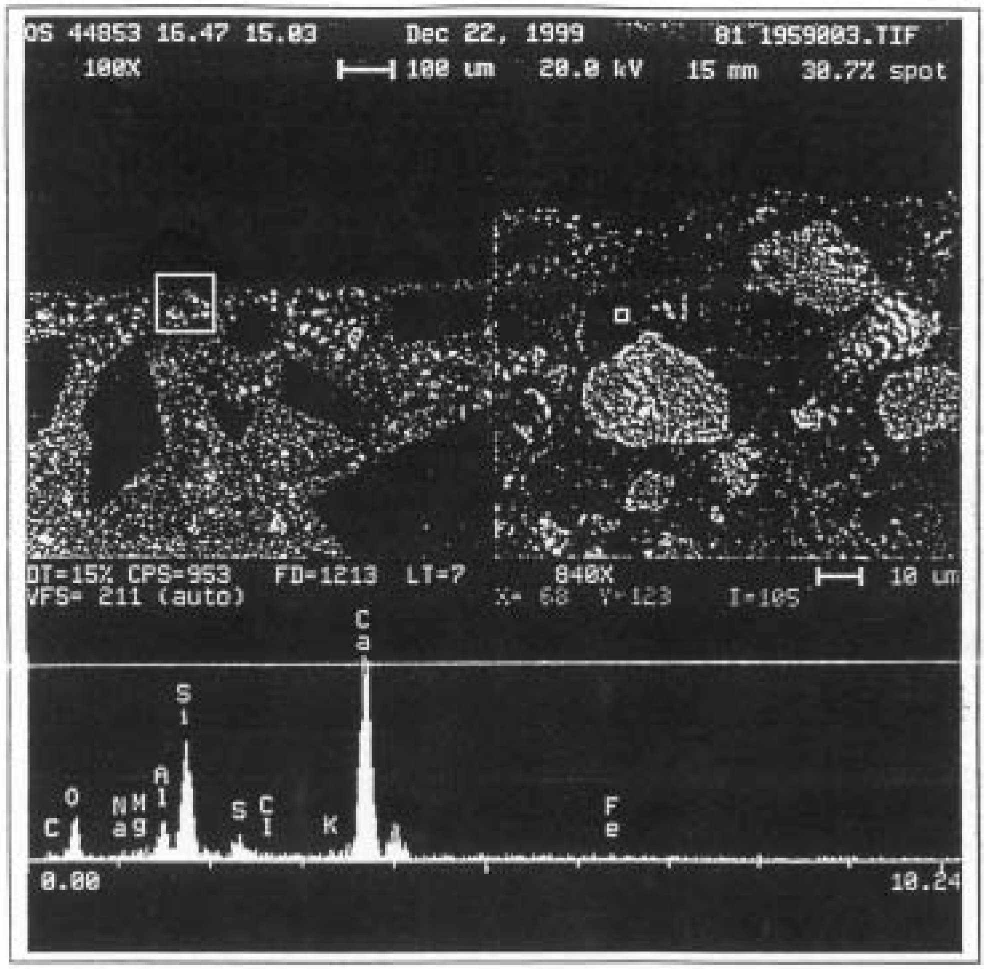
RJ Lee Group, Inc.
Project No. MAH912505

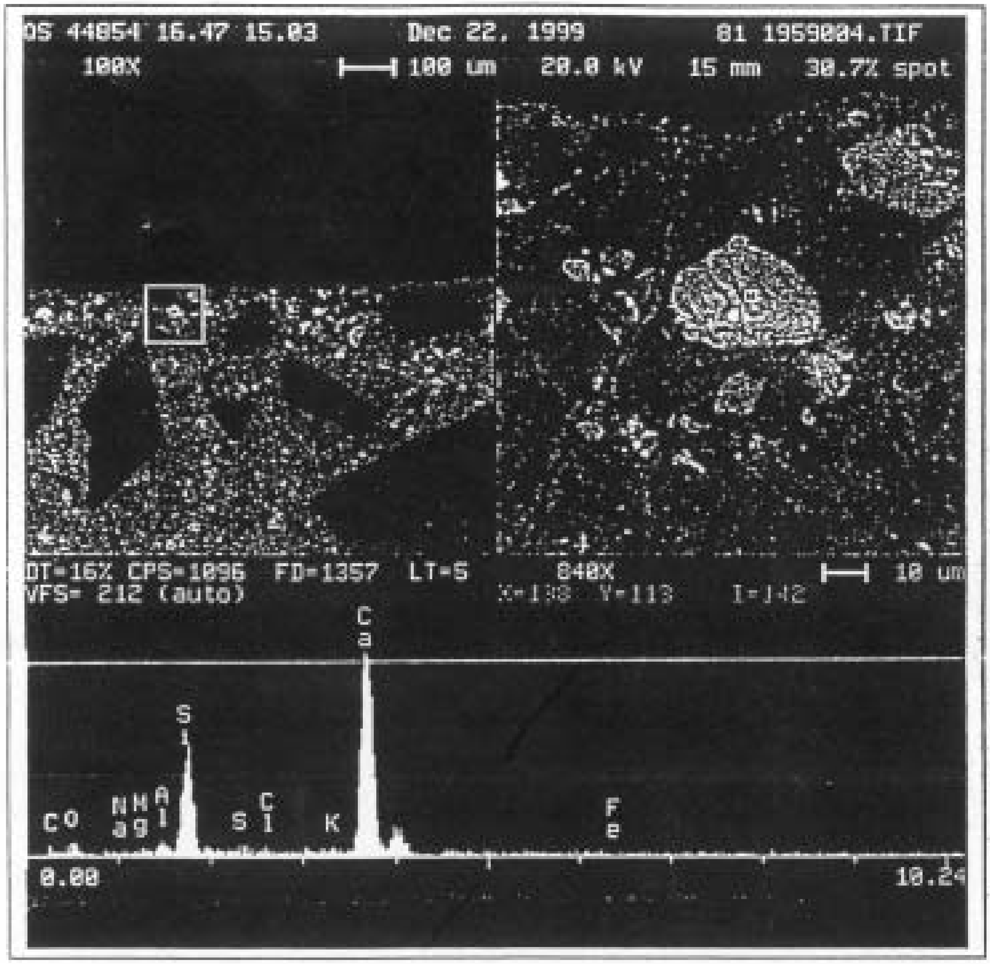
Sample No. 0811959
Client ID Small Spots



Unaffected Region at Top Surface
Hydrated Paste Composition

RJ Lee Group, Inc.
Project No. MAH912505

Sample No. 0811959
Client ID Small Spots



Unaffected Region at Top Surface
Unhydrated Cement Grain Composition

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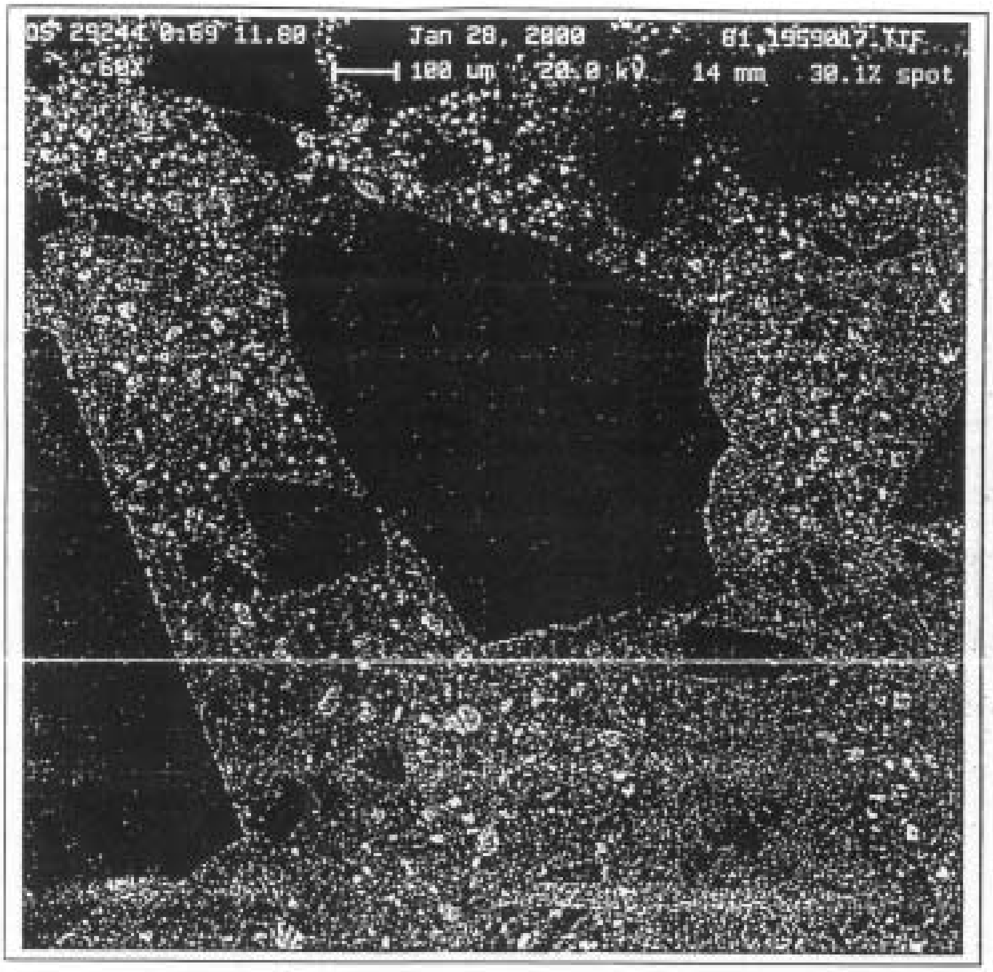
RJ Lee Group, Inc.
Project No. MAH912505

Sample No. 0811959
Client ID Small Spots



Interior Region of Sample
Cracking Indicative of Shrinkage

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RJ Lee Group, Inc.
Project No. MAH912505

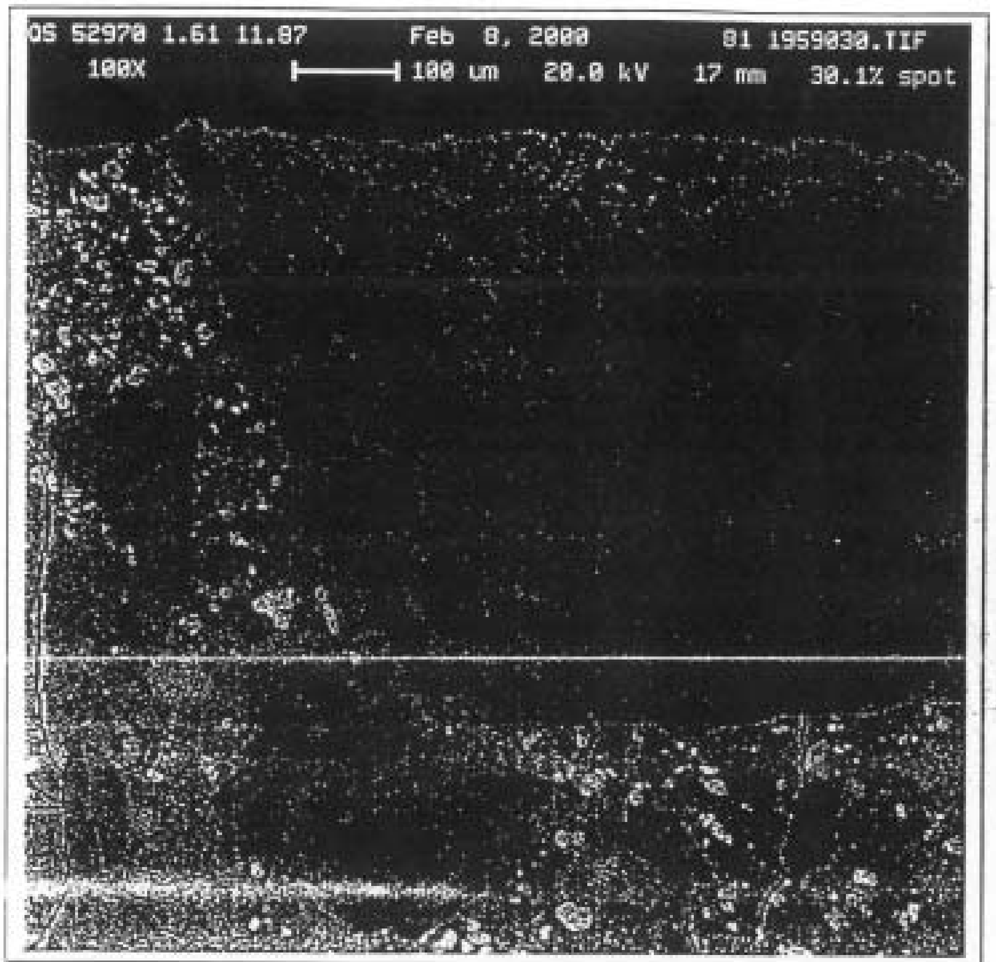
Sample No. 0811959
Client ID Small Spots

Interior Region of Sample
Cracking Indicative of Shrinkage

Page 10 of 10

RJ Lee Group, Inc.
Project No. MAH912505

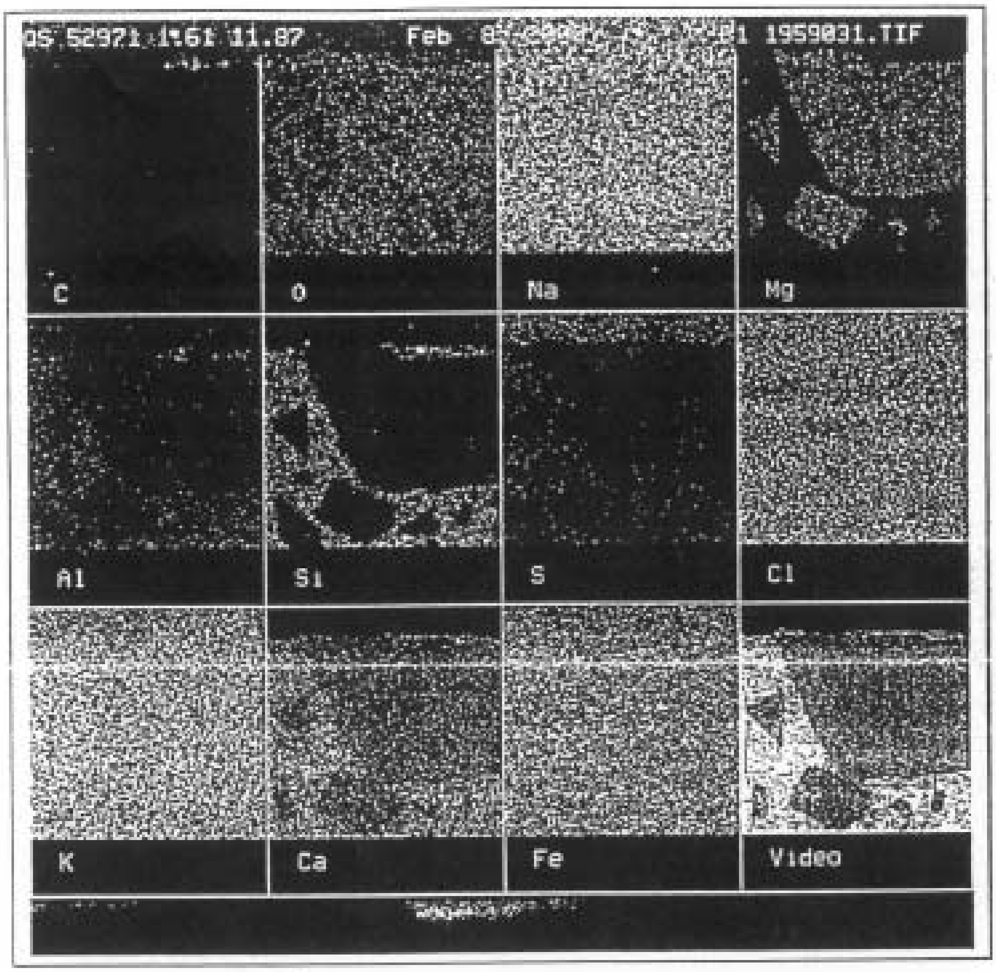
Sample No. 0811959
Client ID Small Spots



BSE Low Magnification
Affected Region Above Aggregate

RJ Lee Group, Inc.
Project No. MAH912505

Sample No. 0811959
Client ID Small Spots



EDS X-ray Map
Showing Affected Region Above Aggregate

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RJ Lee *Group*, Inc.
350 Hochberg Road
Monroeville, PA 15146
Tel: (724) 325-1776
Fax: (724) 733-1799

The Materials Characterization Specialists

April 25, 2000

Mr. Greg Garrett
Applied Materials Technologies, Inc.
P.O. Box 7842
Chandler, AZ 85246-7842

RE: RJ Lee Group Project # MAH912505; Supplemental Report

Dear Mr. Garrett,

Cross sections of two core samples were examined by scanning electron microscopy (SEM). The samples were identified as Core #1 (small spots) and Core #2 (large spots).

The results from the analyses of these two cores were presented in a report dated March 6, 2000. In our subsequent discussions you requested we answer four additional questions:

- Is the pigment defective?
- Is there a depletion of calcium along the top surface?
- When did the dissolution/carbonation reaction occur?
- Can we give a range at which the pH of the solution would cause the dissolution/carbonation reaction occur?

To answer the first two questions additional SEM analyses were required. The pigment content and relationship to the spotted regions was examined by backscattered electron microscopy (BSE). X-ray mapping was used to evaluate the calcium content along "unaffected regions" at the top surface.

BSE images of pigment particles are shown as attached figures. Pigment particles were observed throughout the sample. Pigment particles were observed in the spotted regions, but were more prevalent in the unaffected paste.

X-ray maps were taken from the top surface within unaffected paste regions and are shown in the attached figures. No discernable difference is observed in calcium content as a function of depth.

Summary of results:

- Barium sulfate and iron-rich pigment particles observed.
  - ✓ Barium sulfate more easily observed.
  - ✓ More barium sulfate observed in affected regions than iron.
  - ✓ Iron-rich particles are detected in affected region, but more prevalent in unaffected region.

- X-ray maps do not show discernable difference in calcium content.
  - ✓ X-ray maps taken along top surface, in unaffected paste regions.
  - ✓ No enrichment or depletion is observed.

Conclusions:

- The discoloration observed is mostly due to an increased porosity in the affected spot. I have conferred with Niels Thaulow concerning the iron-rich particles and he indicates the overall number of particles is far less than would be expected from his past experience; both in the affected or unaffected regions. Further SEM analysis is recommended of the starting pigment material.

- No depletion of the calcium content near the surface is observed, as shown by X-ray mapping.

- Our previous analyses indicate that the spotting occurs after plaster hydration. This is best exemplified by relics of former cement grains that show unusual hydration (i.e. a high silicon to calcium ratio).

- Further testing is required to fully determine the range of pH (in the pool solution) that can cause the two-phase microstructure observed in the first report (dated 3/6/00). I have conferred with Niels Thaulow, and neither he nor I can relate these types of effects to previous projects.

Sincerely,

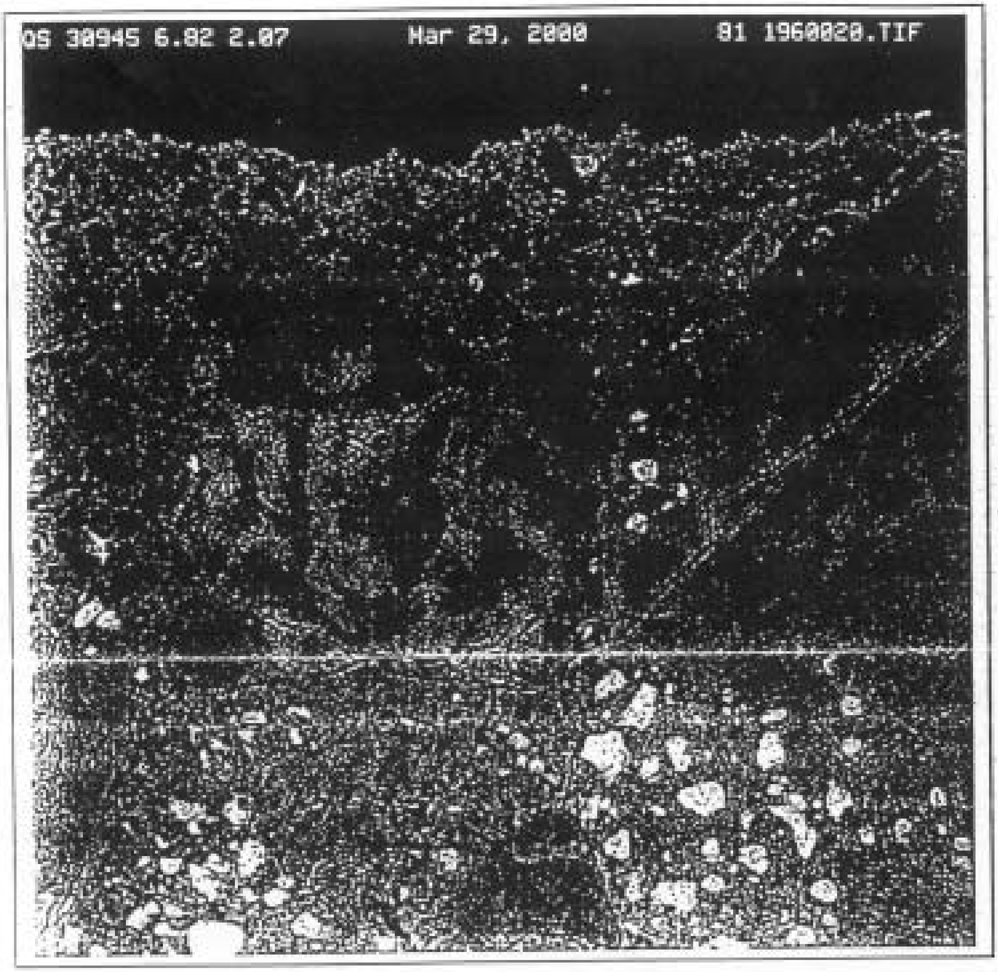
Boyd A. Clark

Boyd Clark
Senior Materials Scientist
RJ Lee Group, Inc.

Page 2 of 2

RJ Lee Group, Inc.
Project No. MAH912505

Sample No. 0811960
Client ID Large Spots

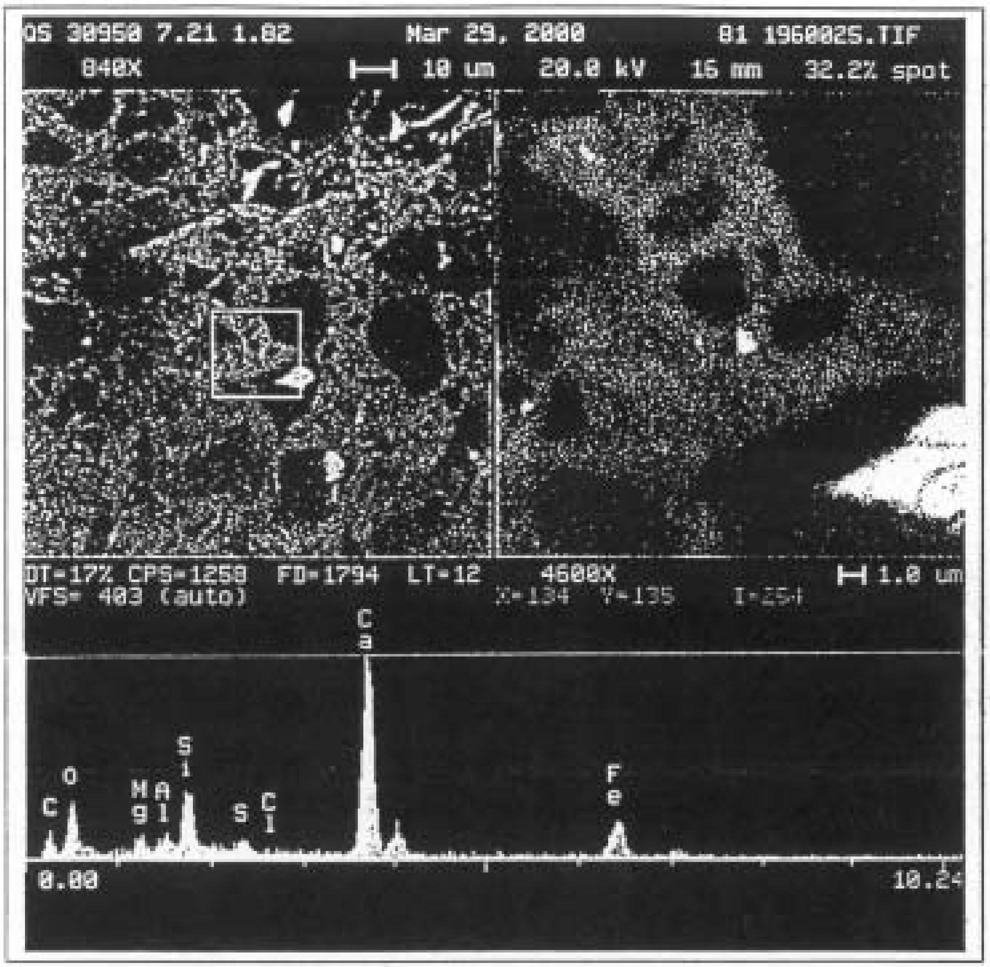


BSE Low Magnification Image
Interface Between Affected Region and Unaffected Paste Interior

Page 1 of 11

RJ Lee Group, Inc.
Project No. MAH912505

Sample No. 0811960
Client ID Large Spots

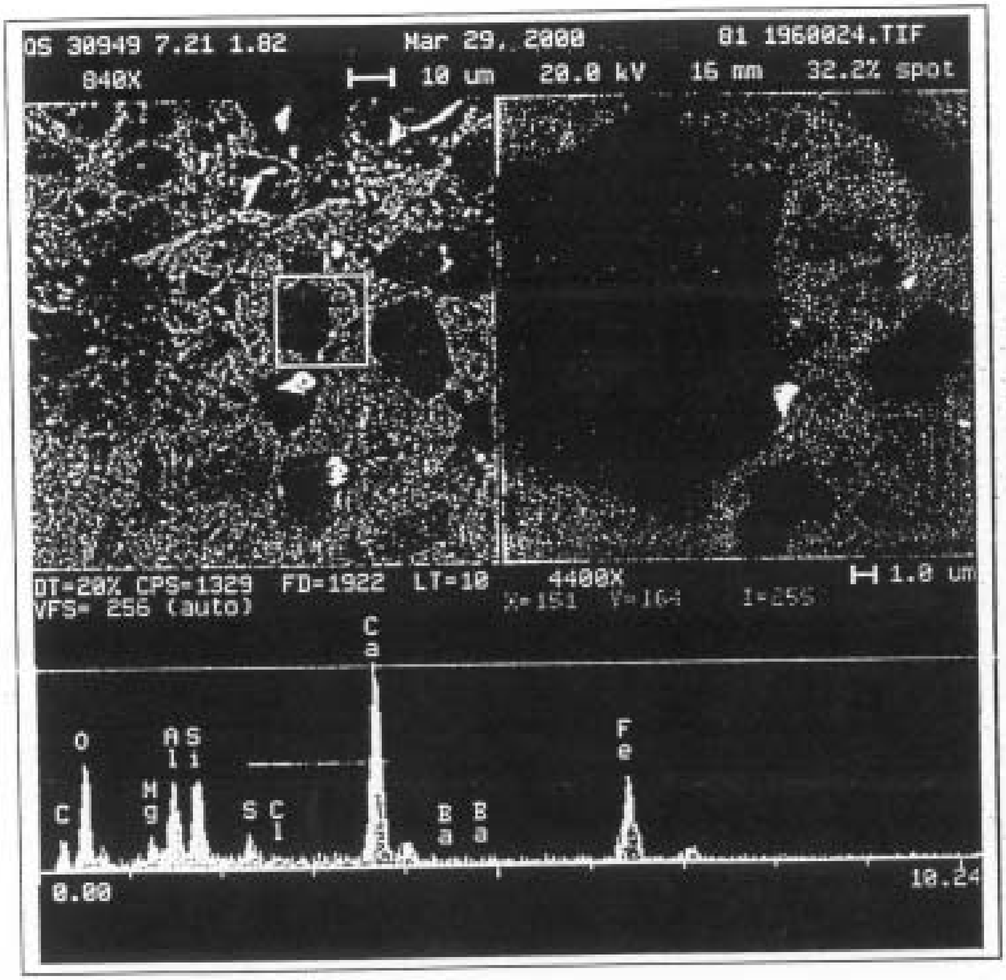


Affected Region
Iron-rich Particle

Page 2 of 11

RJ Lee Group, Inc.
Project No. MAH912505

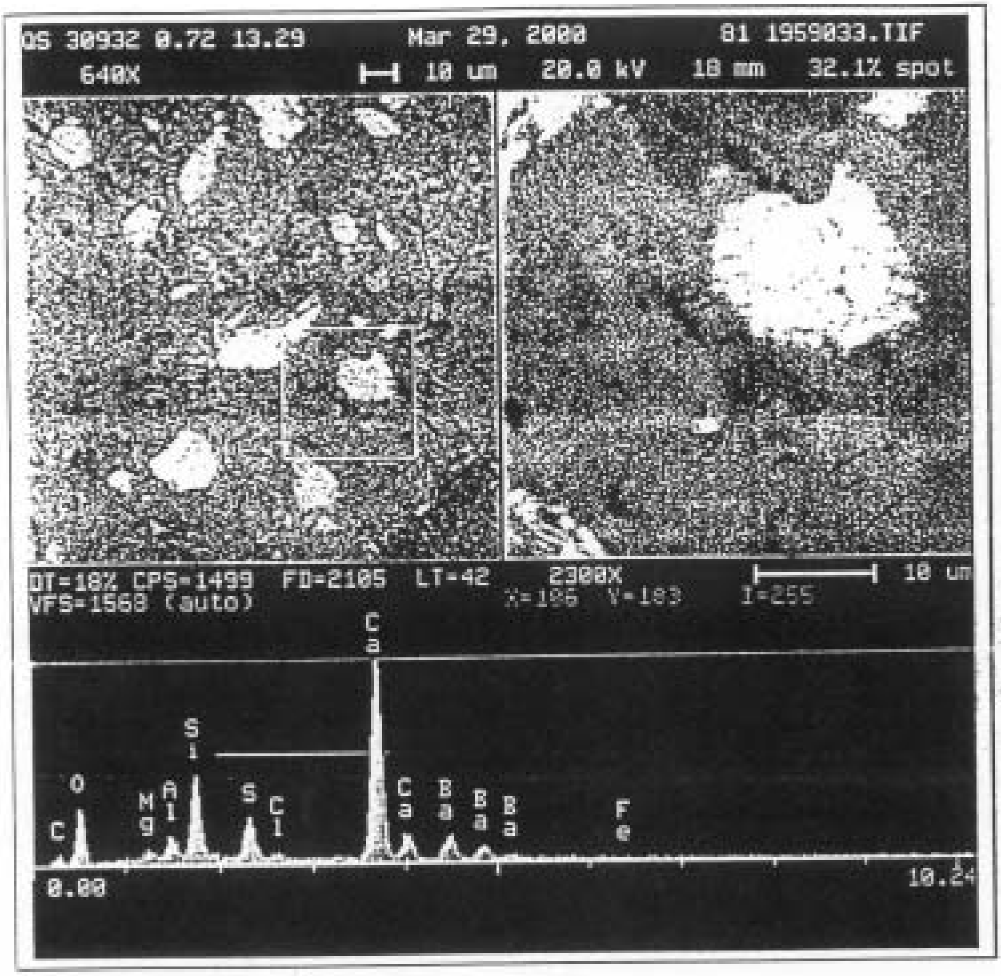
Sample No. 0811960
Client ID Large Spots



Affected Region
Iron-rich Particle

RJ Lee Group, Inc.
Project No. MAH912505

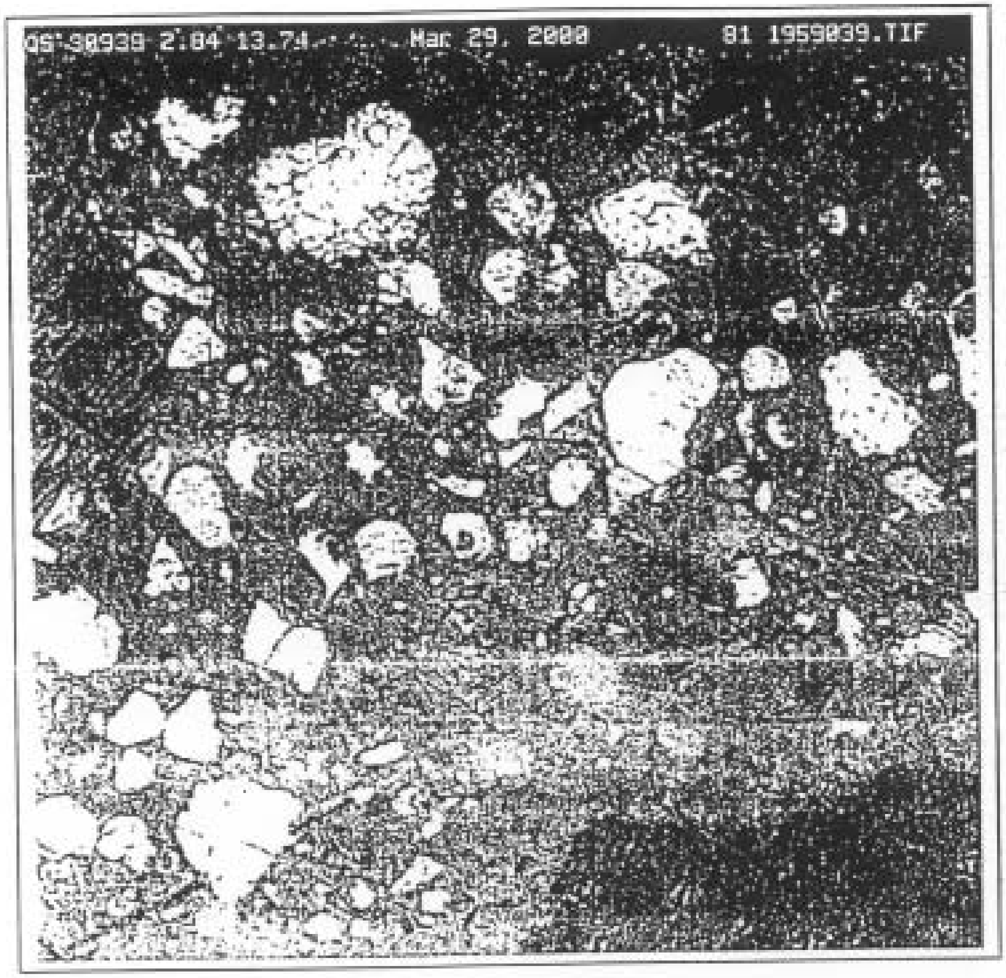
Sample No. 0811959
Client ID Small Spots



Unaffected Region
Barium Sulfate Particle

RJ Lee Group, Inc.
Project No. MAH912505

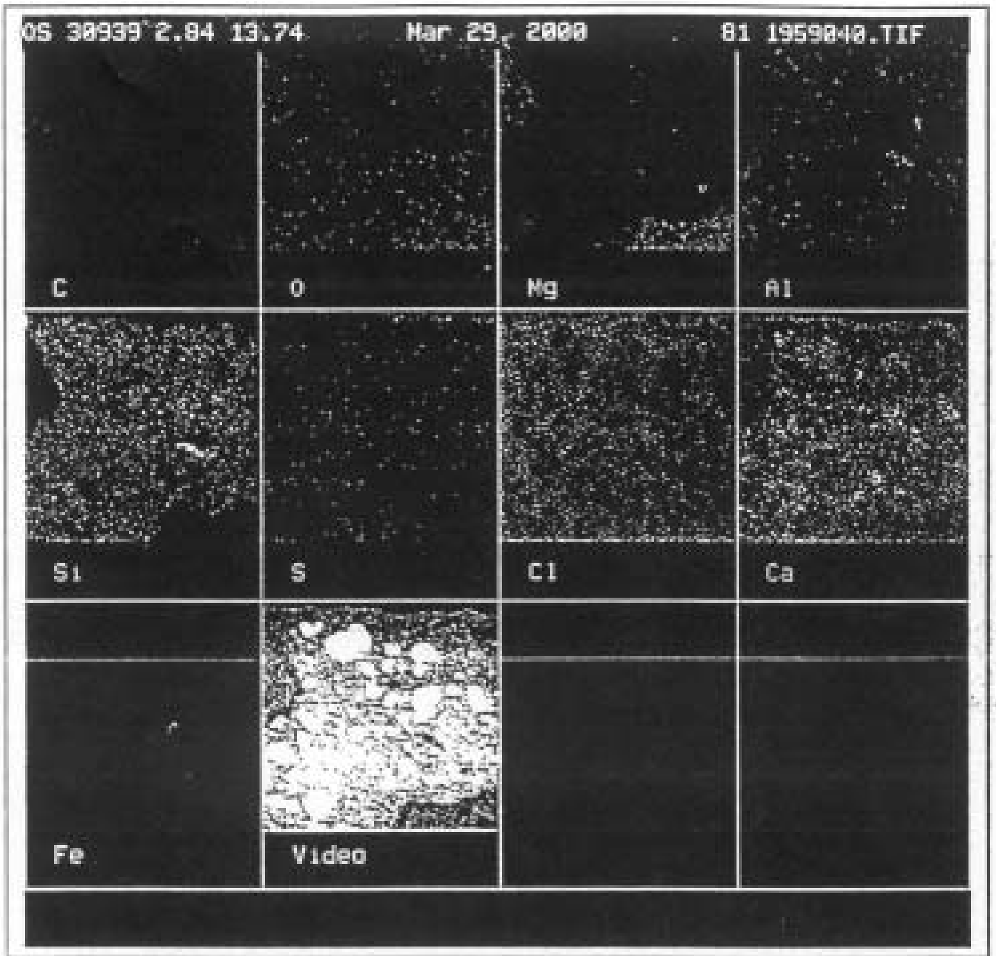
Sample No. 0811959
Client ID Small Spots



BSE Low Magnification
Unaffected Region

RJ Lee Group, Inc.
Project No. MAH912505

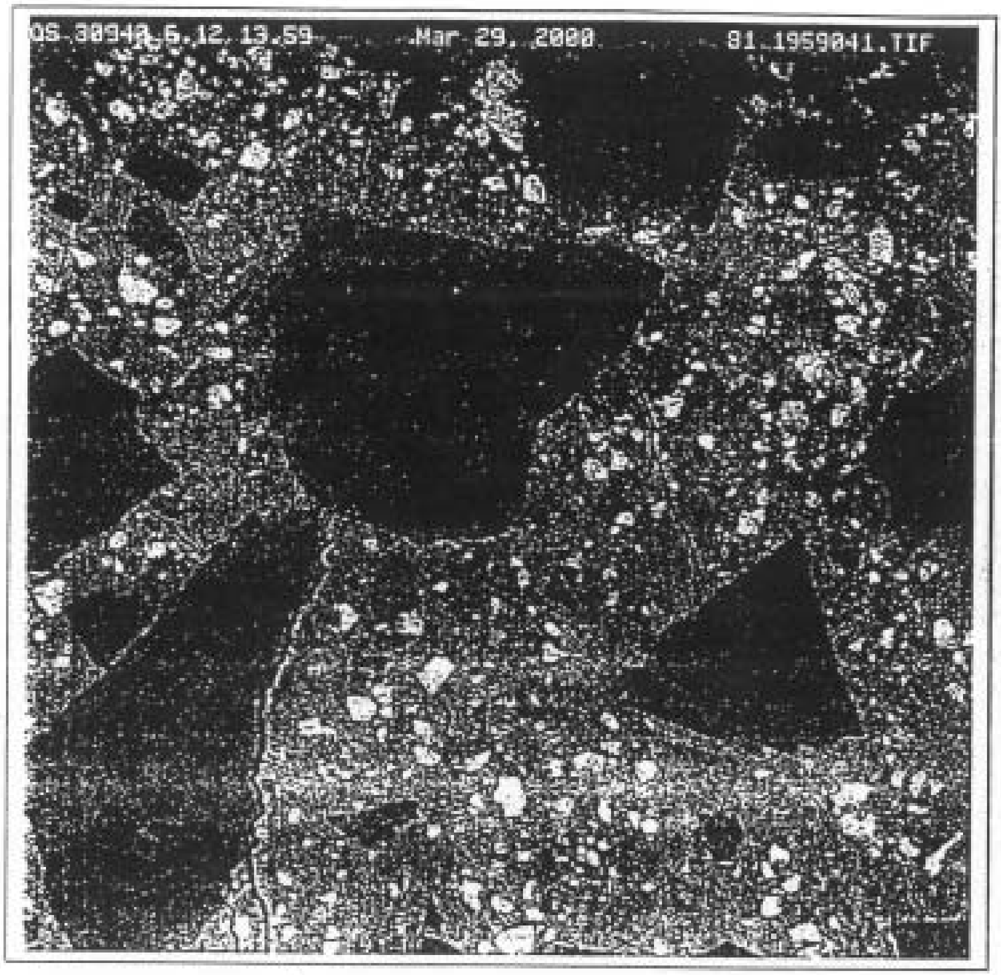
Sample No. 0811959
Client ID Small Spots



EDS X-ray Map
Unaffected Region

Page 6 of 11

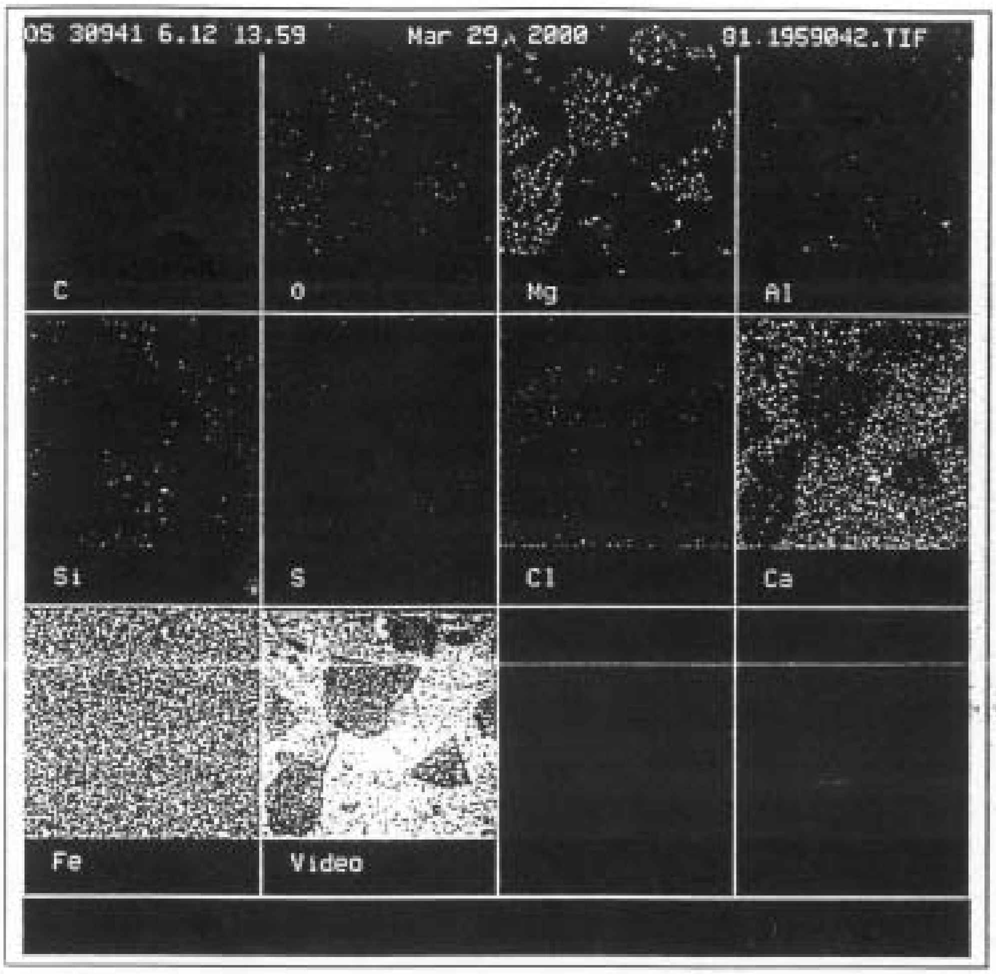
Sample No. 0811959
Client ID Small Spots



BSE Low Magnification
Unaffected Region

RJ Lee Group, Inc.
Project No. MAH912505

Sample No. 0811959
Client ID Small Spots

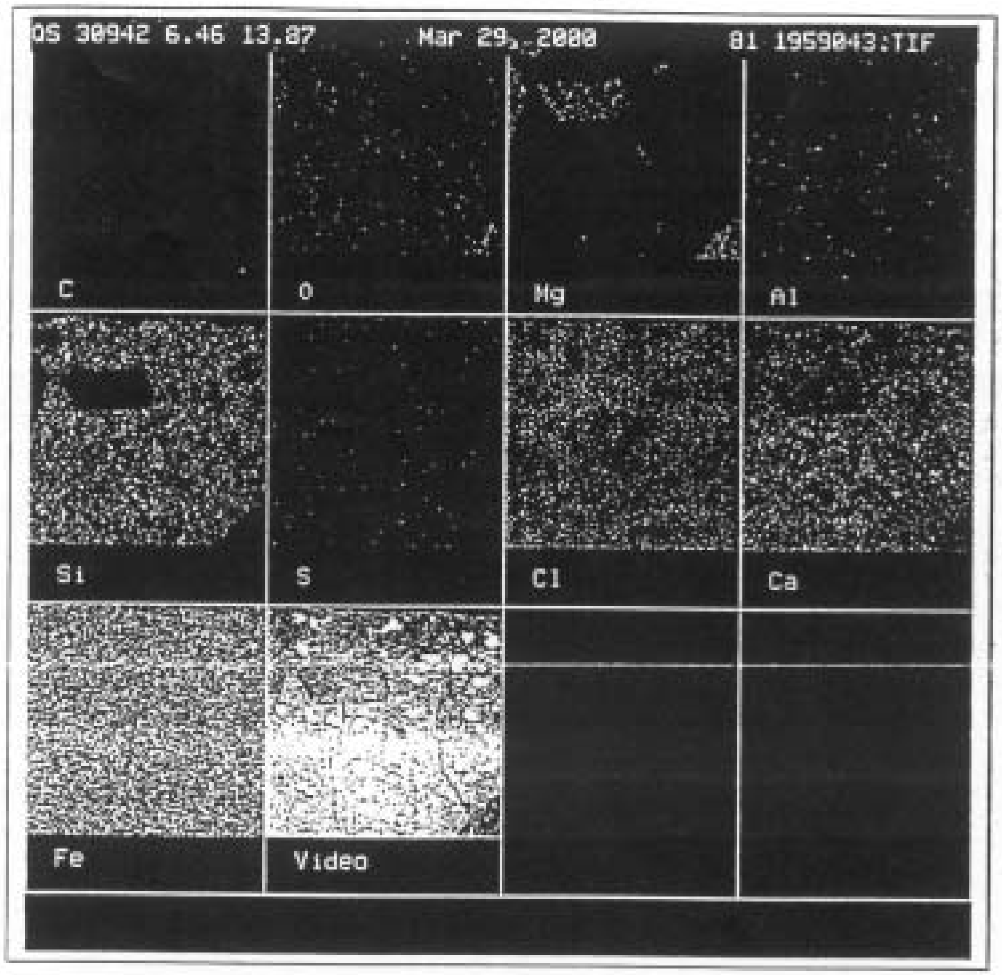


EDS X-ray Map
Unaffected Region

Page 8 of 11

RJ Lee Group, Inc.
Project No. MAH912505

Sample No. 0811959
Client ID Small Spots



EDS X-ray Map
Unaffected Region

Page 9 of 11

RJ LeeGroup, Inc.

350 Hochberg Road
Monroeville, PA 15146
Tel: (724) 325-1776
Fax: (724) 733-1799

The Materials Characterization Specialists

February 18, 2002

Mr. Que Hales
Pool Chlor
3116E Pennsylvania Street
Tucson, AZ 85714

RE: Petrographic Examination of Concrete
Project No. MAH112353

Dear Mr. Hales:

Enclosed is a summary of the results from the examination of two concrete samples by scanning electron microscopy (SEM) and acid soluble chloride analysis. Four concrete samples were received at RJ Lee Group's laboratory on December 12, 2001. The samples were identified as follows:

RJ Lee Group Sample No.	Client Sample ID.	Type of Test Performed
0815911	ES1	Not analyzed
0815912	ES2	SEM and acid soluble chloride analysis
0815913	M1	Not analyzed
0815914	M2	SEM and acid soluble chloride analysis

The concrete samples submitted for petrographic analysis were first examined visually. Samples ES1 (0815911) and ES2 (0815912) were chunks of mortar having two layers. The bottom mortar layers were gray in color, top layers were dark-gray in color and approximately ¼" in thick. White areas were observed on the top, almost completely covering the surface. Samples M1 (0815913) and M2 (0815914) were cores of approximately 2¾" diameter. Similarly, these cores consisted of two layers. The top layer was approximately ½" thick. White spots were observed on the top surface. The samples were photographed in its as-received condition. The depth of carbonation was measured after slicing and application of phenolphthalein. A section obtained from the top of the core was analyzed by SEM. Small amounts of powdered samples from the top layers were used for acid soluble chloride analysis according to ASTM C1152/1152M-92. The analysis results are summarized in a table.

SEM Sample Preparation

Vertical cross sections of sample ES2 and M2 were cut from the samples after sections cut for carbonation test. The sections were polished using 163 through 30 μm grit abrasives. The sections were dried, and vacuum impregnated using a low viscosity epoxy resin that contained a fluorescent dye. The excess epoxy was removed using metallographic abrasive papers. Care was taken not to grind into the sample. The impregnated samples were then polished using consecutively finer silicon carbide grit slurries (600 to 1000 grit) on a glass plate. Polishing was performed starting

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with the use of 9 μm diamond paste and final polishing to 1/4 μm diamond paste on cloth. The polished surface was then coated with a thin layer of carbon by evaporative deposition.

SEM Analysis

The prepared section was analyzed using an SEM operated in the backscattered electron (BSE) imaging mode, coupled with energy dispersive spectroscopy (EDS). The top layers of the samples were analyzed comparing white verses dark areas. BSE images of representative features are attached in the Appendix B.

Sample No. 0815912 (ES2)

- Depth of carbonation at the top of the sample was about 1 mm.
- Crushed dolomite was used as fine aggregate.
- Decalcification of C-S-H was observed below the carbonation layer.
- Depletion of calcium hydroxide was observed in this zone.
- AFt deposits were observed below the decalcification zone.
- Increased porosity was observed in the decalcified zone.
- The carbonation zone at the top surface was not uniform.
- Below the decalcified zone cracking of the paste was observed, which extended 2-3 mm.
- The paste was not altered below this zone.
- Calcium hydroxide was present in this zone.
- The composition of the C-S-H was normal.
- Patches of Cl-rich AFm and C-S-H were observed.
- Estimated water to cementitious ratio was 0.45 in the unaltered zone.

Sample No. 0815914 (M2)

White area

- Depth of carbonation at the top of the sample was about 1 mm.
- Crushed dolomite was used as fine aggregate.
- Decalcification of C-S-H was observed below the carbonation layer.
- Magnesium silicate formation was observed.
- Depletion of calcium hydroxide was observed in this zone.
- AFt deposits were observed below the decalcification zone.
- Increased porosity was observed in the decalcified zone.
- The carbonation zone at the top surface was not uniform.
- Below the decalcified zone cracking of the paste was observed, which extended 3-4 mm.
- The paste was not altered below this zone.
- Calcium hydroxide was present in this zone.
- The composition of the C-S-H was normal.
- Patches of Cl-rich AFm and C-S-H were observed.

Dark area

- Depth of carbonation at the top of the sample was about 1 mm.
- Minor decalcification of <1 mm thickness was observed below the carbonation zone.
- Magnesium silicate formation was observed.
- The paste was unaltered below this zone.

- Cracking of the paste was not visible.
- Patches of Cl-rich AFm and C-S-H were observed.
- Estimated water to cementitious ratio was 0.45 in the unaltered zone.

Summary

Petrographic analysis of the concrete samples shows white area on the surface. The paste of the white areas shows carbonation and decalcification of the C-S-H. Increased porosity was observed in these areas. Below this decalcified zone, deposits of ettringite and cracking were observed. This altered zone extends up to maximum 5 mm. Angular, fine aggregates were exposed at the surface due to loss of material from the surface. The exposed dolomite aggregate did not show evidence of acid etching. The white areas seem to form due to local leaching of cement paste creating porous, decalcified areas. The pattern of the leached areas may have been determined by the finishing process, with local areas of higher w/c being more susceptible to leaching of calcium ions.

Bulk analysis of mortar indicates high concentration of chloride present in the samples. The chloride-containing compounds were distributed all over the cement paste, except the decalcified zone. This indicates that chloride was added to the mortar mix. It is known that addition of calcium chloride accelerators may influence the color of the concrete surface.

The results are submitted pursuant to RJ Lee group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. The samples for this project will be stored for a period of 60 days.

If you have any questions or if you want us to do any further investigations, please call me at 724-325-1776.

Sincerely,

Niels Thaulow
Director of Construction Materials

Attachments

Top & Bottom Views of As Received Core

MAH112353 – Sample No. 0815913- M1

Side Views of As Received Core

MAH112353 – Sample No. 0815913- M1

Side Views of As Received Core

MAH112353 – Sample No. 0815913- M1

MAH112353

Sample No. 0815913 – M1

Figure 1: DSCN0211.JPG

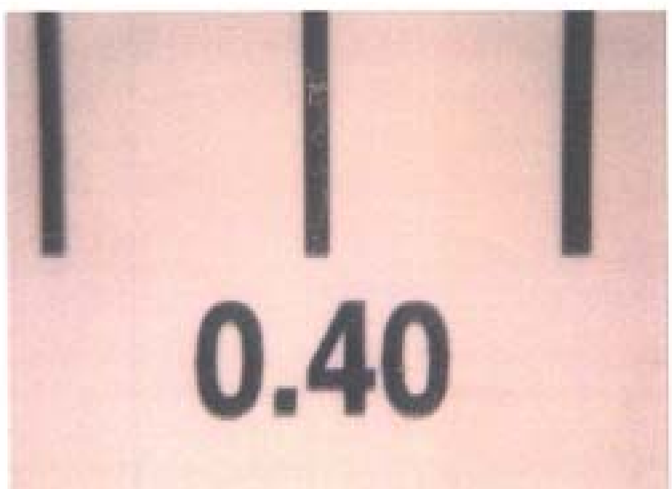


Figure 2: DSCN0212.JPG

1 1

MAH112353

Sample No. 0815913 – M1

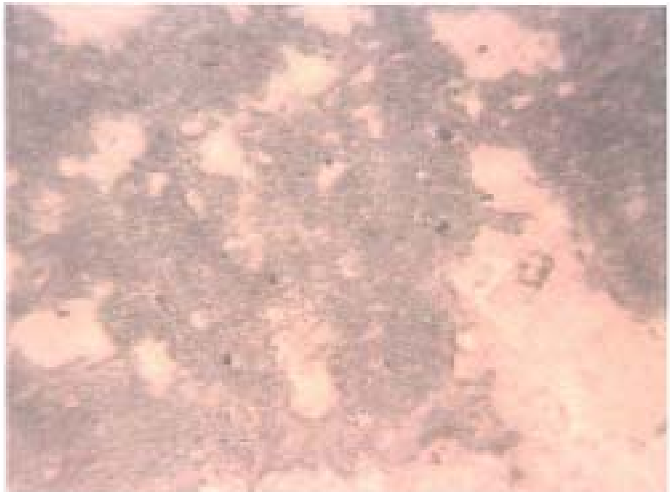


Figure 3: DSCN0213.JPG

Figure 4: DSCN0214.JPG

2 2

MAH112353

Sample No. 0815913 – M1

Figure 5: DSCN0215.JPG

Figure 6: DSCN0216.JPG

3 3

MAH112353

Sample No. 0815913 – M1

Figure 7: DSCN0217.JPG

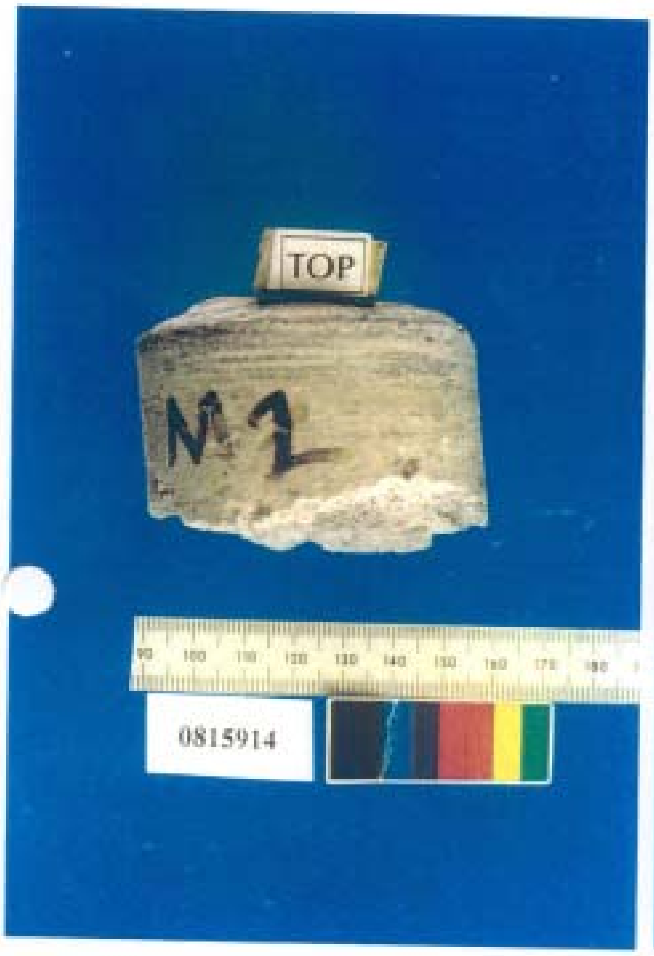
Figure 8: DSCN0218.JPG

4

4

Top & Bottom Views of As Received Core

MAH112353 – Sample No. 0815914 - M2



Side Views of As Received Core

MAH112353 – Sample No. 0815914- M2

Side Views of As Received Core

MAH112353 – Sample No. 0815914- M2

MAH112353

Sample No. 0815914 – M2

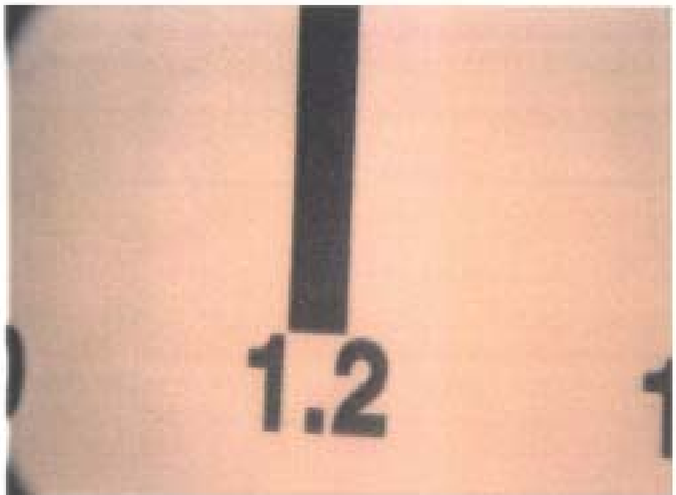


Figure 1: DSCN0219.JPG

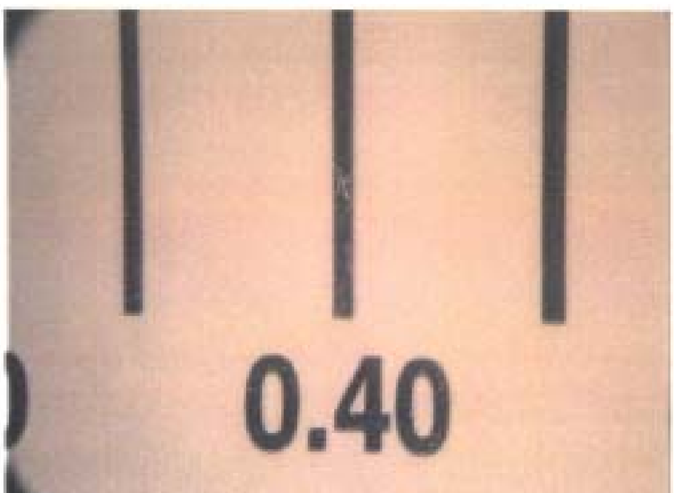


Figure 2: DSCN0220.JPG

1

MAH112353

Sample No. 0815914 – M2

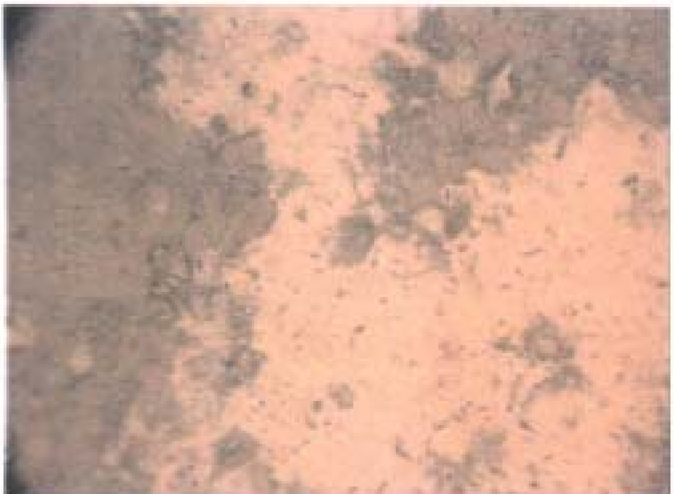


Figure 3: DSCN0221.JPG

Figure 4: DSCN0222.JPG

2

MAH112353

Sample No. 0815914 – M2

Figure 5: DSCN0223.JPG

Figure 6: DSCN0224.JPG

3

MAH112353

Sample No. 0815914 – M2

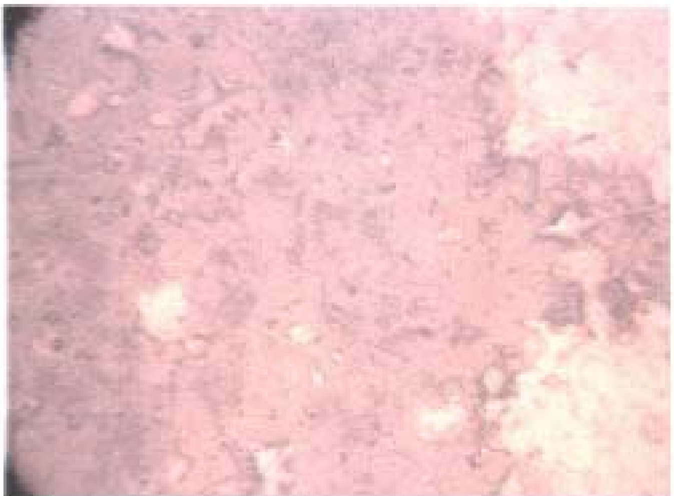


Figure 7: DSCN0225.JPG

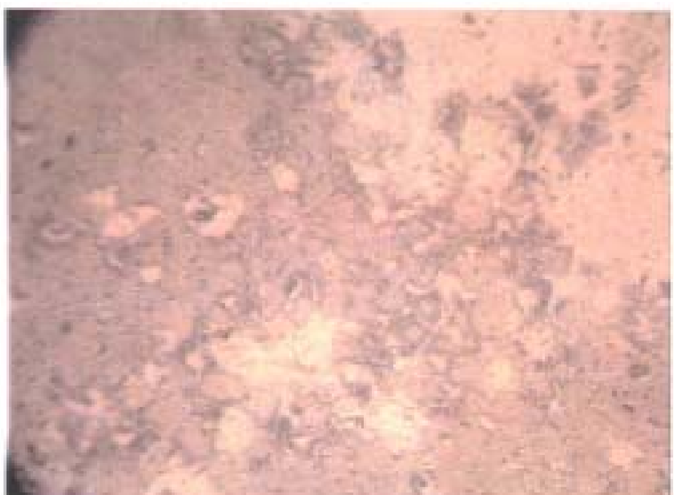
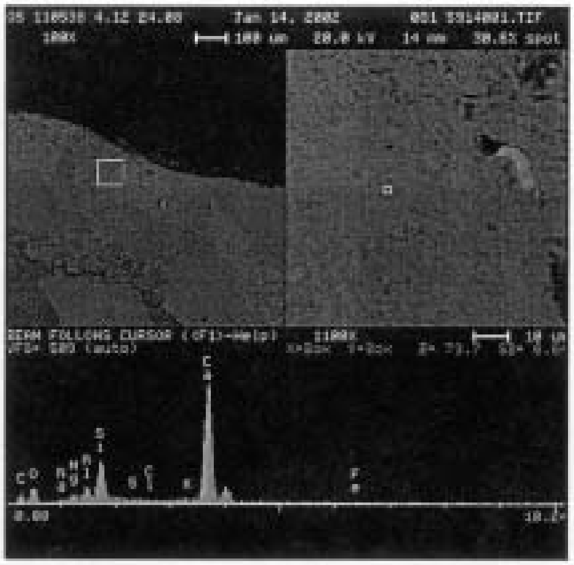


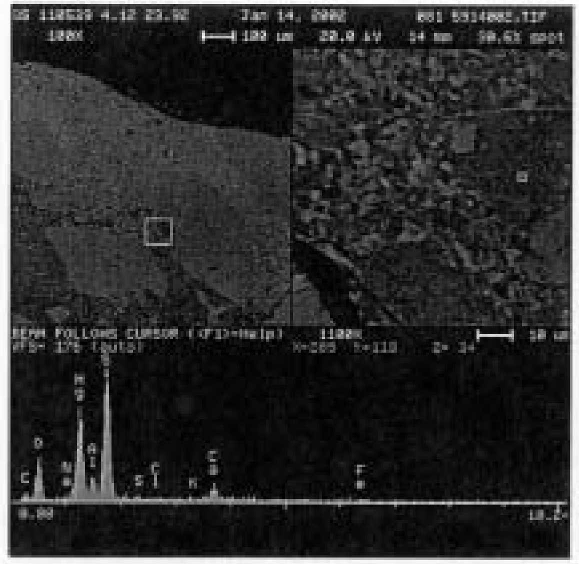
Figure 8: DSCN0226.JPG

4



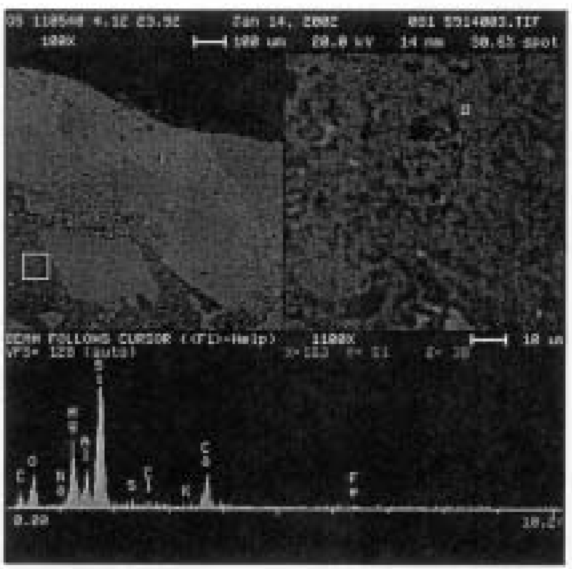
5914001.TIF Y (mm) 24.079

Carbonated paste



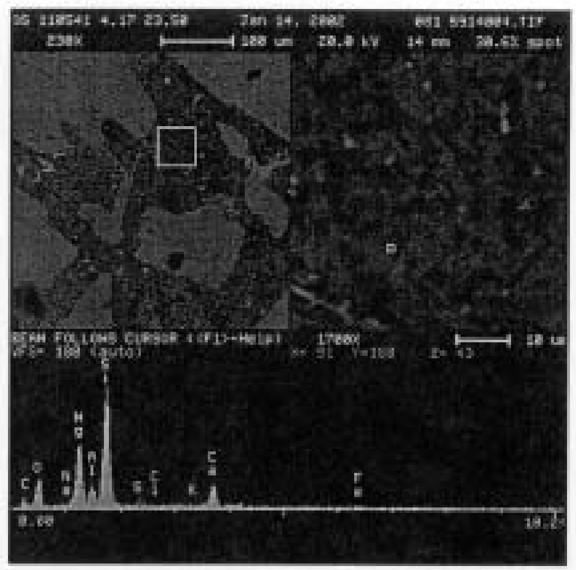
5914002.TIF Y (mm) 23.922

Mg enrichment of paste



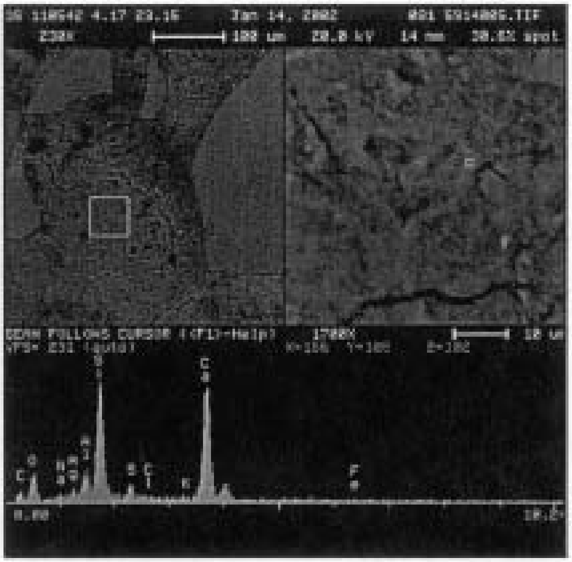
5914003.TIF Y (mm) 23.922

Mg enrichment of paste



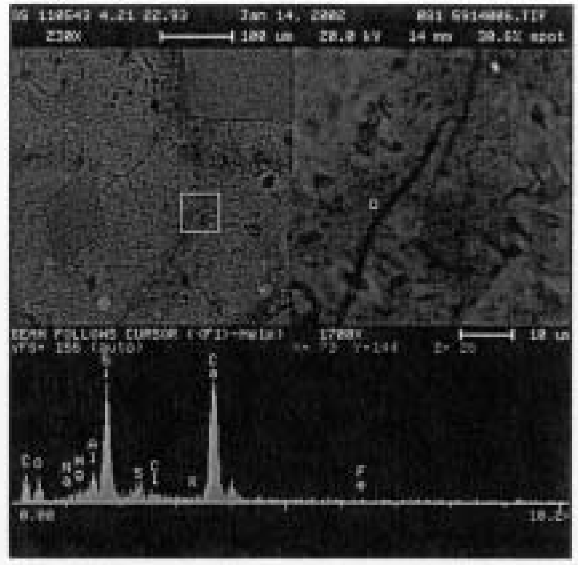
5914004.TIF Y (mm) 23.504

Mg enrichment of paste



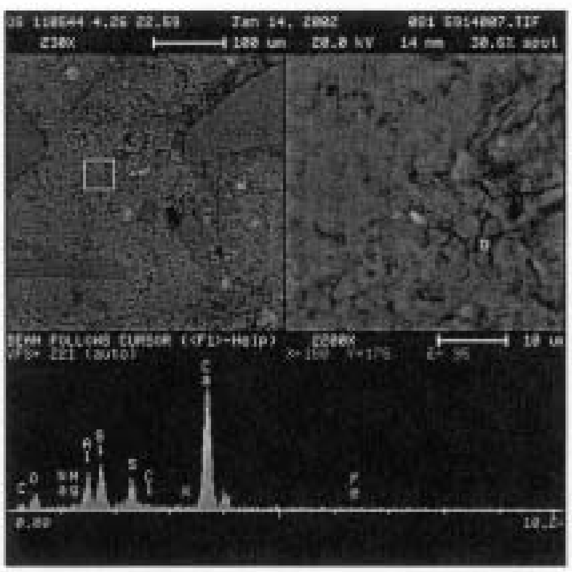
5914005.TIF Y (mm) 23.145

Partially decalcified paste



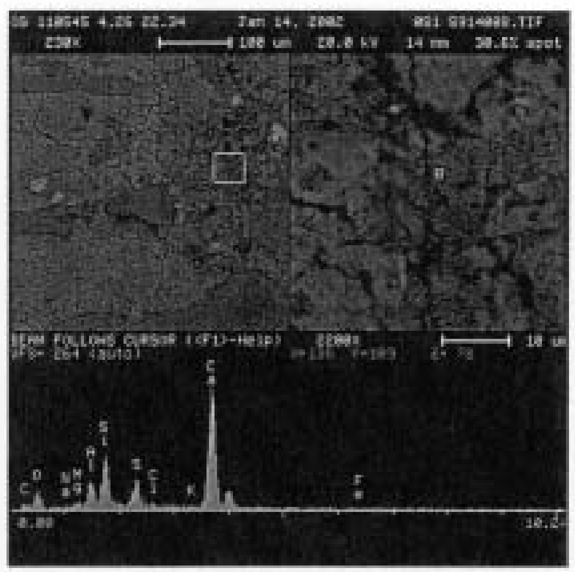
5914006.TIF Y (mm) 22.932

Partially decalcified paste



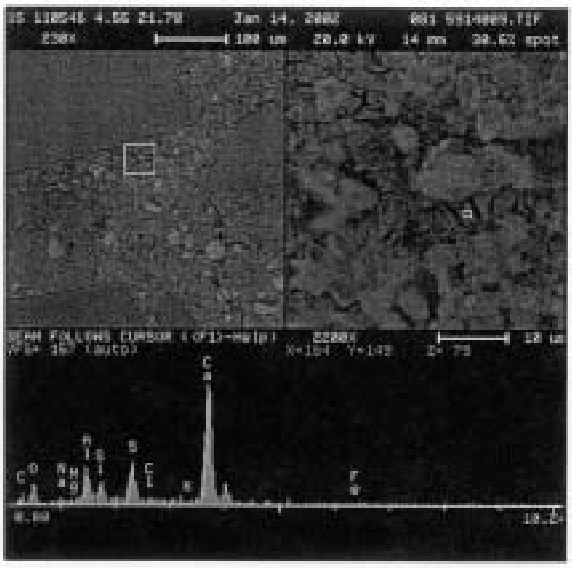
5914007.TIF Y (mm) 22.593

AFt deposit(s)



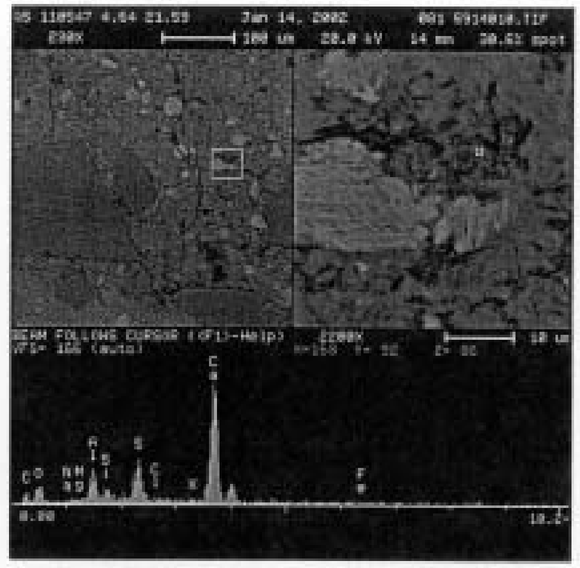
5914008.TIF Y (mm) 22.339

AFt deposit(s)



5914009.TIF Y (mm) 21.785

AFt deposit(s)

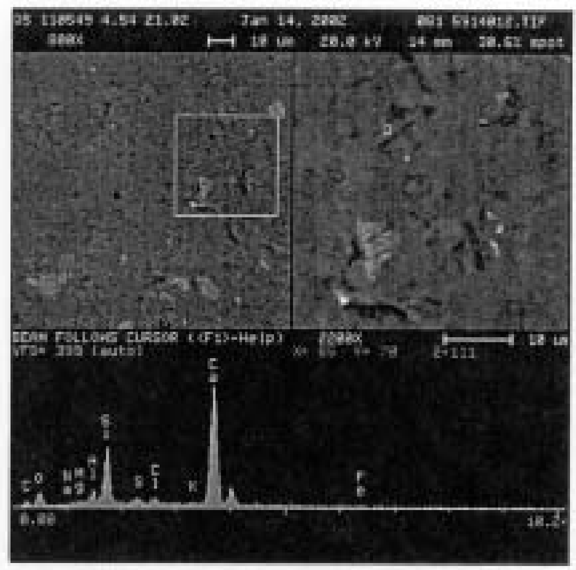


5914010.TIF Y (mm) 21.587

AFt deposit(s)

5914011.TIF Y (mm) 21.295

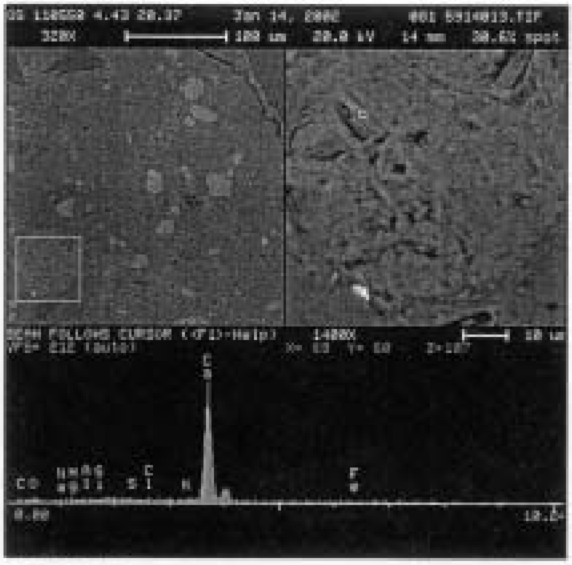
Dense paste



5914012.TIF Y (mm) 21.024

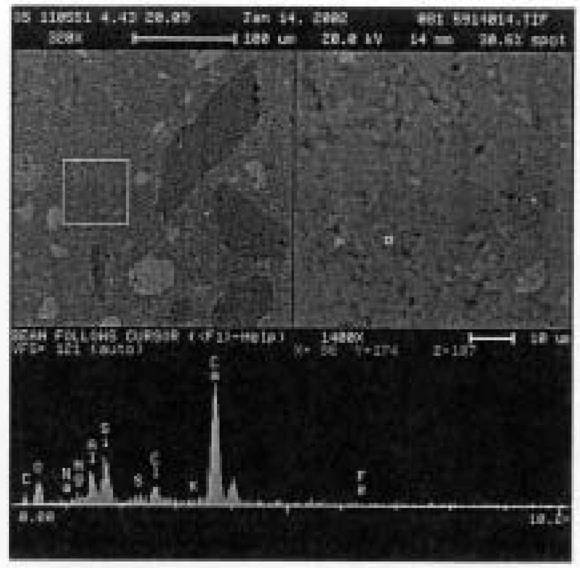
Typical paste structure and composition

MAH112353 - Sample No. 0815914 - M2



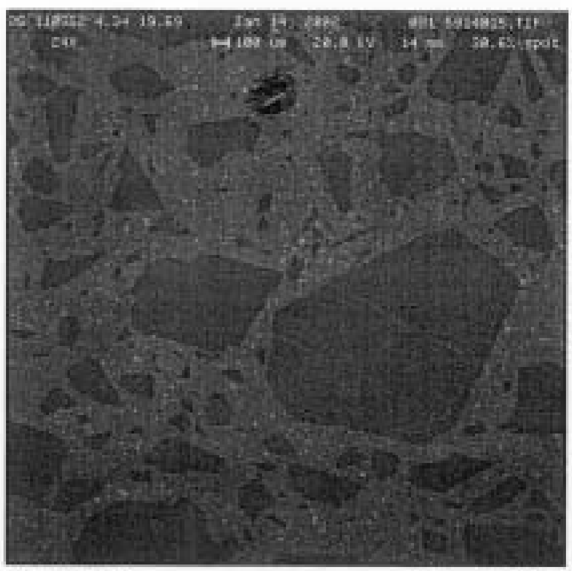
5914013.TIF Y (mm) 20.375

Carbonated paste



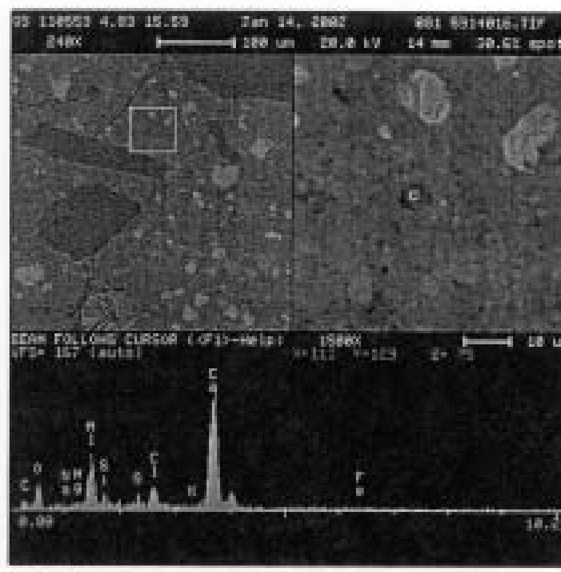
5914014.TIF Y (mm) 20.085

Cl-rich AFt/AFm



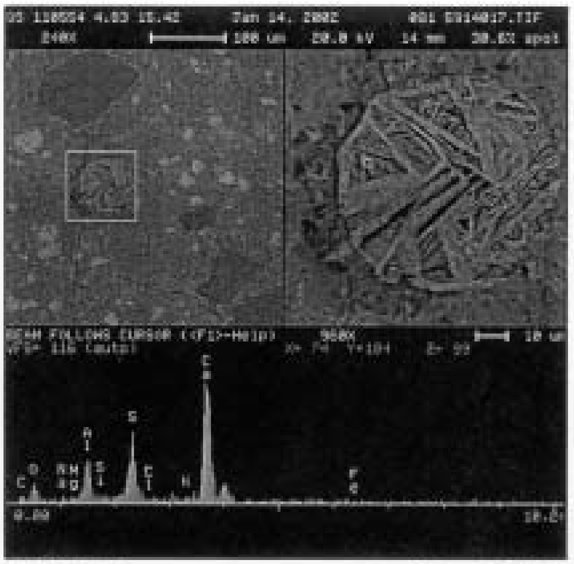
5914015.TIF Y (mm) 19.690

Paste/aggregate distribution



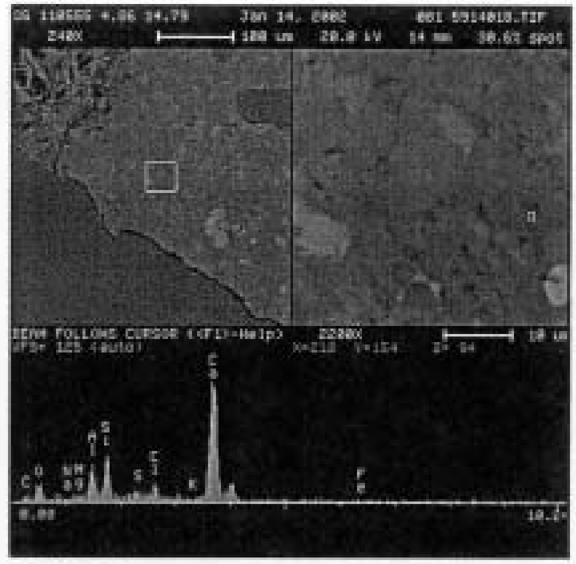
5914016.TIF Y (mm) 15.593

Cl-AFm deposit(s)



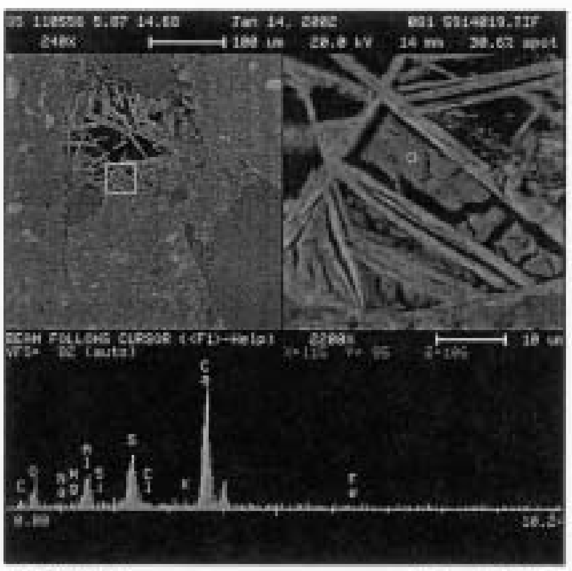
5914017.TIF Y (mm) 15.423

AFt (Ettringite) in Air Void(s)



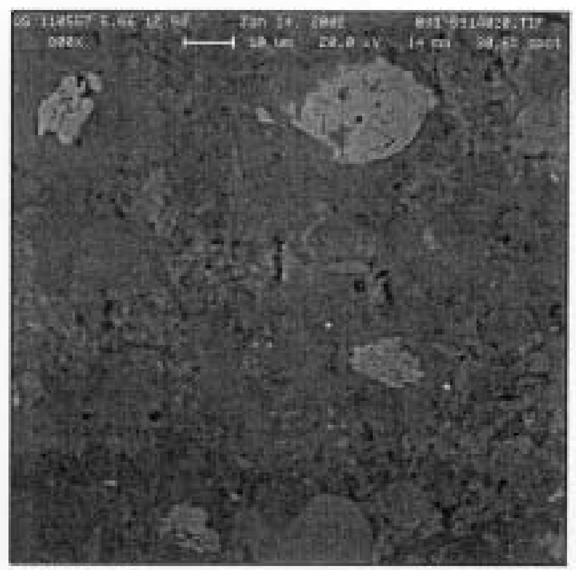
5914018.TIF Y (mm) 14.788

Cl-rich AFt/AFm



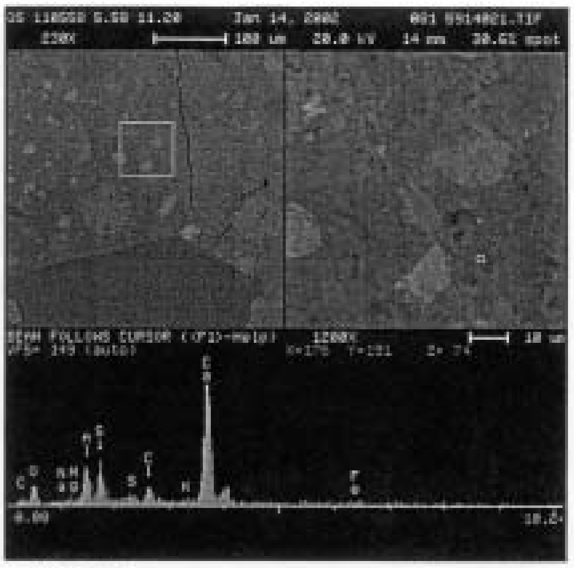
5914019.TIF Y (mm) 14.683

AFt (Ettringite) in Air Void(s)



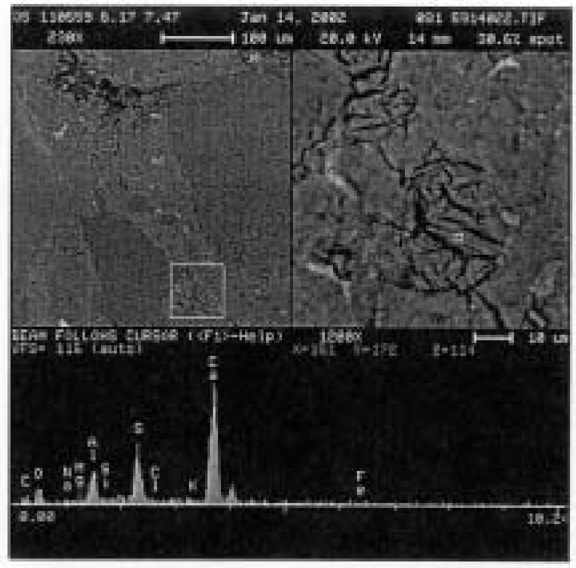
5914020.TIF Y (mm) 12.977

Dense paste



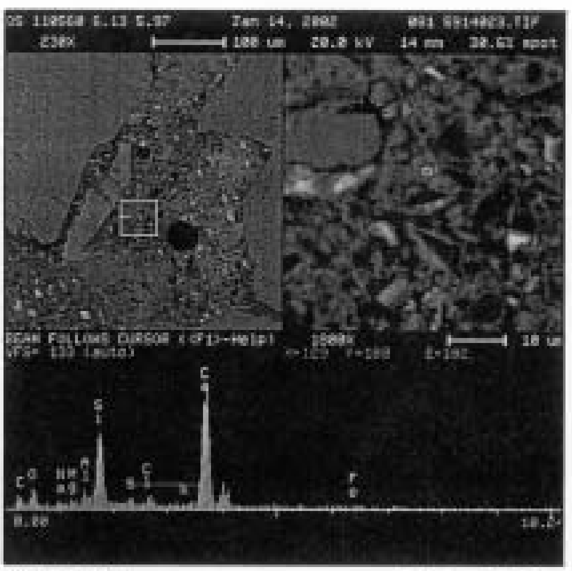
5914021.TIF Y (mm) 11.199

Cl-rich AFt/AFm



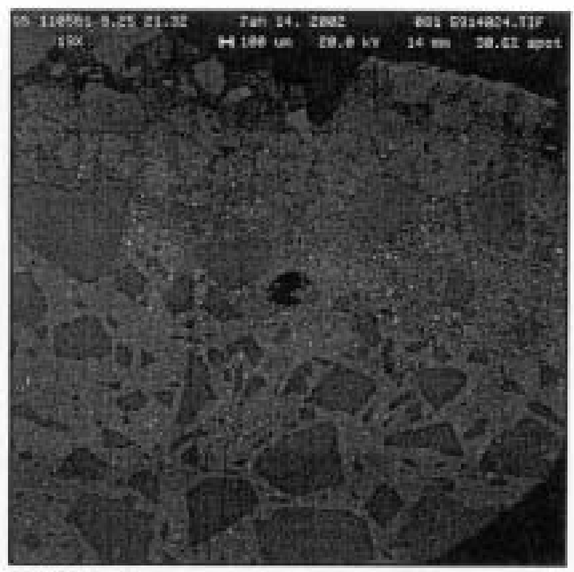
5914022.TIF Y (mm) 7.472

AFt deposit(s)



5914023.TIF Y (mm) 5.973

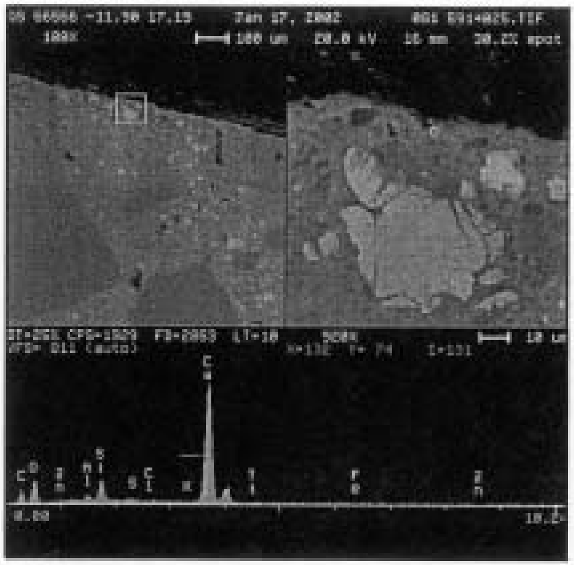
Composition of C-S-H



5914024.TIF Y (mm) 21.318

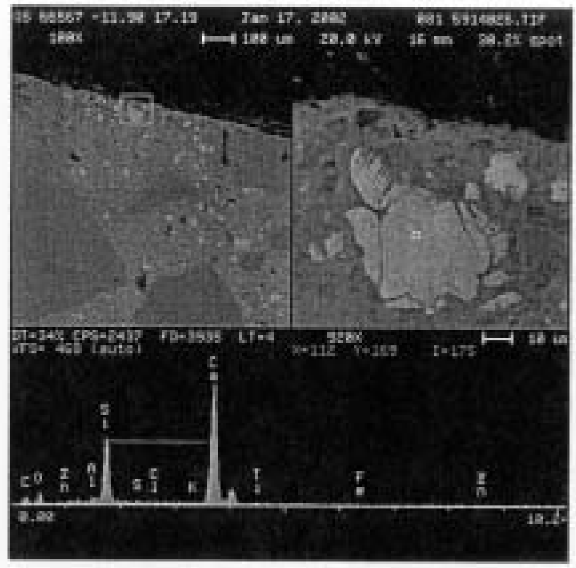
Reaction front

MAH112353 - Sample No. 0815914 - M2



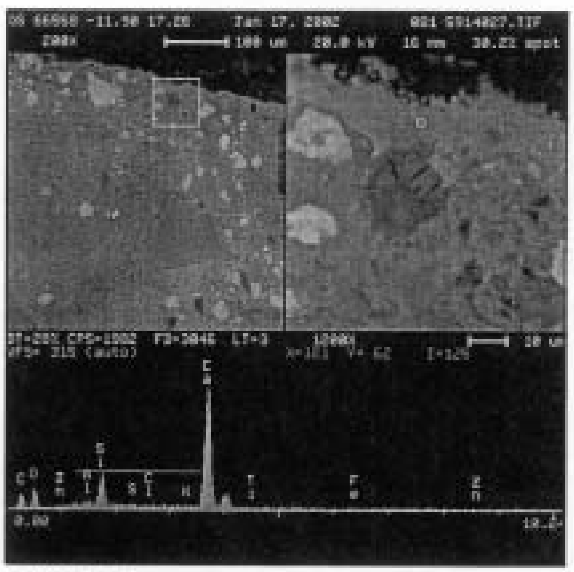
5914025.TIF Y (mm) 17.187

Carbonated paste



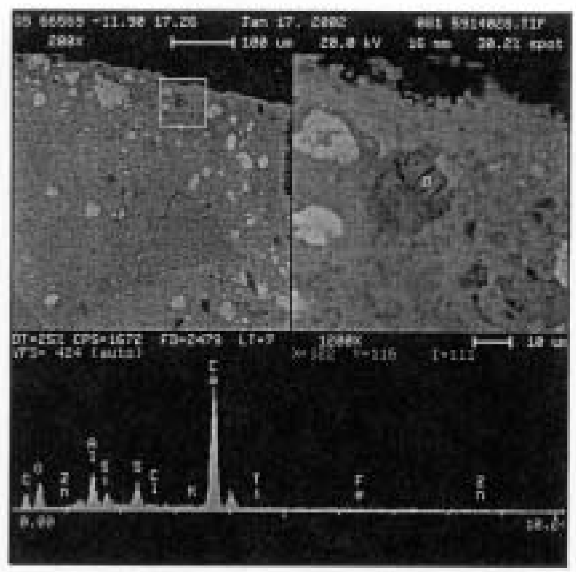
5914026.TIF Y (mm) 17.187

Unhydrated cement grain(s)



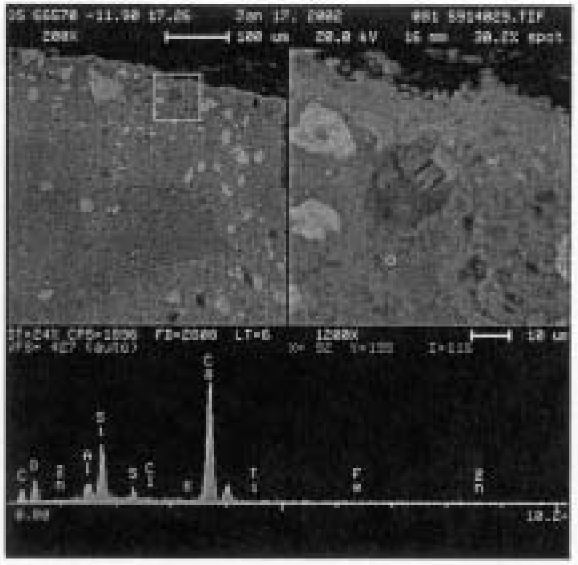
5914027.TIF Y (mm) 17.263

Carbonated paste



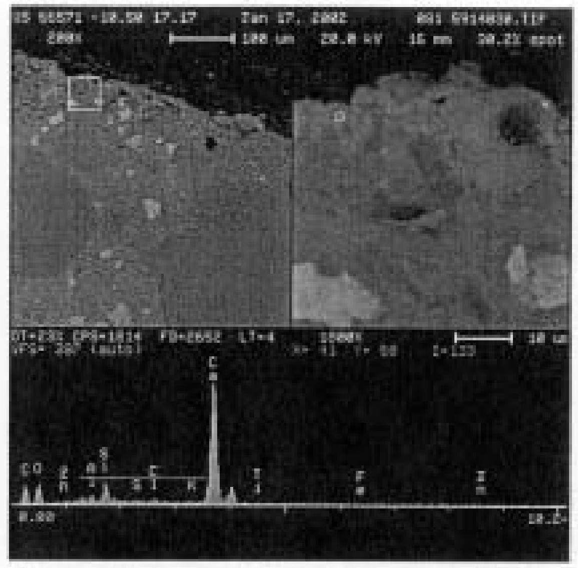
5914028.TIF Y (mm) 17.263

AFt deposit(s)



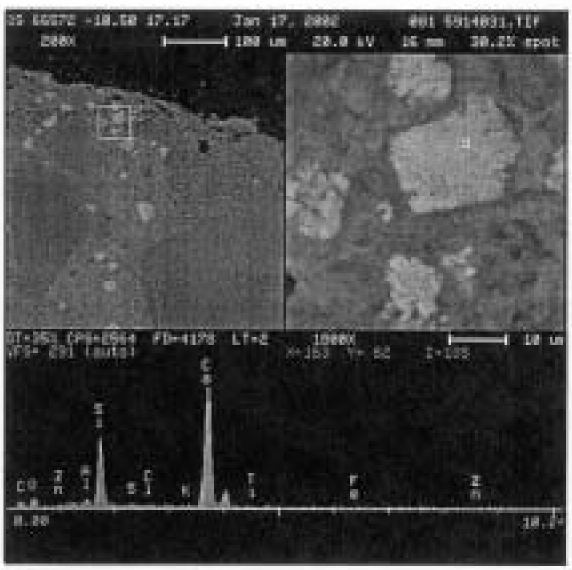
5914029.TIF Y (mm) 17.263

Composition of C-S-H



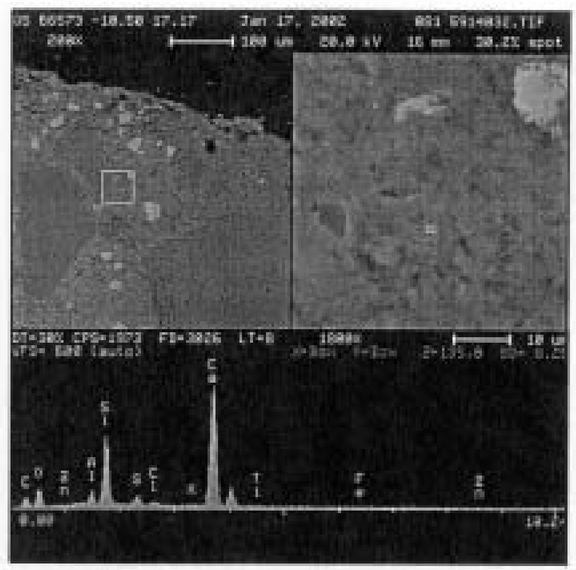
5914030.TIF Y (mm) 17.166

Carbonated paste



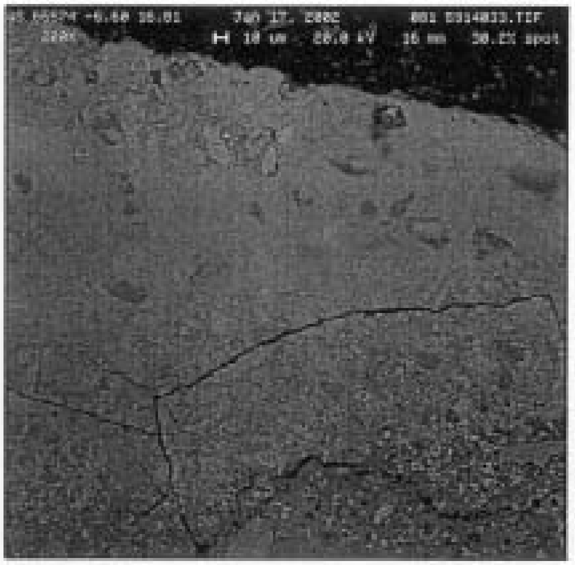
5914031.TIF Y (mm) 17.166

Unhydrated cement grain(s)



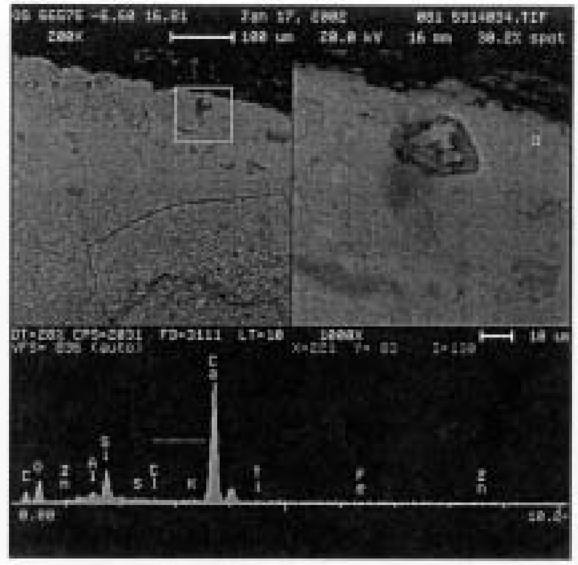
5914032.TIF Y (mm) 17.166

Composition of C-S-H



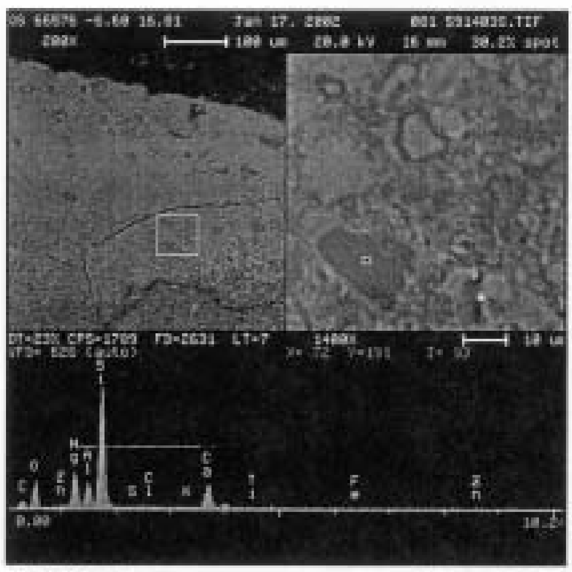
5914033.TIF Y (mm) 16.813

Reaction front



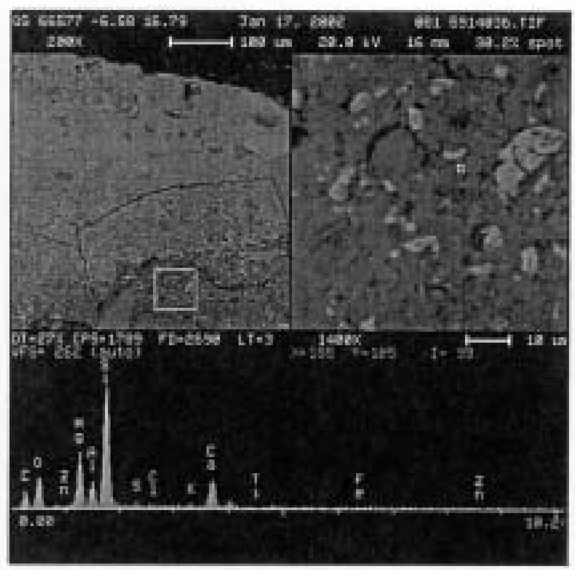
5914034.TIF Y (mm) 16.813

Carbonated paste



5914035.TIF Y (mm) 16.813

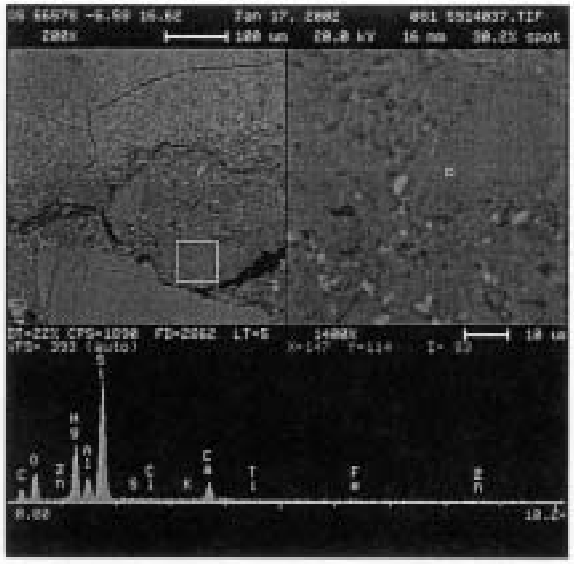
Magnesium enrichment



5914036.TIF Y (mm) 16.788

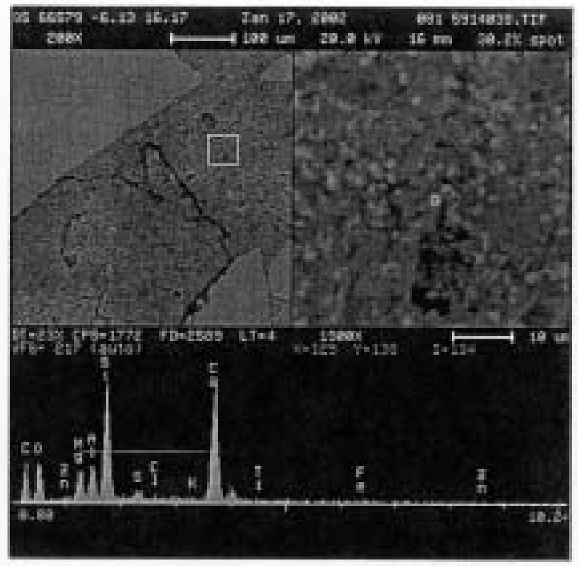
Magnesium enrichment

MAH112353 - Sample No. 0815914 - M2



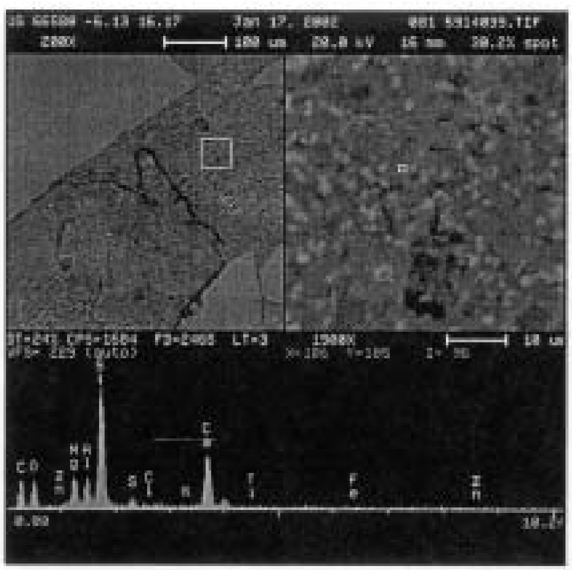
5914037.TIF Y (mm) 16.624

Magnesium enrichment



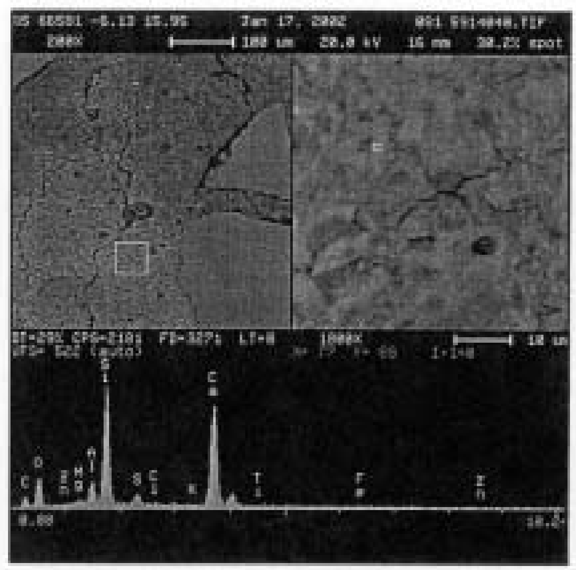
5914038.TIF Y (mm) 16.174

Partially decalcified paste



5914039.TIF Y (mm) 16.174

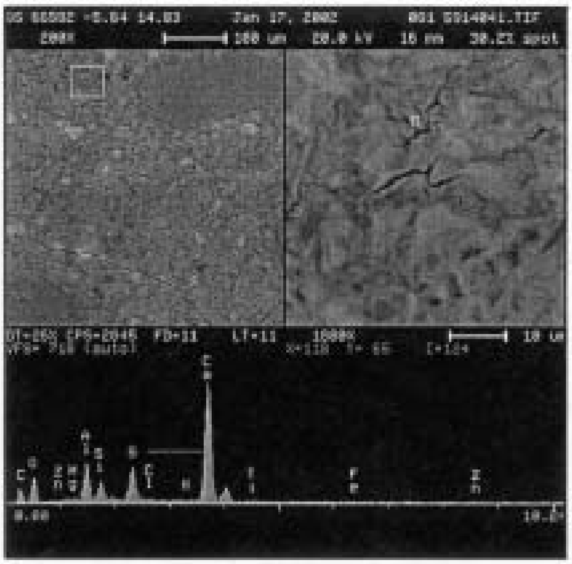
Partially decalcified paste



5914040.TIF Y (mm) 15.953

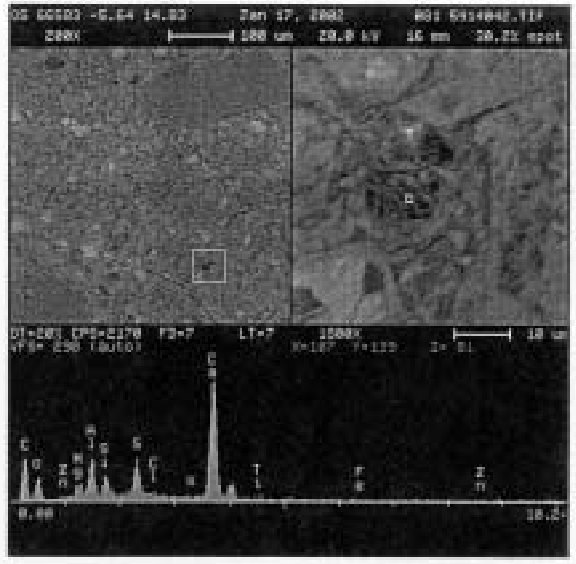
Partially decalcified paste

RP04IA.Jyo



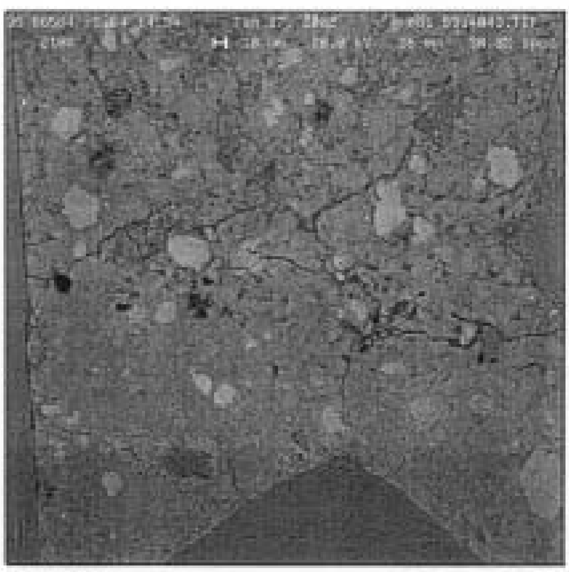
5914041.TIF Y (mm) 14.832

AFt deposit(s)



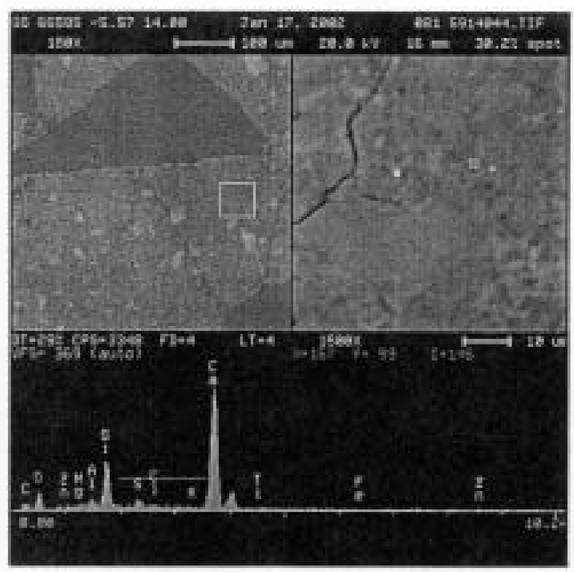
5914042.TIF Y (mm) 14.832

AFt deposit(s)



5914043.TIF Y (mm) 14.341

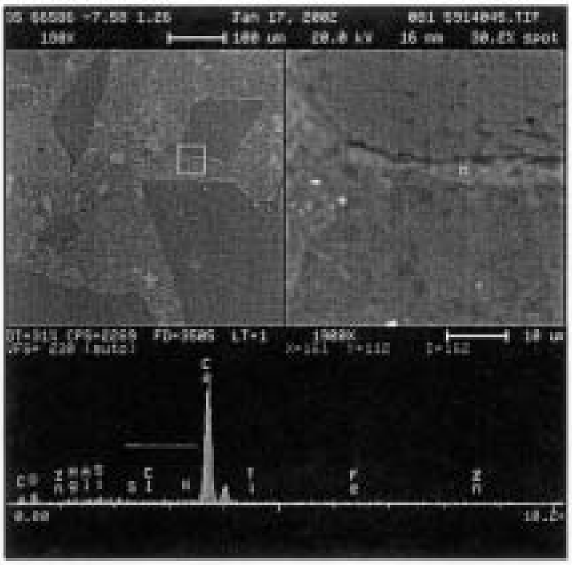
Crack(s) in paste



5914044.TIF Y (mm) 13.996

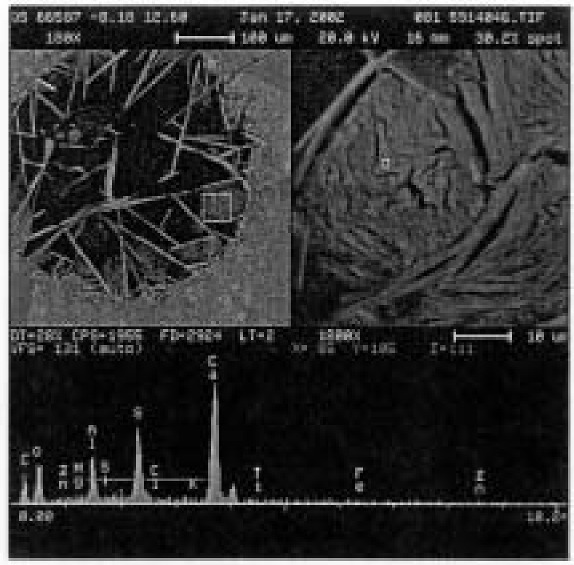
Composition of C-S-H

MAH112353 - Sample No. 0815914 - M2



5914045.TIF Y (mm) 12.574

Ca(OH)2



5914046.TIF Y (mm) 12.604

AFt (Ettringite) in Air Void(s)

RJ LeeGroup, Inc.

Acid Soluble Chloride Analysis

Project No: MAH112353

RJ Lee Sample No.	Client Core Id.	Chloride Concentration (wt.%)
815912	ES2	0.38
815914	M2	0.32

Note: Chloride percent is by mass of concrete

Note -

(Moaske) 0.32% = 1½% pure cc
or 2% flake

(Echo Summit) 0.36% = 1¾% pure cc
or 2.25% flake

DEFENDANT'S EXHIBIT S
HALES
4-21-03 SK

Acid Soluble Chloride table.xls1

You have also asked me to clarify a general point made in my past reports. In past reports I have used the terminology "...water driven reconstruction of the hydrated cement paste" in describing changes observed in the hydrated paste microstructure. This terminology only describes the way in which ionic species (calcium, chloride, sulfate, etc...) can be moved within the paste microstructure.

Differences in solubility of the various paste components will allow one species to move more or less freely through the paste porosity (as examples calcium chloride and calcium carbonate will have very different solubilities in water of pH 7). Once the local solution chemistry changes (on the microscopic level) the ions in solution may precipitate as another compound. Thus, to conclude that the water (solution) is "aggressive" to the paste misinterprets the microstructural changes, the problem could very well be that the paste has components that are ill suited for the environment (calcium chloride as an example is soluble over a wide pH range).

I believe that the present study Pool Chlor and RJ Lee Group are undertaking, evaluating a number of plaster failures in comparison to industry prepared standards, will give us the insight to understand these paste reconstruction phenomena.

Boyd A. Clark, Ph.D.
Senior Materials Scientist

MIX-IN COLORS FOR CONCRETE

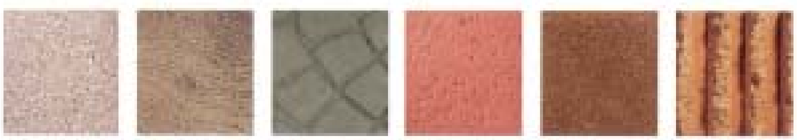
Uses: Davis Colors are used in cast-in-place, slab-on-grade, precast, tilt-up and ornamental concrete; shotcrete, mortar, concrete masonry units, pavers, retaining wall units and rooftile. They can also be used to color cast stone, plaster, stucco and other cement-based construction materials. Designed for mix-in use only; they should not be sprinkled or dusted onto the concrete surface.

Ingredients: Pure, concentrated pigments made of high-quality metal oxides recycled from iron or refined from the earth and specially processed for mixing into concrete. Davis Colors comply with ASTM C979 *Pigments for Integrally Colored Concrete*. They are lightfast, alkali-resistant, weather-resistant, durable and long-lasting like concrete. Davis Colors are available in a wide spectrum of standard colors and can be custom formulated to match design requirements. ★Unlike other Davis Colors, Supra-Instant® black #8084 is a specially treated carbon black. Carbon black is the highest in tint strength and the most economical, but can fade if concrete is not sealed against water penetration. Sealing and periodic re-sealing can minimize this effect.

Packaging: Concrete suppliers use our Mix-Ready® disintegrating bags or Chameleon™ bulk handling system. Mix-Ready® bags are tossed into the mix without opening or pouring. They disintegrate under mixing action, releasing pigments to disperse uniformly leaving no bags to litter the environment. The Chameleon™ is a computer-controlled automatic bulk-color dosing system.

Installation: Integrally colored concrete is installed the same way as high quality uncolored concrete. Choose a color on the inside of this color card and specify it by name, color number and dose rate. Create a custom color by varying the amount of color added to the mix. Confirm desired color with a fully-cured job-site test panel. Typical dose rates range from 1/2 to 7 lbs. per 94 lbs. of cement content and should never exceed 10% of cement content. Cement content includes portland cement, fly ash, silica fume, lime and other cementitious materials but does not include aggregate or sand. Davis Colors have been used successfully in a wide variety of mix designs and are compatible with commercially available admixtures. The only known incompatibility is with calcium chloride set accelerator which causes blotching and discoloration. ★Supra-Instant® black #8084 reduces or negates the effect of air-entraining admixtures.

Finishes: Paving and floors can be finished with pattern-stamped, broomed, troweled, exposed aggregate, salt-finished, sand-blasted, or many other visually appealing textures. Cast-in-place, precast and tilt-up structures can be textured with sand-blasting, bushhammering, grinding, polishing, special forms or form liners. The combinations and possibilities are endless. Here are just a few:



Exposed Aggregate | *Light Broom (wavy)* | *Stamped/ Patterned* | *Salt Finish* | *Sand Blasted* | *Form Liner*

Curing & Sealing: W-1000 Clear™ is a non-clouding, spray-on cure and sealer that meets or exceeds ASTM C309 standards and is specially formulated for colored concrete and exposed aggregate finishes. Other curing methods, such as water curing or plastic sheets cause discoloration. Color Seal™ is an optional, thin-film sealer that's tinted to match the shades on this Color Selector. When applied over colored concrete or the W-1000 Clear™, it provides a more uniform appearance.

Quality Tips: For best results; materials, curing, weather conditions and workmanship should be uniform throughout a project. Quality starts with the concrete mix; use a low water-content, high-performance mix design. When planning a project, budget for craftsmanship.

Consumer Advice: Contractors are independently owned and operated without affiliation to Davis Colors. Choose a licensed and qualified contractor who provides written information and example projects you can see before you buy. Check the yellow pages, ask your local ready mix or building material dealer or visit www.concreteconnection.com to find contractors who specialize in colored concrete.

Specify Davis: Choose a color from this color selector and specify it by name, color number and dose rate. Add color call-out to plan documents or specifications. For complete architectural and guide spec information, visit our web site, refer to our architectural binder, call, fax or write. Our guide specifications can be found in SweetSource®, Spec-Data®, ARCAT/Spec-Disk® or at www.daviscolors.com/tech.

For samples or additional information contact:

Mixing Guide:

Use the same pigment-to-cement ratio, type and brand of cement and aggregates throughout project. Changes in cement and aggregate color affect final color.

Keep slump less than 5" (12.5 cm) and water content consistent. High water content causes concrete to appear pale or "faded". If higher slump is required, use a water reducing admixture instead of added water.

Calcium Chloride set-accelerator causes discoloration. Do not use with color.

Specify air content of 5% to 7% for improved workability and long term durability in freeze/thaw climates.

Schedule loads for consistent mix times. Deliver and discharge in less than 1-1/2 hours. Clean mixer thoroughly between color change-overs.

Confirm color number and weight in Mix-Ready® bag (or combination of bags) is the same required by mix design.

Wet mixer with 1/2 to 2/3 total batch water. Toss in Mix-Ready® bags and mix at charging speed for at least one minute. Add cement, aggregate and remaining batch water. Continue mixing at charging speed for at least 5 minutes (7 minutes for pea-gravel mixes).

Notice: In mixes with small aggregate or batches with short mixing duration, Mix-Ready® bags may not completely disintegrate. In sand-blasted or exposed aggregate finishes, use small bag sizes (15 lbs. maximum) or open bag and pour color normally.

The Chameleon™ is a computer-controlled color dosing system for Ready Mix operators exclusively from Davis. It improves color accuracy and availability. Chameleon™ dose rates differ from the rates on front of this card. For more information, go to www.daviscolors.com/chameleon.

Contractor's Guide:

Prepare a well-drained subgrade. Add a 2 to 3 inch (50 to 75 mm) layer of sand, gravel or crushed stone. Uniformly compact the subgrade and moisten evenly, leaving no puddles, standing water, ice, frost, or muddy areas.

If vapor barrier is used, overlap sheets and tape over holes in barrier. Place a 3" (75mm) layer of granular self-draining compactible fill over the barrier to minimize shrinkage cracking.

Position forms for uniform slab thickness. Follow American Concrete Institute standards for reinforcement and joint placement to control cracking.

Allow ample time and manpower for placement and finish work. Finish evenly and with care.

Begin troweling after bleed water evaporates. Late or hard troweling and edging causes "burns" or dark spots.

Water added at job-site to mixer or pumps will cause color to pale. Keep additions to a minimum and consistent among loads. Don't wet finishing tools or brooms or sprinkle water on the surface.

Do not sprinkle pigment or cement onto the surface.

Rotary, dry-broom, pattern stamped or rough finishes usually cure more even-colored than smooth-troweled finishes.

Uneven curing=uneven drying=uneven color. Cure colored concrete with Davis W-1000 Clear™ cure and seal. (Info at: www.daviscolors.com/literature/pdf/W-1000.pdf)

Do not use plastic sheets, water curing or curing products which discolor. Wood and other objects left on curing concrete cause discoloration.

Efflorescence is a white powdery substance that appears on concrete surfaces. A result of water evaporation, it is more noticeable on colored surfaces making them look faded or lighter in color when not cleaned off. Proper curing and protection against water penetration reduces tendency for efflorescence to occur. Remove with detergent or mild-acid cleaners formulated to remove efflorescence. Follow cleaner instructions and test in a small area to make sure cleaner will not etch or discolor the surface. Wear rubber gloves and eye protection.

DAVIS COLORS

Tel: 800-356-4848
Fax: 323-269-1053
www.daviscolors.com

Because the conditions of use and application of our products are beyond our control, DAVIS COLORS MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE and expressly disclaims liability for consequential or incidental damages whether based on warranty or negligence. Buyer's sole remedy shall be refund of color purchase price from point of purchase.

PRODUCT

Davis Colors™ are color "Admixtures" made of metal or mineral oxides either recycled from iron or refined from the earth that are lightfast, limeproof and permanent. They transform concrete into the stuff dreams are made of.

The Davis Colors™ card shows a spectrum of concrete colors. Custom color shades are made by varying the amount of color added to the mix. Mix-Ready™ colors are designed for mix-in use only, **not** "dust-on" use.

Every batch of Davis Colors is tested to verify it exceeds industry requirements for consistency. Color of concrete may differ from color card or samples and is influenced by the base-color of cement, mix water content, finishing methods and curing conditions.

Please read the Davis Colors™ Card, How-To Brochure or contact Davis Colors for tips on using this product.

PACKAGE

Mix-Ready™ bags are made of special paper which rapidly get soggy and disintegrate under mixing action releasing color deep in the mixer to disperse uniformly. Color handling is clean and environmental waste minimized.

CONTENTS

Iron Oxide (C.A.S. 1309-37-1 or 1317-61-9 or 51274-00-1 or combination); Silicon Dioxide-Amorphous (C.A.S. 7631-86-9)

STORAGE

Keep dry in a cool place, away from sources of heat or open flame.

HAZARDS

Contact a Doctor if accidentally ingested. This product is non-hazardous and non-toxic. Protect against inhalation, wear eye protection and avoid contact with skin or clothing. Clean-up with soap and water. Refer to MSDS for complete handling information.

HANDLING

Keep unused product in closed container. Protect against spillage and accidental contact—product can stain and create quite a mess.

DISPOSAL

Recycle in process whenever possible. Verify current regulatory status with state waste agency or the EPA before disposing in authorized landfill. Product passes EPA 1990 TCLP criteria (40 CFR part 261.24(a)(b)). Non-RCRA waste.

DIRECTIONS

- **Select** a color by number and mix rate from the color card.
- Confirm the color number and weight in this bag (or combination of bags) is the same required by the mix.
- Use the lowest number of bags required for the batch. Mix limit for this bag = 1 per cubic yard (meter).
- Wet mixer drum with approximately 1/2 to 2/3 total batch water. Toss in Mix-Ready™ bags and mix at charging speed for at least one minute.
- Add cement and aggregate and remaining batch water. Continue mixing at charging speed for at least 5 minutes (7 minutes for pea gravel mixes).

MIXING TIPS

- Keep slump less than 5" (12.5 cm) and water content consistent among batches.
- Do not use with Calcium Chloride set-accelerator.
- Schedule loads for consistent mix times. Clean mixer thoroughly to prevent color carry-over.

JOBSITE TIPS

- Grade, compact and moisten subgrade thoroughly and evenly.
- Allow **extra** time for placement and finish work — finish evenly and with care.
- Do not over-trowel. Rotary, dry-broom or rough finishes usually cure more even-colored than smooth-trowelled finishes. Do not wet broom.
- Water added at job-site to mixer or pump will cause color to "pale"—keep additions to a bare minimum and consistent among loads.

CURING TIPS

- Cure colored concrete with Davis W-1000 Clear Cure & Seal or Color Seal II in a matching color.
- Do not use plastic sheets, water-curing or other curing products which can discolor. Wood contact can stain fresh concrete.

LIMITATION

Package and contents have not been tested for compatibility with every admixture or in all mix designs. Confirm compatibility with the concrete—mix and check a test pour before finalizing mix design. Field check mix characteristics throughout pour(s).

DAVIS COLORS

Made in U.S.A. by Davis Colors
Los Angeles, CA 90023 • (323) 269-7311
Beltsville, MD 20705 • (301) 210-3400


Hydrotint
LIQUID COLOR FOR CONCRETE, MORTAR & PLASTER
CO-MO-BLAK® / HYDROJET
D886
1 GALLON
MADE BY DAVIS COLORS
LOS ANGELES, CA • BELTSVILLE, MD
SHAKE OR STIR BEFORE USE • PROTECT FROM FREEZING
REPLACES TAMMS HYDRO COLORS

stains and discoloration.

- Do not use in concrete with Calcium Chloride set-accelerator.
- Keep mix time consisent. Clean empty mixer thoroughly.

JOBSITE TIPS

- Grade, compact and moisten subgrade thoroughly and evenly.
- Allow extra time for placement and finish work. Finish evenly and with care.
- Do not over-trowel or start troweling late. Do not wet-broom.
- A broom, rotary or textured finish will be more even-colored. A hard, dark, slippery-smooth finish is made by extended troweling.