STATE OF MICHIGAN

STATE OFFICE OF ADMINISTRATIVE HEARINGS AND RULES

In the matter of:	File Nos.:	GW1810162 and MP 01 2007
The Petitions of the Keweenaw Bay Indian Community, Huron Mountain Club, National Wildlife Federation, and Yellow Dog Watershed Environmental Preserve, Inc., on permits issued to Kennecott Eagle Minerals Company. _____/	Part:	31, Groundwater Discharge 632, Nonferrous Metallic Mineral Mining
	Agency:	Department of Environmental Quality
	Case Type:	Water Bureau and Office of Geological Survey

D R A F T T R A N S C R I P T

HEARING - VOLUME NO. XXXVIII (38)

BEFORE RICHARD A. PATTERSON, ADMINISTRATIVE LAW JUDGE

Constitution Hall, 525 West Allegan, Lansing, Michigan

Monday, July 14, 2008, 9:30 a.m.

APPEARANCES:

For the Petitioner Keweenaw Bay Indian Community:	MR. ERIC J. EGGAN (P32368) Honigman Miller Schwartz and Cohn LLP 222 North Washington Square, Suite 400 Lansing, Michigan 48933-1800 (517) 377-0726

For the Petitioner Huron Mountain Club:	MR. BRUCE T. WALLACE (P24148) Hooper Hathaway Price Beuche & Wallace 126 S. Main Street Ann Arbor, Michigan 48104-1945 (734) 662-4426
For the Petitioners Yellow Dog Watershed Preserve and National Wildlife Federation:	JEFFREY K. HAYNES (P25140) Beier Howlett, PC 200 E. Long Lake Road, Ste. 110 Bloomfield Hills, Michigan 48304 (248) 645-9400 and F. MICHELLE HALLEY (P62637) National Wildlife Federation PO Box 914 Marquette, Michigan 49855 (906) 361-0520
For the Respondent Michigan Department of Environmental Quality:	ROBERT P. REICHEL (P31878) Assistant Attorney General Environment, Natural Resources and Agriculture Division 6th Floor, Williams Building 525 West Ottawa Street, PO Box 30755 Lansing, Michigan 48909 (517) 373-7540
For the Intervenor Kennecott Eagle Minerals Company:	RODRICK W. LEWIS (P43968) SARAH CATHERINE LINDSEY (P68544) CHRISTOPHER J. PREDKO (P56040) Warner Norcross & Judd LLP 2000 Town Center, Suite 2700 Southfield, Michigan 48075 (248) 784-5000
RECORDED BY:	Marcy A. Klingshirn, CER 6924 Certified Electronic Recorder Network Reporting Corporation 1-800-632-2720

TABLE OF CONTENTS

PAGE

NOTE: Page numbers may change on final transcript.

EXHIBIT INDEX

PAGE

	IDENTIFIED	RECEIVED
Petitioner's Exhibit 632-185 (Parker PowerPoint presentation)		7996
Petitioner's Exhibit 632-186 (Vitton PowerPoint presentation)		7996

NOTE: Page numbers may change on final transcript. Full exhibit list for today will be included in the final transcript.

Lansing, Michigan

Monday, July 14, 2008 - 9:42 a.m.

REPORTER: Do you solemnly swear or affirm the testimony you're about to give will be the whole truth?

MR. PARKER: I do.

JACK PARKER

having been called as a rebuttal witness by the Petitioners and sworn:

DIRECT EXAMINATION

BY MS. HALLEY:

Q Good morning.

A Good morning.

MS. HALLEY: For the record, Mr. Jack Parker is here this morning as a rebuttal witness. Just a note of interest, today is Mr. Parker's birthday, and he assures me that he is 55 today.

JUDGE PATTERSON: 55?

MS. HALLEY: 55.

JUDGE PATTERSON: More or less.

THE WITNESS: I just swore to tell the whole truth.

MS. HALLEY: Notice I didn't ask you.

Q Okay. Mr. Parker, have you had an opportunity to review the testimony and various exhibits and new reports that have entered during the course of this hearing related to the

following witnesses? Mr. Ware?

A Yes.

Q Dr. Carter?

A Yes.

Q Mr. Beauchamp?

A Yes.

Q Dr. Stone?

A Dr. who?

Q Stone.

A Yes.

Q Ms. Arlaud?

A Yes.

Q And Mr. Blake?

A Yes.

Q Did I miss any?

JUDGE PATTERSON: What was the one before Mr. Blake?

MS. HALLEY: Before -- Ms. Arlaud. She testified about blasting.

JUDGE PATTERSON: Oh, okay.

MR. STAPLETON: Arlaud (pronouncing); pronounced Arlaud. You may not have recognized it.

Q Mr. Parker, did you and I develop a slide show together to guide your testimony today?

A We did.

Q Could you read slide number 2?
A It says, "KEMC's crown pillar stability analysis is flawed and misleading."
Q Do you still agree with that statement even after reviewing all the testimony and various exhibits in this case?
A Even more strongly than I did before.
Q Mr. Parker, you are familiar with the RMR system for classifying rocks; right?
A Yes.
Q Now, you have developed an opinion about the adequacy of relying on the RMR system for characterizing rock masses?
A Yes.
Q What is your opinion?
A In most --

MR. STAPLETON: Objection, your Honor. This witness testified and offered that opinion in his direct exam in this case and explained the basis for his opinion. It's needless repetition.

THE WITNESS: I'd like to put it even more strongly than I did before.

MR. STAPLETON: Need a ruling on that objection, your Honor.

JUDGE PATTERSON: Anything, Ms. Fox?

MS. HALLEY: Well, your Honor, it is true that there will be some overlap but very little, I assure you.

And all of Mr. Parker's testimony is related directly to testimony from the Intervenor's witnesses. And as you see, we'll go through the slides, and the very next line is Mr. Beauchamp's testimony that is linked directly to what we're talking about. We're not going to belabor any of these points. We know that we've already discussed it. But it's important, I think, to refresh the memory --

JUDGE PATTERSON: All right. Go ahead. I'll overrule the objection.

MS. HALLEY Thank you.

Q Go ahead, Mr. Parker.

A I'd like to remind you where I'm coming from. I'm 70-some years old, and I've had 60-some years in mining industry, in and around mines, practical. I went to school, too. But I'm relying mostly on what I have seen and learned in the mines. And after spending the last two weeks going through the application, the testimony, all of the transcripts over and over again, I come out with a feeling that they are mostly useless -- useless. They're based on assumptions which are based on assumptions which are based on assumptions and so on. In reality, they are useless. And it made me feel sick to have to argue with stuff which is not valid. That's how I feel about RMR's, RQD's and all that stuff. And I think that I can show why.

Q The quote up on the screen right now is from Intervenor's

Exhibit 305. And the underlined sentence is referencing the numbers, meaning RMR numbers, which is the -- the title of this document is the RMR, "Rock Mass Classification for Jointed Rock Masses." And it says, "The numbers produced are incorrect because they do not have a feel for the rock mass." Do you believe, Mr. Parker, that the Intervenor's witnesses, the list that we just went over, who were responsible for the rock mechanics in the application and in this case -- do you believe that they have a feel for the rock mass?

A I say obviously not. Can I comment on this?

Q Please.

A I just included in my discussion with Ms. Halley several references like this to show that I am not alone in thinking that there's some question about the value of this kind of analysis Laubscher shows here that you better be careful with those numbers. It's not gospel.

Q Mr. Parker, on slide 4, there's an excerpt from Mr. Beauchamp's testimony in which there was a discussion about how many of the cores he had actually seen. And he concluded that he had seen probably 20. And at that time, there would have been about 109 bores total during the development of the application. In your opinion, is looking at 20 bores enough out of a rock mass of this size to develop any sort of sound opinion?

A No. Might I enlarge that opinion a little bit? The cores are about 2 inches in diameter. The holes are 100 feet, 200 feet apart. And are we expected to believe that the cores represent all of that rock mass? That, of course, is ridiculous.

Q Now, Mr. Parker, on this slide is included discussion about what we were hearing or having a little debate about an exhibit. And in the course of that discussion, it became clear that Andrew Ware was going to be the only person from Kennecott to testify about the data collected regarding the cores. Now, in the course of reviewing the testimony, have you seen any testimony from any witness that -- in which they actually verified the cores, they verify what happened as the cores were coming out of the ground and verify the logging? Have you seen any of that anywhere in the course of this proceeding?

A No, I did not. And that's why I think that practically all the testimony that we have heard from the other side and actually from our side, too -- much of it -- is not independent. They did not see the basic data which came from the cores.

Q Is it still your belief, Mr. Parker, that, in order for anybody to do a real assessment of the stability of the crown pillar, they would have to inspect every core that's available?

A They should. They would be negligent if they did not.

MS. HALLEY: Just for the record, I want to be clear. The table that's being discussed in the course of this discussion is on -- included in Intervenor Exhibit 269, which we can pull up if we need to. But it's sort of the big list with all the numbers from the five boreholes. We'll see it in Mr. Vitton's testimony, too. But that was what was being discussed here, actual core data.

Q So at the time that Mr. Beauchamp examined probably 20, there are about 109 cores. And I believe there's been testimony that now there are probably over 200 cores available. Now, without making a determination about whether 200 or 109 is an adequate total number of cores, just to be clear, it's your view that every single core available needs to be examined, logged and verified?

A Yes, it is. That's the short answer. Further answer would explain most people who work in this kind of a mine -- it's not a simple coal seam or anything like that. It's a complicated, intricate orebody or orebodies. And you could never have enough information to define it accurately. And we say that you'll understand the orebody once you've got it all mined out -- it's understood. That's a small sample.

Q Okay. And the second point here is that none of Kennecott's witnesses personally verified the accuracy or methods of the core logging, the drilling procedures or the data gathered

in those processes. Do you still agree with that statement?
A I wasn't here when you talked to Andrew Ware.
Q But you read his testimony?
A Yes. I think he did refer to it once in awhile but not in great detail.
Q Did he personally verify the accuracy?
A I don't think so.
Q And likewise with the driller's logs; is that true?
A It seemed to be apparent that nobody mentioned those logs, although they should have very definitely.
Q In reviewing all of the testimony related to rock mechanics, have you seen any of the data from the driller's logs?
A No.
Q Do you believe that is critical to analyzing a rock mass?
A Of course. And excuse me. But this is where I get my feelings from. When that kind of information, that important information, is withheld, I get suspicious.
Q Now, on slide 7, Mr. Parker, is an excerpt from Wilson Blake's testimony. I believe you were here when Wilson Blake testified; right?
A Yes.
MR. REICHEL: Your Honor, I'm going to interpose an objection. The record will reflect that Mr. Parker testified after Mr. Blake. We took Mr. Blake out of order. There was ample opportunity on direct examination.

MR. HAYNES: Your Honor, if I may, Mr. Blake testified on Friday of the first week of the hearing. Mr. Parker testified, I think, on Wednesday of the first week of the hearing.

MR. REICHEL: I stand corrected.

JUDGE PATTERSON: Okay. That was my recollection.

Q Mr. Parker, in this discussion with Wilson Blake, did he agree with you that he doesn't do RQD's and RMR's either?

A I don't think that he said it to agree with me. He just said --

Q He said, "I don't do RQD's, RMR's"; right?

A I remember that he chuckled when he was asked that question and said, "I dropped that" -- I've forgotten -- "I quit doing that years ago," indicating, I think, that his work, which is mostly in the mines, not theoretical, has shown him, too, that there's not much value in it.

Q Did it strike you as odd in any way that Mr. Blake, who admittedly doesn't do RQD's and RMR's, was selected as the reviewer on behalf of the DEQ to review an application that relies almost solely on RMR's and RQD's?

MS. LINDSEY: Objection to the characterization of the testimony, your Honor. That's not a fair representation of the testimony. There was substantial testimony about geophysical work done for this project. There was substantial testimony about drilling and characterization of

any features or looking for these so-called faults, as you may recall, orienting these things in space and so forth. And that's certainly not a fair characterization of the record. And, in fact, I might add there was substantial testimony by both Mr. Carter and Mr. Beauchamp about the various ways they examined the potential stability of the crown pillar and the rock and that included, as the court may recall, looking at all of the RQD data and all the RMR data and separate models that included a further probabilistic analysis that included the very kind of analysis that Mr. Parker wants to rely on; that is, examining the physical properties of the rock themselves. It included more simplistic analyses of the width of the open spans as opposed to the thickness of the crown pillar. So it is very much an unfair and inaccurate characterization of the record evidence in this case.

MS. HALLEY: I'll withdraw that question.

JUDGE PATTERSON: All right.

MS. HALLEY: We'll go at it a different way.

Q Mr. Parker, from your reading of the application and the subsequent materials, is it your understanding that the vast majority of the conclusions drawn by the Intervenors in this case related to the rock mechanics and the stability of the crown pillar rely on the RMR classification system?

A Yes. They used that as a basis for the conclusions.

Q Okay. Now, given that fact, I believe you were about to say why you believe that Wilson Blake made this statement. We were discussing why RMR's are not -- why they might be a tool but they shouldn't be the primary basis for a rock mechanics analysis.

MR. REICHEL: Objection. Leading.

MS. LINDSEY: Well, again, your Honor, it's straightforward that he was asked the same question -- same series of questions during his earlier examination. We heard, I think, completely Mr. Parker's views about the -- his reliance on the older methods of kicking the rock and smelling the rock and so forth and his lack of any competence in the more modern deterministic methods. So there's no new ground here. There's no specific rebuttal that's been identified here. I guess it's, you know, closing argument. And as we've indicated, the law does not contemplate that kind of taking up the court's time and the parties' time to make closing argument in one's rebuttal case.

A May I comment, please?

Q It's up to Judge Patterson.

JUDGE PATTERSON: Well, I need to rule on it. It was a leading question. I'll sustain the objection on that basis.

Q Mr. Parker, do you agree with --

A Excuse me, Ms. Halley, but could I comment on what Mr. Lewis just said?

Q That's up to Judge Patterson.

JUDGE PATTERSON: No. You have to respond to questions, Mr. Parker.

Q Do you agree with what Wilson Blake is saying here; look at the rock, see how it's behaving, and then presume whether it's good, poor or fair? Do you agree with that approach in a general way?

A That's what I do, yes.

Q And according to what you've read in the application and in the testimony and in the subsequent exhibits and Power Points, do you see any evidence that anybody actually did the type of analysis you and Mr. Blake agree are necessary and responsible?

A They talked about the initial crude way of determining the strength of the rock where you hit it with a hammer or you scratched it with a knife and that sort of thing. In that sense, they were looking at the rocks.

I'd like to comment on Andrew Ware's testimony. I think that it came over as if from a profession geologist who knew what he was doing. I like that -- Andrew Ware's. And I think that, when he was asked these kind of questions, his responses were a little bit cagey as if he did not want to offend anybody. I would go to him if I wanted good

information.

Q Are RQD's one of the factors included in the RMR calculation?

A Yes. That's where it begins.

Q Now, if we were going to look at RQD's, do you believe that they are reliable as a way to classify the strength of a whole rock mass?

A In a limited sense, yes. If RQD's run very high like close to 100 percent, I would expect to find good looking rock. If they were intermediate, I think that depends quite a bit on judgment. If they were low, I'd say they are not good rock and I would not want to build structures in them. So up to that point, I'd say it's useful.

Q How about the process of assigning an RQD to begin with? Is it possible for that process to yield different results based on the direction on which holes are drilled and that sort of thing?

A Yes.

Q Could you explain -- this slide discusses how RQD's could be very different, let's say, for example, that were in an area with bedding plains. And if you drill one horizontally and one vertically, could you end up with very different RQD's?

A Yes, very different.

Q Pardon me?

A Very different.

Q Okay.
A Example?
Q Sure.
A Suppose everybody's tabletop was one bed in a series of bedded rocks like this, layers on top of each other. And I drilled a hole horizontally. And I would normally want to start my hole in a good looking bed just so I get some results. I wouldn't want to start my hole in rubble. So I'd look for a good bed -- good, thick bed. And then if I went horizontally, there's a good chance that I would stay in that bed. And I would quite likely recover a full run, 3 meters for them; 10 feet roughly, of core in one piece. That sometimes happens. That, of course, would be assigned an RQD of 100. And it would represent that core that you got. But if you had inclined your hole or if the beds were inclined, you would be crossing from one into another, into another, into another, and the core would come out in many pieces. That would be an RQD of 60, 40 or very close to 0 depending how thin the beds were. And you're in the same rock mass, so you've got two widely different results from the same rock mass. So one of them is not representative; neither of them is representative.
Q So when that RQD value was incorporated into an RMR process, that RQD value would take with it unwarranted confidence in what that rock actually looked like; is that --

MR. REICHEL: Objection. Leading.

A Can I give you another example?

JUDGE PATTERSON: Sustain that. You can rephrase it.

A Could I give you another --

Q Do you believe that RQD's especially in a situation like what you described carry with them unwarranted confidence?

A If you stayed in the same bed, yes. Can I give you another example?

Q Sure.

A The determination of that number, RQD, depends on length of the specimens, the pieces of core, as they come out of the hole. If it so happens that all of the pieces were longer or equal to the length which you were looking for to determine what RQD is going to be, say, 8 centimeters or 10 centimeters, whatever it is, you could have in your box eight or ten pieces which just marginally made it. And you look at that, and you'd say this rock is badly broken, and yet because those pieces were of a certain length it would still get an RQD of 100 and you'd be misled. And everybody who followed and every calculation that's based on that would be wrong.

Q Now, in a situation like that where the RQD's are misleading and appear -- they are assigned a value that's too high to actually represent the rock mass, what impact does that

have, then on, say, an RMR calculation or even, you know, not necessarily including that in the RMR calculations but just an assessment of the strength of the rock mass?

A Well, the statisticians and the modelers like to average these values. And if you include those, they skew the averages. In the first case where your RQD comes out too high, they skew it in favor of stability.

Q Now, this material came from a report developed, I believe, at the Cleveland Cliffs Mines in Marquette County?

A Yes.

Q Can you -- I'm not sure we need to read this whole thing. But could you explain to us what the United States Bureau of Mines reports concluded from their investigation of the Cleveland Cliffs Mines?

MR. REICHEL: Excuse me, Counsel. Is this quoted document an exhibit in this proceeding?

MS. HALLEY: No, it is not.

MR. REICHEL: I don't think there's a foundation that --

THE WITNESS: Both sides quoted from it.

MR. REICHEL: Your Honor, I don't think there's a foundation for this witness' reliance on this or its relevance to this proceeding.

MS. HALLEY: Well, this particular slide is a demonstrative exhibit, and it is relevant because we are

talking about the effects of faults and how those faults affect the rock mass. And I think, your Honor, you see moving forward we will show and Mr. Parker will rebut this notion that somehow the core that was of very poor quality in some instances for long runs was left out of the analysis and ignored. And this is directly related to that. And this material comes from the region in which the Eagle Mine would be.

MR. REICHEL: Your Honor, again I don't think that that addresses the substance of it. The fact is there's no testimony in this record that I'm aware of that establishes that conditions observed at the Cleveland Cliffs iron mine site 50 or more years ago, whatever the date of this is, are probative of the conditions at issue in this case.

MS. HALLEY: But certainly, your Honor, there are faults in this site. And that's the most relevant part of this document where the authors are discussing the surface of the faults and how that impacts the quality of the rock mass.

JUDGE PATTERSON: All right. I'll allow you to pursue it.

A We will be using this information to rebut some of the comments on the Athens Mine, too.

Q Right.

A I'd like to include this because it shows that this is not

new thinking, that we have to be cautious about using numbers to describe rocks. The Bureau of Mines did this work in collaboration with Cleveland Cliffs, a famous effort of cooperation. They did a lot of measuring, you know, hundreds of measurements of rock strength in a laboratory. And then they come back and they say, "But be careful how you use these numbers." And Burt Boyum, who was the chief geologist at Cleveland Cliffs Iron wrote this piece, which I quoted. And he said -- and I agree with him -- that it's much more important to go look at the structure -- the rock structure than it is to get the numbers on the individual little pieces of rock, because they're not representatives. In his last sentence there, I think I can read it, "The write has in his office a 10 foot core of diorite" -- about the height of this ceiling -- in one piece, a 10 foot core of diorite which appears to be massive and uniform, which would tell you if you weren't careful, that the rock mass was excellent, RQD's 100 and all that. Then he goes on, "Actually only a few feet away from where this core was obtained is a major fault surface" -- that's a major fracturing in the rock. "Tests on this particular diorite might lead one to certain values and yet the mass effect of that diorite is" -- I don't think that's quite right -- "no better than surface of the fault itself." The core does not represent that rock mass. Any measurements you make on the

core therefore are not representative. And if you rely on them, then you're being misled, period.

Now may I comment on what Mr. Lewis said? Ask me what I thought.

JUDGE PATTERSON: There needs to be a question, Mr. Parker.

Q Well --

A It's important.

Q We'll come back to it. But for now do you believe based on your review of the testimony and the various materials presented in this case and in the application, that, in fact, Kennecott has done exactly what Mr. Boyum was warning us against here, relied on relatively good cores while completely ignoring poor quality cores and therefore misleading one about the stability of the rock mass overall?

MR. REICHEL: Objection. Leading.

JUDGE PATTERSON: Sustain it.

Q Mr. Parker, do you believe that Kennecott has done exactly what Mr. Boyum was warning them against doing?

A They have done that.

Q How so?

A They and many other people, too.

Q How did it occur in this particular instance?

A As we've discussed, I have seen many, many errors in the application and in some of the testimony, too. So when you

say "how did they do it?" there's some question about how they did these things. But in general, they measured or said they measured the strength of the rock using standard tests, which as they point out here -- the Bureau of Mines point out -- can be misleading. That's the very start of it, the very first thing you're going to build your case on -- from. I'd like to add a little bit to that. And people -- some people have come to believe that results such as those compressive strengths are gospel and useful and can be reliable, but they're wrong.

Q Now, this slide shows testified from Mr. Ware in which he was asked the question whether the lower rock quality which we've been calling major structures or sometimes discrete features, were included in RMR calculations by Golder. And his answer indicates that indeed they were not. Is that your understanding of this exchange with Mr. Ware?

A Yes.

Q Now, have you seen anything in the testimony or any of the exhibits that indicate anything other than what Mr. Ware said here, that those things were not included?

A I gave him five points for being honest.

Q Okay. Now, based on the paper we just looked at from the U.S. Bureau of Mines in which the last sentence says, "The mass effects of that diorite is no better than the surface of the fault itself," what's your opinion about this

practice that Kennecott used of not including poor quality rock in the RMR calculations?

A I would characterize it as misleading, deceptive or worse. It's intentional.

Q Pardon?

A It apparently was intentional. I don't think anybody -- a geologist, mining engineer, in his right mind would have done that by accident. And let me finish that little bit. I think that anybody else, mining engineer, geologist or writer, would have caught that and corrected it. Nobody did. Of all of the reviewers and experts who read that stuff and the DEQ, too, nobody caught it. I say what's going on here? Do they know what they're talking about? And I get the answer back; it's no.

Q Now, this is an excerpt from Wilson Blake's testimony discussing this very same issue about his inquiry about where the RQD was 0 or low the RMR was not calculated. That's what he was told according to his testimony. And then he was asked, "Is that an acceptable practice?" And his answer was, "I don't -- I -- well, it's certainly not -- I would presume it's not normally done." Do you agree with Mr. Blake or disagree with Mr. Blake?

A I'd say that last one was one of his cagey answers. The middle one, that remains a mystery to this day -- would have been more straightforward.

Q Well, I believe Mr. Blake is saying that, leaving out low or 0 RQD's from an RMR calculation is not normally done.
A I would presume. But then again he's probably never seen it before. I don't know.
Q Do you agree with Mr. Blake that leaving out RQD's from an RMR calculation is not the usual course of business?
A Yes. You have to have it. It's in the formula.
Q Excuse me?
A You have to have it. It's in the formula.
Q And we're not going to go back to your exhibit. But if you recall during your direct testimony, you had an exhibit in which you had red-lined tables of RQD's and RMR's and had illustrated large portions of core where there had been no RMR's calculated; right? Do you remember that?
A Yes.
Q And those areas by and large were areas where the RQD's were very low or 0; correct?
A Yes.

MR. REICHEL: Objection. Leading and repetition of direct testimony.

JUDGE PATTERSON: I think it was leading. I'll sustain that.

Q What does -- Mr. Parker, what does this picture represent; do you know?
A It's a photograph of one box which is about 10 feet or core

from hole 62, which is on the eastern flank of the orebody very close to the contact with the peridotite -- soapstone. Excuse me. Soapstone.

Q And generally speaking, if you were to pull this core out of the hole and look at it, what would your reaction be to the --

A I'd say a rude word.

Q Pardon me?

A I'd say a rude word, and so would anybody else who knew his stuff.

Q All right. Would you characterize it as good, fair or poor?

A Very poor.

Q Very poor. All right. So that slide we just saw would fall into the category of rock that was ignored in the RMR calculations; right?

MR. REICHEL: Objection. Leading.

A That's one kind.

Q Pardon me?

A There was --

JUDGE PATTERSON: Can you rephrase the question? It was leading.

Q The core photo we just saw from hole 62, you classified that as very poor?

A Yes.

Q Okay. And based on your review of the testimony, would rock

that looks like that have been included in your RMR calculations?

A I don't know by that particular box. But a lot of it was, yes.

Q Now, that particular box, very poor rock. Do you -- you reviewed all the core photographs that we had; right? From eight holes?

A I looked at ours and I looked at Wilson Blake's three cores.

Q Okay. Taking it 100?

A Yeah.

Q In the course of reviewing those photographs, is this sample some outlier that's a much lower quality than all of the rest of the rock or is it fairly representative of a significant amount of the rock?

A It's one of the worst.

Q Okay. Are there other sections of core that are very poor quality?

A Yes.

Q How many roughly; do you know? Many or just a few?

A In the cores that I looked at?

Q Uh-huh (affirmative).

A Which is a small proportion; right?

Q Yes. I understand.

A And it was a small proportion, because that's all they gave us. All right. Well, considering the significance of the

project and the significance of the analysis, I'd say there was a lot of it.

Q There's a lot?

A A lot of this bad core.

Q At what depth in the crown pillar does this type of core -- the very poor quality, as you put it -- where do we most often find that?

A It tells you from and to. Those are the depths in meters. This particular hole was just about vertical. Therefore from 21 meters, multiply that by 3. It's 60-some feet down to 23. That's that particular box. Multiply that by 3, and it's getting close to 75 feet. Those are the depths represented here.

Q Generally speaking, the poor quality rock is located in what area of the bedrock; upper, middle, lower?

A Well, this, I believe, is due to fracturing as the peridotites, the intrusives, thrust up through the other rocks. Because that's where I got the contact of the two. And I think that there was something violent going on there. And you can -- for the cores, you can really angle the bedding and see that sort of thing. Things got screwed around when it thrust its way violently through. So that is typical of some of the contact zones. And then there are other places within the orebody and within the siltstones where there are other faults, fracture systems. It's

typical of those. But I think most important in this document -- these documents is that the upper portion of many of the core holes has rock like this probably because of weathering. And that represents the upper part of the crown pillar. So if we say there are 20 meters of this stuff up there that's ignored -- the bad stuff is ignored and we say that the crown pillar is 60 meters thick, that's wrong, because of the upper 20 meters, 15 meters we might get -- and we could look at those if you want -- is worthless. In fact, it's worth than worthless, because it represents a dead load on the good rock that there is there. You know, as I --

Q So, in effect, it diminishes the thickness of the crown pillar by the length of the very poor quality core?

MR. REICHEL: Objection. Leading.

A I'd say the effective thickness is there, but it's no good. For us, it's no good. And I'd like to add to that that I saw nobody complaining about that in all the reviews that were made. Nobody seemed to catch onto that. I say, "Why not? Did you know of anybody who knew something about rocks?" No, apparently not.

Q Not through any of Kennecott's review?

A Pardon?

Q Nobody who did reviewing for Kennecott commented on that?

A I didn't see any adverse comments.

Q How about for the DEQ?
A How about --
Q Did anybody from the DEQ comment on that particular issue?
A No. Apparently they accepted it. Sainsbury might have complained.
Q While we're on the topic of Sainsbury, have you seen anything in the testimony or any of the subsequent material that's come into evidence during the course of this proceeding that either makes you agree with Dr. Sainsbury's criticisms of the procedures or methods used by the company or that makes you disagree with his analysis?
A I think the answer to that question is yes. But do you want me to try to expand that?
Q Please.
A Although we come from different backgrounds -- his is more academic and scientific and mine is all mining -- we came to pretty much the same conclusions. I say the application was worthless. He said that it was high school stuff and questionable and not defensible or his words, which I looked up in the dictionary and it said cannot be supported in fact. That's what I say. They're all wrong. And we know what happened to his testimony.
Q The last point on this slide -- I think we've covered the first two. But the last point is discussing the strength of the rock in the crown pillar. And what did the company

characterize the crown pillar as? What type of rock?
A The Beauchamp work, geotechnical, after measuring strengths of rock of several different kinds and recognizing that there were several different kinds of rock in the crown pillar, they chose to use the properties of the best as if it were representative. I shake my head. I can't believe it.
Q Have you had the opportunity to review the lithology data --
A Yes.
Q -- related to the holes in the crown pillar?
A Yes. That was very useful.
Q And what is your conclusion about what, in fact, the crown pillar is made up of? What type of rocks?
A Peridotite, feldspathic peridotite, pyroxene, gabbro, siltstone, sandstone, hornfels. I think that's it.
Q Are there significant portions of the types of rock that are not peridotite?
A Yes, very significant.
Q What are those?
A Especially around the fringes. In the latest evaluation of the crown pillar, Beauchamp for Golder for Kennecott included about 26 holes more than the original. And that was so that they could include a perimeter around the ore, which is the right thing to do. And so that's how 62 got into -- it's a really bad one and it found its way in there.

But to claim that the rock was essentially peridotite with this high strength is wrong, false, misleading, deceptive.

Q Is peridotite the strong- -- does peridotite have the strongest strength of the various rocks that make up the crown pillar?

A With the exception of hornfels, and I question the use of the high number, which was attributed to hornfels. That's because hornfels is the rock which has been baked and changed chemically at the contact. Juices and heat some out of the intrusive and alter the surrounding rock. And sometimes there's a lot of silica in that, which makes it hard and brittle. And when they come up with a really high number, I think it's one of those cases where the investigator picked a nice piece of rock because it looks good and I'll test -- that's the one I'll test. And he got the high results ignoring the shattered hornfels. So essentially they used the highest strength even though there was a lot of that shattered siltstone available.

Q And did you see any strength testing that occurred on the siltstone or the various other rocks that you just discussed?

A In, I think it was, Andrew Ware's testimony, there was mention of some testing being done in the early years before this was done. they did not show us the results of the early tests, which I think were done out west in a

laboratory.

Q Is siltstone typically weaker than peridotite?

A Yes.

Q Are all of the other types of rocks other than the hornfels which you just discussed typically a weaker type of rock than the peridotite?

A Yes. But I didn't finish my answer.

Q Oh.

A Were tests run? Yes. And there were some peculiar things happened there. When we questioned the use of the point load test as representing the strength of the rock which, of course, it does not -- you have to throw in some factors in there which have nothing to do it. But anyway we questioned that. Kennecott said that they would run some more tests and have Coleman Engineering run some tests the conventional way compressing the cores to get unconfined compressive strength, UCS. And they would compare those with the results obtained from point load tests. Okay. For some strange reason, they omitted the sediments, the sandstones and siltstones, from that series of tests. I say why did they do that? That was the weakest rock? Well, if their development work is going to be in that rock, what's going on here? Why did they leave out the weakest rock? A responsible engineering department wouldn't have done that.

Q Now, we're going to shift gears just a minute to talk about

the Athens Mine. And Mr. Carter -- Dr. Carter -- excuse me -- and I believe Mr. Beauchamp gave quite a bit of testimony related to the Athens Mine with the attempt of demonstrating that your testimony and, I think, Dr. Vitton's testified about the Athens Mine was relevant to this scenario was somehow incorrect. Now, you've had an opportunity to review the testimony about the Athens Mine -- right? -- from Dr. Carter and Mr. Beauchamp?

A Yes.

Q Okay. Do you still believe that the Athens Mine is critically important to an analysis of the crown pillar stability at the Eagle?

A I do critically.

Q Pardon me?

A Critically I do.

Q Critically.

A Yes.

Q Now, Mr. Beauchamp and Dr. Carter had some quibbles with you about the size of the collapse and that sort of thing. Could you just tell us based on reports from -- well, the reports that you found related to the Athens Mine what exactly the dimensions of the failure were and what the geography of the site was?

A As I read through all of their testimonies, I got the impression that they had -- either had not read the

available literature or they had read it very hastily and missed the important points. And here are some examples.

Q Okay.

A Talk about it?

Q Please.

A Okay. And Wilson Blake was another one who referred to it without reading it properly. He's my friend. But some examples, the mine was opened years and years before this collapsed happened in 1932, I think it was. And a large area was mined out. Some of the critics took the area of the whole mine and said that was the size of the cavity. All right. Well, that wasn't the point. The part which collapsed only had those dimensions, 250 by 350 feet, which is not very big. And that was the -- at the very base of the collapse. So the rock above that area was essentially a crown pillar, albeit it a very, very thick one, because the distance from the top of the cave to the surface was 1900 feet. And that was amazing that it should suddenly happen. It was, there it is. The crown pillar was not made up of coffee grounds and Dr. Carter said. That's the way he evaluated it. But if he had looked carefully at the drawings, which somebody will show some day, you can see in small print that the rock above the mine -- the crown pillar is called jasper. Sometimes it's called jaspilite. Jasper is a mineral. Jaspilite is the rock made up of that

mineral. And it's a lot of chert quartz except that it's not crystalline and more 10:3902 force facing. But it's a lot like chert, flint, very hard, brittle, high silica and one of the tests run by the Bureau of Mines came up with an apparent unconfined compressive strength of 49,000, which I think is nothing like coffee grounds, way off. Neither is it like KEMC's peridotite.

Q It's even stronger?

A Two or three times as strong.

Q Is that what the numbers indicate?

A And yet it still collapsed is the important point. It did collapse in spite of these things. But -- and nobody seemed to watch these things except Burt Boyum and his crew. They knew very well the north wall was a thick diorite dike, which is an intrusive sheet of rock which is just about vertical. And the south side of that fall -- north and south side would be the 350 dimension, I think -- was a dike fault which suggests that there was a fault and a dike intruded the fault. Both of them were sub-vertical. So this orebody was contained between two almost vertical dikes, which is a suspect situation. It's like a plug waiting to fall out. It is. Can we go further, please?

Q So, Mr. Parker, given those --

A There's some missing -- some important ones missing that -- I can tell you what they are. In one of the -- the very

first paper which was written by Allen -- that's his last name -- he was a mine engineer, so he probably knew what he was talking about. He described the contact zones where the dikes hit the other rocks as soap rock, s-o-a-p, soap like you wash your hands with, which would imply that it was soft and slippery, which I think would normally consider to be fault gouge where one rock had squeezed and crushed another one. That, of course, sets it up for a fall to slide out. They recognized that. Carter didn't or any of the other people who talked about the Athens Mine -- they missed those things.

Q Given those facts, do you still believe that the Athens Mine is an important lesson to learn from?

A Of course, it is. Of course, it is. Do you want me to tell you why, sum it up?

Q Uh-huh (affirmative).

A If you looked at the drawings, you would see that the volume of the crater at surface was about the same as the volume of the crater underground, which means the rock which fell did not expand in volume, which means it did not unravel as some people say it did. If it had unraveled, it would have filled the hole and there would be no crater. So that's quite clear. But there is a big crater. It happened not over a long period of time, as Wilson Blake suggested. He took the beginning of the mining to the time of the

collapse, not the beginning of mining that small area. But read Allen's paper and you'll see that it happened overnight. Nobody was in the mine fortunately. And that often happens somehow and nobody is in there when it collapses. We give thanks for that. They're all wrong. And then I say, well, why did that plug of ground fall? Why wasn't it clamped in place as they say, a clamping pressure or horizontal stress, whatever you want to call it. It can only have fallen because that horizontal stress clamping pressure was inadequate, maybe tensile rather than compression. And I'd like to point out to Dr. Carter and all the other critics that that is there at the Athens Mine and at the neighboring Negaunee Mine and the neighboring Moss Mine and probably a few other places. We have similar plug-type collapses which tell us that contrary to their statements it is possible to have an absence of clamping stress and that could happen at the Eagle project.

Q Do we know what the horizontal stress is at Eagle?

A Nobody knows.

Q And can we rule out the possibility of a plug failure if we don't know?

A No. If you don't know what the clamping stress, you cannot make a prediction that's reliable. You have to say, "I don't know." But you can go after -- you can get the horizontal stress and help resolve that situation. And they

seemed to make some effort to do that by taking one stress measured in the middle of the Lower Peninsula which we drove past yesterday and we didn't see anything, and another was taken in Minnesota far to the west and some which were taken at the White Pine Mine, 50 -- 100 miles west. Nothing nearby. They also averaged this -- and I thought this is crazy. What are they thinking of? They averaged the stresses over the Canadian shield, which is just about half of Canada. You look at the map and say, "Can I take one number to represent the stresses?" Of course not. Of course note. It's crazy, stupid. It makes you sick.

And at the risk of giving ideas free to Kennecott, I would point out that it is possible to measure the stresses at that site at reasonable cost in a short time. Do you want details on that?

Q Pardon me?

A Do you want details on that to just prove my point?

Q Sure.

A There are at the site two outcrops, the big one, which is called Eagle Rock, and right at the crown pillar is another outcrop. It's an ideal situation for somebody to come in with a diamond drill and measure the stresses directly right in the crown pillar. Now, why didn't nobody notice that? I'd say -- I throw up my hands. I say, "Who was it working on this? Who was reviewing it? Where were the experts?"

And they weren't there. But it can still be done very easily. I'd say 60,000 bucks and one week of work would give them two or three measurements rather than a single measurement and you're halfway to resolving that question, is it or is it not. Somebody has suggested to me and I think is sitting back there that maybe they did measure and didn't like the answer. And I suppose that's possible. It's speculation.

Q Now, do you remember Wilson Blake's testimony when he said that, "Regional geology" -- "Considering regional geology is a cornerstone of a prevention program"? It was on the previous slide. We could go back to it but, if you remember, we don't have to.

A I'd say one of the cornerstones, yes.

Q Do you agree with that comment he made?

A One of, yes.

Q Okay. Has that analysis of regional geology been done here in the application and the testimony and materials you've seen?

A Very superficially. That's right. I want to add one more thing about that core. Rock like that is an obvious channel for water to get from surface down into the rock mass in the mine. I saw no mention of it being tested for permeability, a zone like that. All right. An obvious one, what's going to --

Q Just for the sake of clarity, when you say "a zone like that," are you talking about like the zone in hole 62 that we saw?
A Yes; yes. I thought it's painfully obvious you might get wet.
Q We're going to touch on that in just a moment. Now, in the course of reviewing this issue about whether the Athens Mine is relevant or not and looking again at Dr. Carter and Mr. Beauchamp's testimony, did you look at a paper called "Five Key Factors to Avoiding Ground Collapse" by Jim Galvin?
A Yes.
Q And could you sum up for us what the five key factors are or at least those that are relevant to this site?
A Not one, two, three, four, five, no. I read it and I know what he's talking about. We could go through it.
Q Okay. Well, let's go to the second bullet point here. And he said that, "The second key element to consider is the regional effects of geological structure." What does that mean to you?
A It's what Burt Boyum said; look at the faults. And I've got to say one more thing about Burt Boyum. He said look at the faults and the dikes and the sills of the major structures. And he seemed from his iron mine experience to think that especially critical were what he called slips, which are plains on which movement has taken place in the rock; two

masses have slid past each other, slips. And you can see it. You can recognize it because you can see the evidence of sliding, so it's easy to recognize slips. But he said those were especially critical, because they suggest that that has been relatively recent movement and that it could happen again. And that's very often where a collapse of -- a major collapse starts.

Q And have you seen any evidence in the testimony or in the application indicating that that type of failure is improbable?

A No. I'd say it's probable. And they halfway recognize it. Again, I think even points to the geologist who said they put I think three holes at an angle like so (indicating), a low angle, trying to define a fault about halfway through the orebody, subvertical fault. And they said they couldn't find it. But there was, I think he said, a six-inch zone of crushed rock, which sounds to me like a fault, like a slip. But it's not taken into account in the design.

Q Now, also included in that same paper is a discussion of width to depth ratio related to the size of the crown pillar. Can you explain to us what that really means in a practical way and what the width to height ratio is at various depths in the Eagle Mine?

A Okay. I'll start by telling you that Jim Galvin is a -- and you see his credentials there. He's head of the mining

department. He's written papers, and he's done a lot of consulting in Australia and some South African mines. Hard rock mostly like the Eagle hard rock. And when he's talking about total collapses, it's a lot like the crown pillar situation. And very often people these days they'll start mining at the bottom of an orebody and work their way upwards. That's because you leave a lot of your problems behind you, then, and work their way up. Which until they get closer and closer to the surface and they've created a crown pillar, the rock that remains between the top of the mine and the surface on top of bedrock. And he's talking here about what happens as you mine upwards and the thickness of the crown pillar, which he's calling height, I think, yes, height, and the width of the crown pillar. He looks at that ratio. And --

Q And his trigger for when the possibly of tension occurs is --

A When the width to height ratio exceeds four-tenths.

Q Okay. And then the next point here is I believe your calculation of where that ratio would occur at Eagle?

A Yes. That stage which he says cannot be ignored, it would be where our crown pillar was 150 feet thick. That's what he says.

Q Feet or meters?

A Pardon?

Q Feet or meters? You said 150 feet.
A Meters.
Q Meters?
A Yeah.
Q Okay. And so we would exceed this trigger point at which this has to be considered in the body of the crown pillar as it is currently permitted; correct? Is that right?
A Yes, we would, according to this, we'd pass that point; yes; yes.
Q And then could you read the last point there and explain that significance?
A Now he starts talking about a sudden failure. You notice that? The probability of a sudden tensile failure, which is worse than a gradual one, of course, increases as depth -- at depths less than 200 meters from surface. That's a pretty thick pillar. And especially at less than 100 meters.
Q So is the crown pillar at Eagle within this range? Is it less than 100 meters?
A Less than. All three thicknesses considered, less than 100 meters. Now, this is another expert talking, not me. But those were his observations based on the reality.
Q But it is your belief that this type of failure should be considered? And this paper supports another reason that it should be considered?

A Yes.
Q And why the Athens Mine is relevant?
A Yes.
Q Okay.
A Is there any more there? Is there any more from him?
Q Yes.
A Good.
Q Now, he goes on to discuss the probability of failure in the presence of structures like joints, shears and faults. Is it your understanding that this orebody contains joints, shears and faults and that they border the orebody?
A Yes.
Q And that the probability of failure goes up especially if lubricated he says by rain? Does it matter if it's by rain or by groundwater?
A No; same thing, same effect.
Q Okay. And you just testified, I believe, that you thought that the broken up core would serve as a conduit for water?
A Yes.
Q Therefore, it would be lubricated?
A Yes. I think that's rather obvious, yes.
Q Okay. And could you read his second point here?
A "The result can be sudden plug-type failure without warning, as occurred at an Australian lead-zinc mine. The crown pillar collapsed so violently in 1966

that fly rock was found up to 75 meters away."
In other words, she went "boom" and rocks fell all over the place. I'd point out that he has records just how this sort of thing. And it appears that Dr. Carter didn't know much about it. Why didn't he quote this and the other plug-type failures? And here I've got to give credit to Stanley there. He's good at searching these things out, how it came from Australia, and yet our experts didn't find it, you know.

Q Whose experts?

A Anybody, except Stanley.

Q Now --

A And they should have.

Q -- in that particular situation, the width to height ratio was 0.7; right?

A Yes.

Q Where this sudden plug-type failure occurred without warning; right?

A Yes.

Q Okay. Now, what is the width to height ratio at Eagle with the permitted crown pillar of 87.5 meters?

A Well, I said it as 0.7 in the third paragraph where it'd be like a 60 meter wide crown, which is just about what is planned for -- was planned for. I'm going to modify that, because I think it will change, at a depth of 86 meters,

which is -- which would be not the full depth, but that would be the depth of the bed -- thickness of the bedrock.

Q It would be in the crown pillar?

A Yes, the thick -- I say depth -- or he said depth. That would be thickness of bedrock. But we know that at the Eagle there will be some sand and gravel on top. Okay. Not really depth.

Q And in the next point you calculate the width to height ratio at Eagle with a crown pillar roughly 60 meters wide, and you calculated the depth of each permitted -- well, each crown pillar --

A Considered.

Q -- depth that has been proposed so far. And the final one 87.5 meters is the one that has been approved by the DEQ; right?

A Yeah.

Q Okay. And what is the width to height ratio at the currently approved crown pillar thickness?

A That's the one which has been guaranteed stable; right?

Q Well --

A 0.69, which is pretty close to 7.

Q Where the sudden plug-type failure occurred?

A Yes.

Q Does Mr. Galvin's paper further support your view that the Athens Mine should be considered and rebut Dr. Carter's view

that it should not?

A It's an excellent example of what could happen at Eagle.

Q Now, in the course of Mr. Ware's testimony he gave some more detailed descriptions of the orebodies -- well, this particular orebody and other orebodies in the vicinity, but this is the one I want to talk about right now. Now, the crown pillar as we've been discussing it, could you point out the area that it includes on this, particularly on the bottom section of that picture? Do you have a pointer up there? Okay. Well, you might have to get closer to use that.

A Yeah. Officially I have to comment that the date on this one is March or May 200- --

Q I believe it's 2006. Have you looked at the original?

A I'll have to stand up. It looks like 8. And I suspect that in the beginning, because the shape of the orebody has changed from when the application was written.

Q Okay. So the record is clear, this pair of illustrations are titled "Crown Pillar Zone and Mining Block - Orebody Geometry" figure one, and this is an illustration taken directly from Dr. Carter's set of slides. And it's the orientation on the top picture is north-south section across orebody looking west, and the bottom picture, which is the one we're most interested right now, is the "East-West Strike Section Along Orebody," looking north.

A That's right. And it looks as if it was drawn by Trevor Carter.
Q Okay. You're referencing the "Drawn TGC" or "TOC" in the corner, one of the two?
A Maybe "TOC," but I take the "TC."
Q So my question for you, Mr. Parker, is you look at that illustration, the bottom illustration. When we have been talking about the crown pillar, what area are we talking about? Could you just point out the area on that illustration?
A Everybody so far has considered the crown pillar to be this portion which is closest to the surface.
Q Okay.
MS. HALLEY: Now, for the record, Mr. Parker pointed at the sort of brownish-goldish blob that is vertically oriented on the left-hand side of the illustration.
Q Mr. Parker, has anybody talked about the stability of a crown pillar above the spiral, which is adjacent to that vertically oriented orebody in sort of the middle of this illustration? Has there been any discussion of crown pillar stability in that region?
A We've talked about it.
Q I mean in the application or in the course of the testimony.
A Not in the application and I haven't seen it in any of the

other writings.

Q But that would be a crown pillar, would it not?

A By definition, yes.

Q Now, I have the same question about this (indicating) area of rock, which is, for the record, above the more laterally oriented goldish brown blob which, if you sort of imagine the whole thing being a boot, it's the toe of the boot. Now, would that be considered a crown pillar above that area, Mr. Parker?

A If you accept the definition that it's that rock between the top of the mine and the top of the bedrock, yes.

Q And have you seen any analysis whatsoever about the stability of that portion of the whole mine's crown pillar?

A No. Should there be? Of course there should.

Q All right. Okay. You can sit.

A I point out that somewhere else in the application or one of the later documents they talk about measuring surface subsidence as a warning system that something might be going wrong. They talk about having two reference points on surface.

Q Do you think that's enough?

A No, of course not.

Q So you're saying there are two essentially monitoring points for subsidence total to monitor subsidence at the whole --

A That's what I read.

Q Okay. You can sit down, if you wish, or you can stand if you want to, since it's your birthday.
A Thank you.
Q All right. Mr. Parker, have you -- you said that you have reviewed Ms. Arlaud's testimony?
A Yes.
Q Now, you reviewed this application a long time ago -- right? -- almost when it -- right after --
A The application?
Q -- it was filed in 2006; right?
A I think I got it in April, yeah.
Q Okay. Now, did it at that time include any sort of blasting plan or any details about the blasting that would be proposed at Eagle?
A Some, but not very much.
Q Okay. Now, you've reviewed Ms. Arlaud's testimony?
A I have.
Q And all of the testimony related to blasting in this case; right?
A Yes.
Q Have you yet seen any sort of blasting plan that would give someone like you the ability to review it?
A I saw some strange numbers that were referred to briefly, but I couldn't believe them.
Q What do you mean?

A In the early days they said they would use four-inch diameter blast holes, which I say if they're filled with normal explosives would do a lot of damage to the walls. And remember how it's mined in panels, it would do a lot of damage to the pillars between those panels. And then later it would damage the four-inch holes filled with normal explosives would damage the backfill, too. I say that four-inch doesn't sound very good. Then in the application itself they talk about using even bigger holes and even higher density explosives to cut costs, which is the sort of thing that you would normally do, say, in an open pit mine where damage was not much of a problem. But to talk about using six-inch holes in this particular mining plan is, again, frankly ridiculous. That's just one thing. Somewhere else in more recent documents I haven't been able to find it because I haven't had much time, but I saw reference to a blasting pattern in which -- I'll draw a little sketch.

(Witness draws diagram)

A A panel to be mined would be ten meters wide. Now, here's a peculiar thing. If you go through the application you'll sometimes see the width of the panel and the width of the intervening pillars to be ten meters and sometimes you'll find 15 meters and sometimes you'll find 30 meters. I say make up your mind. Anyway, then I saw in this blasting plan

that they were -- they blast this much, that's all broken here is the remaining ore. I'm looking down on this plan view. They said they would put these four-inch holes in rows alternating three holes per row and two holes per row. I said, "What?" I shake my head and wonder what they're talking about. In a situation like this, a blasting pattern like this would leave this wall, which is the stope, very jagged like that, broken with a lot of loose rock. In some mines you can go back into a working area and reach maybe with a high lift 100 feet maximum and try to pry down the loose rock to make it safe. But you couldn't do that in this when the height is something like the atrium down there outside here. You couldn't get in it to scale that. Therefore, you've got to do some extra careful blasting, which Ms. Arlaud finally got around to. You do something like drilling smaller holes very close to the wall like this and blasting them very lightly to get what they call a pre-split effect. You create a split there before you do your heavy blasting and like that. You get a relatively smooth wall. That would have to be done first, I think. You can't do this with -- I say, "What's the spacing we're doing these holes going to be?" Well, in this case you put one against the wall, this one against the wall, this one in the middle. Therefore, the spacing there is about five meters; right? And the spacing between these is odd. Five

meters is 15, 16 feet. That wouldn't work. I've seen blasting plans like this which I hope have been changed by now. But that was the way it was in the application, which was what we're talking about, I think.

Q And, well, we're also talking about her testimony.

A Okay. Oh, we're talking about her now?

Q Uh-huh (affirmative). Did she outline any blasting plan in her testimony? Did she offer a blasting plan to the court, --

A No.

Q -- what would be used at this site?

A No.

Q "No"? So without a blasting plan, is there any way for you or anybody else to assess what impacts there may be from blasting?

A Yeah. We can get an idea of what would happen.

Q But no details?

A I say that because, again, it should be obvious that you've got a hole here. Any one of these holes is about 100 feet deep. And so normally you'd fill that with explosives to break the ore; right? And so you -- and in a four-inch hole you could get about four -- I think it's four and a half pounds of explosive to a foot. So if you just about fill this hole, you could end up with, say, 400 pounds of explosive going off at any one time. Now, to be efficient

in breaking a situation like this, most people would like to blast more than one hole at a time. This one would take out something like that, and this one would take out something like that. This one is supposed to take out something like that. But you get better fragmentation if you break it in smaller pieces. You get more for your money if you blast several at a time and you cause the rock face to swell out like that, blast away like that, from the flat face. And then you get cracks in it like so. That's the advantage of blasting several holes at a time. But even if you went one at a time, you'd be detonating, blasting about 400 pounds of explosives. So we can go to the industry standard and mines and figure out at what distance 400 pounds of dynamite or ammonium nitrate, because which is cheaper, would effect the fish. Yeah. We don't have a blasting plan. But if we look just one hole and, if you go to a bigger hole, it gets worse. And if you go to a higher density explosive, it gets worse again.

Q I see.

A And nobody looked at the fish.

Q And in fact, Ms. Arlaud testified that the papers and the regulations that you talked about on your direct examination really didn't relate to blasting below streams. Have you had an opportunity to review that testimony from Ms. Arlaud?

A Yes.

Q And do you have a response to that?
A She didn't read the papers carefully. There is a statement in one of them I think it's called Alaska regulations, blasting regulations, which is available to anybody. Alaskans did the research. Oregon followed suit. I don't know what Michigan does. I don't think Michigan has a law concerning this kind of blasting. But anyway, the regulation clearly state that they pertain to blasting in, under or adjacent to water where fish live. So that's not what she said.
Q And has her testimony or anyone else's alleviated your concern that impacts to fish from blasting should be analyzed and considered as part of this --
A Of course.
Q -- process?
A Of course. Why didn't they do it? I don't know. You guess.
Q So you believe that the papers and statutes that you discussed before about blasting are relevant to the Eagle site?
A Of course.
MR. REICHEL: Objection; lack of foundation. I don't think there's a statute at issue.
MS. HALLEY: Mr. Reichel's right. There are regulations.

MR. REICHEL: Actually, I'm not even sure they're regulations, but they're guidelines.

Q Has any of the testimony indicated to you that anyone has considered the impacts from blasting to fish or any other animals in the vicinity?

A Not until it was brought up by us.

Q In the subsequent testimony, has any of -- have any of Kennecott's witnesses or DEQ's witnesses addressed the issue of blasting --

A Not until --

Q -- and its impacts to fish?

A Not until Ms. Arlaud.

Q Did she actually address it?

A Talked about it.

Q What did she say?

A She said it don't apply to us.

Q Right. But did she actually do an analysis of impacts to blasting on fish?

A No.

Q And you believe that analysis should be done?

A Of course.

Q If you had a group of really mine -- really good mining engineers, which Kennecott Rio Tinto should be able to put together, they would have done all these things as a matter of course and more.

Q Okay. That I think takes us to our next slide here. Did you have the opportunity to review Mr. Steve Donohue's testimony?
A Yes.
Q And Mr. Donohue testified that he signed the application and took responsibility for pulling it all together and submitting it?
A Yes.
Q Okay. Now, what is your impression of the general quality of the application?
A Very, very poor. Right from the beginning, I said that it should have been returned to sender as inadequate, a week after I read it. And I haven't changed my mind.
Q None of the testimony in this case has changed your mind?
A About sending it back?
Q Uh-huh (affirmative).
A No. Well, it's changed my mind in the sense that my feelings are stronger now than they were originally, because I know more.
Q You know more about what?
A I was able to study the whole application. Well, just that relating to mining and geology and rock mechanics. I studied it more carefully, and then I've seen the more recent testimony, so I know more about that.
Q Do you believe that the application had significant

omissions, material that just wasn't provided?

A Yes. You need some examples?

Q Sure.

A I thought there was going to be a mine manager popping through the door and I was going to ask him a question. But one of the things as stated flatly in the application is that, therefore, the risk of underground fires is negligible. I shake my head, shake my head. Who wrote that? Who approved it? Who didn't catch it? Who didn't scratch it out real quick? There's always a danger of fire. And when you're in a place like a mine with limited ingress and egress, ways in, ways out, it's worse. And one scenario which came to my mind was that if one of the haul trucks or any other truck climbing that decline from the mine up to its surface, which is the intake airway, if it popped a hydraulic hose and the oil squirted out over the engine and the exhaust, which does happen, and the oil burned and then the tires burned, there would be a slug -- big slug of dense black smoke going into the mine all over the mine, because this is the main air intake, just one. So the only person to get out of the mine alive -- when you've got that tire smoke, you've seen it in the riots, it's black, just plain black. You couldn't see your hand in front of your nose and you cannot breathe it, so you're dead within a minute or two. And that would apply to -- the way the mine is laid

out, that would apply to everybody. The one person would get out, probably the truck driver would bail out of the truck when the fire started and run up the hill in the fresh air. That's just one example.

There can be electrical fires, explosive fires, maybe the ore itself will burn. I don't know about that. But I wonder what happens when you blast, which is a very hot reaction against massive sulfides. Because sulfa will burn. I don't know about that, but I would sure as heck try it, consider it. Of course, there's the -- oh, and then there's arson. That's a not uncommon cause of fires underground and loss of life. Some disgruntled employee is what they call them starts a fire because he's mad and perhaps mad literally, too. But anyway, it happens. So of course there is a danger. It's not negligible. It should be taken into consideration. There should be multiple escape ways and fresh air, for example. There aren't.

Q I think maybe what you're talking about with the fires is we go to that, I believe, in our next slide, number 22. And you've worked in over 500 mines, I think you said?

A Yes.

Q Now, is it your experience that most of the problems at mines are due in large part to human error?

A "In large part"? I don't know for sure how to interpret that. But a lot of them are naturally.

Q And because of that element of human error, is it your belief that mine plans should include contingency plans for things like fires -- we just talked about that -- or a collapse of the crown pillar or any number of things that could go wrong, accidents, that could happen?
A I haven't looked very closely, but I would bet that those things are required by law, two exits, for example, fresh air.
Q But do you see where those requirements have been met in the application or in the subsequent testimony?
A I have not seen that.
Q Now, do mine plans prevent accidents from happening? In the course of everyday work in the mine, because there's some mine plan that says, you know, some particular thing, does that mean that accidents don't happen?
A No. Lots of bad things happen. I think that they often are called accidents, but they're not accident by definition in that they could have been prevented.
Q How about some examples? What are some things that commonly go wrong in mines despite mine plans and permits and everything else?
A Well, let's say the hydraulic hoses burst. Was anybody checking the condition of the hydraulic hoses at regular intervals? Maybe, but maybe not. Or maybe it was a cursory examination. That could have been prevented. The mass

fatalities could have been reduced in number if there had been either ways out of the mine and fresh air or sometimes it is permissible to simply construct what are called refuge chambers, short tunnels in which people can barricade themselves and survive for a few days with communication to surface through a hole. Yeah. That would prevent a lot of deaths.

Q What I'm wondering, though, is even with mine plans and even with permits, do accidents still happen?

A Again, I'd call it an accident if it could not be prevented.

Q Well, we can call it something else, a mishap.

A Yes. Then they do. Incidents they call them.

Q Incidents. Okay. Do they happen in mines on a daily basis?

A Mine-wide they do.

Q Pardon?

A I'm sorry. I meant worldwide they do. You look at the news and see how many people died in China this year in coal mines.

Q Does the fact that there's a permit from the DEQ mean that every employee is going to do exactly what they're supposed to do and that there won't be any mishaps?

A Doesn't guarantee it, and it's highly unlikely that they were to do that.

Q Why is it highly unlikely?

A Because I think humans in general and perhaps miners in

particular have strong opinions about the way to do things. So the engineer sends down a plan, "This is how you should drill and blast," and the miner says, "He just got out of college. Now he's went behind the ears. I'm going to do it my way. Nobody's looking anyway, so I'll do it my way." Yeah. Often that happens.

Q Now, Mr. Parker, this is a portion of the Part 632 statute which you have had the opportunity to review; --

A Yes.

Q -- is that correct?

A Yes.

Q Now, this portion of the statute indicates actions which could lead to criminal -- lead to criminal violations or be defined as criminal violations. And in subsection four there of Part 63223 says,

> "A person who on or after February 1, 2005, intentionally makes a false statement, representation or certification in an application for or form pertaining to a permit under this part or in a notice or report required by the terms and conditions of a permit issued under this part is guilty of a felony and may be imprisoned for not more than two years and shall be fined not less than $2,500 or more than $25,000 for each violation."

Okay. Now, let's go back to the portion of that language

underlined there and which says "intentionally makes a false statement or representation." Is it your opinion, Mr. Parker, that this application contains false statements or representations that you believe are intentional?

A I think I've said it this morning in a different way perhaps that I cannot believe that a group of responsible mining engineers, geologists, rock mechanics experts and reviewers would have made a lot of those statements by accident, which means they made them intentionally.

Q Now, a lot of those mistakes or intentional false representations, whatever they are, would many of those if the permit gets carried out in a way that it is currently issued lead to the substantial endangerment to the public health, safety and welfare?

A One example would be the statement that the fire risk is negligible. If you disregarded that risk, somebody's likely to get hurt.

Q And would that same analogy apply to a plug-type failure of the crown pillar?

A There's reason to believe that.

Q And by ignoring those things, is it your opinion that death or serious bodily injury could occur to people, particularly workers, I suppose?

A Yeah. I'll give you another example. From the Athens Mine they remarked that it was odd that when that plug did come

down it did not act like a piston and push a large volume of air out ahead of it. And that would go through the mine workings and be called an air blast. They said that that did not occur, at least there was no evidence of an air blast. Nobody was in the mine, but there was no damage that could be attributed to an air blast, like walls being blown over, vehicles being moved, thrown away. There was no evidence of it. But in many instances where there has been a large failure like that up in the copper country where we live, air blasts are violent and people do get hurt and people do get killed. There was a recent one in Australia, North Park, --

THE WITNESS: Stanley, I'm looking at you.

A -- a big air blast, a plug-type, and people were killed, yeah.

Q And if people were in the mine when a plug-type failure occurred, what would happen to them?

A In that -- in that particular mine, they were killed. You're in a small tunnel. A large volume of air comes through at very high velocity, you get mashed.

Q Okay. Now, if we look at near the bottom of the page here, subsections A and B, we just talked about -- you talked about intention and then we just discussed the danger of serious bodily injury and death. And then the statute goes on to say,

"Either of the following occurred: A, the defendant had an actual awareness, belief or understanding that his or her contact" -- "conduct" -- excuse me -- "would cause a substantial danger of death or serious bodily injury."

Is it your opinion, Mr. Parker, that in this instance the Intervenor has an awareness or understanding that the conduct that we just talked about, ignoring things like fires and plug failure, those are just examples, would cause substantial danger of death or serious bodily injury?

MR. LEWIS: Objection; foundation, Your Honor, also objection to relevance. This whole line of questioning about this provision has nothing to do with this proceeding. The foundation is asking Mr. Parker as if he knows what's in the mind of various people who filled out various parts of the mine permit application. And apparently Mr. Parker is quite willing and able to sit up here and accuse those people of being dishonest and being liars, but he certainly hasn't laid any foundation for that opinion. And again, premising these questions in the context of this criminal provision has no relevance to this proceeding.

MS. HALLEY: Well, Your Honor, Mr. Lewis is probably right. I'm not going to ask Mr. Parker to read the minds of the Kennecott representatives or consultants.

Q So we'll go right to subsection B, which is that, "The

defendant acted in gross disregard of the standard of care that any reasonable person should observe in similar circumstances." Is it your opinion, Mr. Parker, that in this instance Kennecott is acting in gross disregard of the standard of care that any reasonable person should observe in a circumstance like this?

A I think the key is on -- in those words "any reasonable person." I would expect, as I said, that mining engineers with some experience and geologists with some experience and a lot of miners themselves would recognize the problems and say, "Hey, that's not right. Let's not do that." And in my summary I think I said something like this, this leaves us with a possibility that the people who did this were not competent to do that particular job or they deceived us. They have a choice. Say, "I didn't know, you know." I've heard that come out in this testimony. "I didn't know that. Nobody told me." And they could plead ignorance.

Q Whether they're incompetent or deceptive, those were your words --

A They have done it.

Q Now, Mr. Parker, just so the record is clear, you and I talked at some length about discussing this part of the statute. And we discussed the fact that you are not pointing the finger at any particular individual. Is that the way you still feel about this; that --

A Yes; yes; yes. I say it's a group effort. I say the problem is systemic.

Q Does that excuse it?

A No. I'm not accusing any individual, but I'm saying this is what happened.

Q Is it excused somehow because you're not pointing to one particular individual? Does that somehow make it any less serious?

MR. REICHEL: Objection to the relevance. I mean, first of all, --

A Not in my mind.

MR. REICHEL: -- we're having -- excuse me, sir -- we're having this witness testify apparently about -- offer some opinion about criminal culpability. I mean, whether it's excused or what's serious. I mean, I just don't see how this is --

MS. HALLEY: Well, Your Honor, Mr. Parker is, I think, the most experienced miner who's sat in that chair so far or will in the course of this whole proceeding. And certainly he can testify about the standard of care that any reasonable person should observe in a circumstance like this. He's certainly qualified to talk about that and to testify as to whether this company is disregarding that standard of care or not based on his review of the application and the testimony.

MR. REICHEL: Well, again, Your Honor, this is not a criminal prosecution. This is an administrative proceeding. It's not an enforcement proceeding either civil or criminal. I just don't see the relevance of this witness offering his what appears to be his conclusion as to whether or not someone or some entity in his opinion has committed a crime.

MS. HALLEY: Your Honor, I have not asked Mr. Parker if anyone's committed a crime. We are looking at the language of the statute. And the question is whether there has been disregard of the standard of care that any reasonable person, in this case a miner or a mining company, should observe in similar circumstances, in this case, developing a mine like the Eagle Mine. I'm not asking him to make any determination about whether there's any criminal implications at all. I'm asking him whether he believes that that has occurred.

MR. REICHEL: Well, Your Honor --

MS. HALLEY: I'm not asking for any legal conclusion whatsoever.

MR. REICHEL: Well, we could read it back, but I think the question I originally objected to was making all of these assumptions, whether, quote, "something was excused or excusable," or words to that effect. If that's not asking for a legal conclusion, I don't know what is.

A I wouldn't mind --

JUDGE PATTERSON: Yeah, I would sustain the objection to that question. I think he can certainly opine as to whether he feels the -- and he has, that the application and the process and the review was adequate or what he considers the standard of care. But I'm not sure he can go beyond that in the context of the statute.

MS. HALLEY: I will limit my question. This will be the last question on this topic.

JUDGE PATTERSON: Okay.

Q Mr. Parker, is it your opinion that the Intervenor, Kennecott, the mining that they are proposing and which the DEQ has approved at this point is in disregard of the standard of care that a reasonable mining company or a reasonable regulator should observe in this circumstance?

A I think I've said that several times, and I'll say it again. Yes, I do believe that. I'll give you just one of those examples is that the statement that the risk of fire is negligible. Anybody in the room here could probably say, "Jeez, I don't like that. That's wrong." Is the risk of fire in this room negligible? No. In this building? No. It has to be taken into consideration and not dismissed.

Q Now, Mr. Parker, this is our effort to provide a summary of your final points. Would you mind reading through the points on this slide and providing anything that we've

missed through your testimony so far?

A All righty. Okay. The first one, "KEMC rock mechanics analyses is based" -- "are based on statistical maneuvering." Yeah, I see that. I mean, they talk about rock quality, but they're not really describing it. Look at the cores. Obviously they're not describing those. "Poor quality rock has been completely ignored." I don't remember completely, but obviously a lot of it has been ignored. "Athens and other regional plug failures are relevant." They definitely are. And then the critical evidence -- and if they had read the available literature, they would have known it. Reasonable persons would have searched the literature. It seems to me that they avoided case histories such as -- which isn't an unusual thing to do. If I want to know what's the possibility of a mine in the middle of that map collapsing, then I'd say, "Well, can we look at some of the mines in the same area, similar geology, see what happened there?" That's the most obvious way to get relevant information. They didn't do it. That's negligence. We have seen no data from or testimony about driller's logs. Yeah, we talked about that. I think driller's logs themselves, in case you haven't caught it, the drillers, if they see anything unusual happening while they're drilling, they make a note of it in their log, which is usually a little book. So they tell you at what depth,

for example, the water which they're using to drill with to clean the mud out of the hole, the water disappears. Whoops. They go like that. "We lost water at 375 meters" would appear in a driller's log. Or if it didn't, they shouldn't be drilling. And likewise, if extra water came welling out of the hole or squirting out of the hole when you got to a certain depth, you'd say, "I just hit a significant zone through which water was in high pressure." That would be in the log. And I think that would be very important information. We've got thousands and thousands of feet of diamond drilling holes. Why was it not mentioned? Why weren't the losses of water and the gains of water used in analyzing the amount of water which will probably flow into the mine? They're not there. Why not? A reasonable person would have done that as a matter of course.

Q But pickup course of this proceeding, we haven't -- have we seen -- have you seen any testimony or materials from those driller's logs?

A No.

Q I think we're on the last point.

A I think that statement is true. I haven't seen any.

Q Could you read it for the record?

A "No witness has testified who actually logged cores or participated in the drilling." I wish they had. I would have asked the obvious question, "Were you using an eight

centimeter or ten centimeter length to evaluate RQD?" That's in dispute; no proof.

Q Are there many, many questions you would like to ask to the geologists who were actually on site that would probably help us all understand what went on and more about the data?

A And help Kennecott, too, yeah. Yes; yes. I started -- I think I started this -- all this business, my involvement in it, by saying I'm not against mining. I think there's a good orebody there. I think that it should be mined. That's what it's for. But it should be mined responsibly. And their application does not give an indication that the people are responsible.

Q Does the subsequent testimony indicate that --

A Pardon?

Q Likewise, does the subsequent testimony and materials in this case given straight to you anything other than that initial impression?

A No. You know, to sort of sum it up, if it were my property, I wouldn't want these people running my mine unless they've changed. Okay.

Q Can we do the same with this slide? This is your conclusions and the final slide.

A The first sentence says, "Crown pillar collapse is likely." I agree with that. The geology, the structure, the strengths of the rock, the case history such as those at

Athens Mine, all suggest to me that it's possible. Now, if anybody asked me to put a percentage on that, I wouldn't do it because I don't think that's possible. I think that those probabilities and probabilities effect a failure are meaningless, much like the weather forecast. There's a 20 percent chance of rain, there's a 5 percent of the crown pillar possibility -- probability of the crown pillar collapsing. That's meaningless. Does it mean five days out of 100 it will collapse? No. I think that whatever it means judging from their analysis is that if you had 100 such crown pillars, five of them would fail. And then I have to ask myself the question, "What if it's my crown pillar if it's one of those five?" I don't like -- I don't like to evaluate it that way. It's meaningless or worse. The application should have been. Yes, that's what I said right off the bat, and I agree with that statement even more strongly because they know more. "If operated as proposed," I use that in most of my summaries, those two words, "as proposed" or "as planned," I think I say "as planned." "If operated as planned, the mine would endanger the public health, safety and welfare." I usually insert those two words "if as planned." And I doubt they would do it as planned.

"The testimony and subsequent reports in this proceedings have done nothing to change my mind, my opinion,

that the mining as proposed is dangerous and the application misleading," that I agree with. "Return to sender," it's a bit late. We've spent a lot of time and money on it. I would like to do more than just send it back. But I agree that in the early days that should have been done. Right away anybody who read it should have said, "Look at all these spelling mistakes. Look at all the misstatements. Look at all the technical errors" and say this is not good. Any responsible person looking at that, which includes all the experts and the DEQ and the DNR if they were involved, anybody who was involved, ought to have noticed some of these things and then having noticed how sloppy the presentation started off, they should have dug deeper and they'd have found the other things. I agree.

MS. HALLEY: Thank you, Mr. Parker. I don't have any further questions at this time.

MR. WALLACE: Can we go ahead right now, Your Honor?

JUDGE PATTERSON: Yeah; sure.

MR. WALLACE: I just have a few questions, Mr. Parker.

DIRECT EXAMINATION

BY MR. WALLACE:

Q You commented that you believe that only a very superficial analysis of regional geology had occurred here; do you

recall that testimony?

A I referred to that, yes.

Q Okay. What are some of the things that should have been done to do a more comprehensive analysis of regional geology?

A I suppose the most obvious one is case histories. There are old mines in the area. The Ropes Gold Mine is one that we have not mentioned in this hearing today. But that was another instance which should have been looked into. The crown pillar, the rock between the mine and the surface, caved suddenly and somebody was delivering I think it was coveralls and he and his truck went down the hole. That was sudden. He got okay. There are photographs available in the media that was described. All that information was available. There's a mine not too many miles away which collapsed. Nobody went to look at it, nobody talked about that. It seemed to me -- this is the way I saw it -- that they avoided such things. And look at the circumstances which surrounded the Athens failures and all the other -- there's a lot more failures than that. Stanley pointed one out to me yesterday as we were driving down.

THE WITNESS: Remember that what Trevor Carter I think talked about the village, town, city perhaps of Negaunee being completely undermined by Cliffs. No problem. Remember him saying that? What did you show me yesterday,

Stanley?

MS. HALLEY: We can't do that.

Q Well, we probably shouldn't set up a dialogue at this moment.

A Okay. He pointed out a place where in recent years somebody's front yard had collapsed into a mine very close to the main street. That happened.

Q Now, you've no doubt read that one of the big concerns about this mine is that it's a sulfide mine. And the history of sulfide mining with leaching sulfuric acid bearing heavy metals into the environment?

A Yes.

Q Would an analysis of the case histories of mines where sulfide mining operations have resulted in environmental problems be useful in your experience as a mining engineer?

A Again, of course, naturally you'd do that.

Q What might that tell you about the relationship between human error and the consequences such as leaching sulfuric acid in the environment --

MR. LEWIS: Objection to foundation, Your Honor.

Q -- based on your experience?

MR. LEWIS: There's been no testimony, no evidence that this witness has had any experience with sulfide mining, knows anything about the potential risk of sulfide mining. It's rank speculation serving no relevant purpose.

Q Are you familiar with sulfide mining operations, sir?
A I worked for ten years at White Pine. That was 80 percent sulfides.

MR. WALLACE: I don't want to go back over his entire background, but I think that there's a substantial record of his experience with sulfide mining, mining in general, environmental consequences of mining that supports this question.

JUDGE PATTERSON: Again, I recall some of that. I'll overrule the objection.

Q And my question is, what is the interrelationships of human error to environmental problems that result, for example, from sulfide mining?
A I guess it depends on what you mean by "error." They did something wrong, well, in the early days, of course, they simply ignored the damage. That's an error.
Q Let me ask you this: Do electrical failures occur in mining operations?
A Of course they do.
Q Do they result in, for example, wastewater treatment plants not functioning properly?
A Normally you would have standby power which would take care of that. If you didn't, then you're -- or if something happened and a rock fell on a cable, you might be instantly in trouble, yeah.

Q Well, do pumps fail in mining operations?
A Yes.
Q Okay. Do gauges fail in mining operations?
A Yes.
Q Okay. Do waterproof liners of pits rip and tear and fail in mining operations?
MR. REICHEL: Objection; lack of foundation. There's no --
A That question really should go to Stanley.
MR. REICHEL: Excuse me.
A He's the expert.
MR. REICHEL: I don't think there's --
MR. WALLACE: I'll withdraw it. He's not going to answer it anyhow, so --
Q You indicated that three slanted drill cores were taken, but that was insufficient to determine the presence of subvertical faults, if I understood your testimony?
A Well, I think it was in Mr. Ware's testimony he told us about there was three holes and said that they were not able to locate that particular fault.
Q What would be -- what would be a, you know, proper and thorough way to determine the presence of subvertical faults using drilling?
A Well, it's expensive, of course. But if you really wanted to, you'd have to drill more holes. You could miss it by a

few inches and it could be there. It's a very small sample you're taking.

Q Would you be willing to place a minimum number or a number on the quantity of -- quantity and orientation of drill holes in order to find possible subvertical faults that could result in a plug failure?

A I'd say the more the better. But the cost is going to come into that decision.

Q You indicated three was not enough. Could 20 be enough?

A I would think the probability of determining that it was there or not there would be high if it was 20 holes.

Q And what is the importance of determining whether subvertical faults are present at this proposed mine site, sir?

A Well, Golder did an analysis because there appeared to be a fault just east of that high ore section, almost as if the structure had been broken there by a fault. And, therefore, this piece of ore was different from that piece of ore. And the intervening fault there could be bad, bad ground. There's two reasons there. One, I want to know more about my orebody, and another I want to know about this condition of the rock structurally speaking.

Q Would that be the kind of fault that could play a role in a plug failure?

A In what?

Q In a plug failure.
A If it's in a bad place, yes.
Q You testified that the thickness of the crown pillar at the Athens Mine, the one that collapsed, was 1900 feet; is that right?
A That's what the literature says.
Q Okay. Does the thickness of the crown pillar offer any intrinsic protection against plug failures?
A One would normally think so. But one should look at the case histories and say that strange things do happen.
Q I think you indicated that nearer the surface tensile failure -- the likelihood of tensile failure is greater; is that correct?
A That came from the Australian paper.
Q Okay. And just explain to us, then, what relevance that has to the collapse of a crown pillar.
A Well, I was going to ask if we could put on a demonstration of what happens in a plug failure. You want one?
Q Can you do it?
A I'd ask for volunteers to do it.
Q Is it dangerous? I'll volunteer if it's not. What do you need? I think it would be useful to see what you're talking about here.
A I wanted somebody to go out there and find me a block of rock or concrete which was in good condition, ten pounds or

something like that. And I'd say the RQD of this is 100; right? No cracks. Good, excellent rock. I'd say, "What's the RMR of this rock?" It's pretty strong. That's what we have to consider, compressive strength. That's one of the factors. And it's dry is one of the other factors. Therefore, we'll give it a pretty high RMR. I'm just pulling these numbers off my head just like they did. I'll say, "Okay. The RQD is 100 percent. The RMR is not 100 percent, but we'll say 90, which is very, very good." Okay. I'll just look at this thing. I'll write it on there, paint it on there, RQD 100, RMR 90. Very good rock. This is going to be the plug. I want Mr. Lewis to just sit in his chair there. That's all he has to do, sit and watch while his assistant or our assistant stands on the table and holds this rock above his head like this (indicating) between the palms of his hands. This is clamping pressure. And I'll go for a cup of coffee and say, "Just hold it like that for awhile. And when I come back, we'll ask you what you think about clamping pressures and absence of clamping pressures, and who's going to clean it up."

Q I don't think we need the demonstration. I think that vividly portrayed your point.

A And it's real. The RQD and the RMR are excellent. There's no clamping pressure, which is possible at the Eagle and was not omitted. That pulled in some averages from somewhere

miles away. Therefore, their approach was completely wrong. And I would just demonstrate that.

Q So is there anything in this record that meaningfully tells us how tightly that crown pillar will be held in place by horizontal stress?

A There is a theoretical approach, again, based on all these things and which says that, when you make a cavity which we're doing and when we mine make a cavity, the stresses have to go around that cavity. They can't go through it. They have to go around it and, therefore, they're concentrated at the corners especially. We don't like sharp corners. I note that the stopes are all rectangular, square corners. That's bad news. But don't worry about that. Some of the stresses are concentrated theoretically around this cavity and that results in extra -- could result in extra compression at the top, which is the crown pillar. It could be assisted by this theoretical stress concentration.

Q Did that theory pan out in Athens?

A Obviously not.

Q And they'd mined that for how many years?

A Now, I told you that the area which collapsed was fairly recent.

Q When you talk about -- you talked about the weathering of the top portions of the proposed crown pillar in this mine, --

A Yes.
Q -- and I think you were saying that as a result of weathering that that portion of rock should not be -- should not be counted in the thickness of the crown pillar; is that what you were saying?
A If it's going to be counted, it should be given a very low strength value. It's there. It's rock.
Q But then you -- and what I'm leading up to, but then you said actually there's another factor here. It's, I think you said, it's a burden.
A Yes. If it has no strength in that 20 meters or whatever it is with water in it, bears down on what's left. Yes, it's a load added to what is left of that crown pillar.
Q And does that further increase the likelihood of a failure?
A Yes.

MR. WALLACE: Thank you. I have nothing further right now.

JUDGE PATTERSON: It's noon.

(Off the record)

JUDGE PATTERSON: Ready?

MR. LEWIS: All right with you, Mr. Reichel?

MR. REICHEL: Please go ahead.

MR. LEWIS: Mr. Parker, I'm Rod Lewis, as you know. You met me before and you recently tried to drop a rock on my head, as I recall. I'm not going to approach

because I know you've got that big stick up there too, so -- I'm not going to spend too long with you, I don't think.

CROSS-EXAMINATION

BY MR. LEWIS:

Q I might start in reference to one of your slides, Mr. Parker, about the Athens Mine. And you referred to these width to height ratios. Do you recall that?

A Yes.

Q And I think one of your slides indicated that you'd referenced some author who talked about the width to height ratio ought not exceed 0.4; is that right?

A I remember the statement, yes.

Q And then you indicated on that same slide that -- I believe on the next slide actually that at Eagle using a dimension of 60 meters wide for the opening and then using the 87 meter crown pillar thickness, that would equate to a .69 ratio?

A I think so.

Q Now, you are aware, aren't you, sir, that the mine plan is for one stope at a time to be open during mining?

A Yes, I know that.

Q And that the width will be ten meters?

A I read that, yes.

Q Okay. And I think if you do the math with ten meters rather than 60 meters and 87 meter crown pillar it comes out to

something like 0.1. Does that sound right?

A Yes.

Q And that would be on the safe side of the 0.4 number, would it not?

A I realize that, yes. But, but, but, but I don't think that it's realistic to believe that only ten meters will be exposed at any one time. I think the backfill, for example, will settle and leave the crown unsupported essentially.

Q Now, you talked about backfill a little bit the last time you were here, as I recall. You indicated you had Googled "backfill." Do you recall that?

A Yes.

Q And I think you also deferred largely on the backfill to Dr. Vitton -- is that correct? -- as far as expertise on backfilling?

A I think he knows more about it than I know, yes. And we have, of course, discussed it.

Q I understand that. Now, you testified as some length today as you did before about, as I understand it, your lack of confidence in the use of RMR numbers for predictions of crown pillar stability; is that correct?

A Where was the question in that?

Q Yes. Let me rephrase it. I understand your position to be, Mr. Parker, that you don't have much confidence in the use of RMR numbers for predicting stability of a crown pillar?

A That is correct.
Q And do you have any confidence whatsoever in the use of the RQD data in predicting crown pillar stability?
A Very little confidence.
Q And that leaves us, does it not, then, Mr. Parker, with what you said I think the first time you were here; that it's your position that really what ought to be done here is we ought to first get underground and then collect additional data with additional drilling and characterize the crown pillar at that time?
A I don't remember exactly how I put it, but I suggested -- I think I suggested that it was a good idea, so I did go the way most people would go until I realized more recently that those outcrops are available.
Q That was something you realized between the last time you testified and this time?
A That's when it really sank in, when I was looking it over again.
Q So your opinion has changed now based on that?
A Definitely we should -- they should measure stresses on those outcrops.
Q Now, you authored several pages of written comments before the permit was approved; isn't that true, Mr. Parker?
A Which permit?
Q The permit for the mine. You submitted substantial lengthy

written comments prior to the issuance of the permit?
A What permit is that?
Q Do you understand that a permit has been issued for the mine?
A For Kennecott Eagle to go ahead and mine?
Q Yes, sir.
A No, I didn't know that.
Q You do recall or don't you, Mr. Parker, writing lengthy written materials that were submitted to the DEQ as part of the public comment process?
A I remember writing an e-mail to Rebecca Humphries hoping that it would get there before she made a decision and I was told -- and because I don't believe it -- that she never received it. My machine told me that it had been delivered.
Q Is that all you recall about the written public comments that you submitted?
A Submitted to whom?
Q Well, they were submitted on behalf of the National Wildlife Federation to the DEQ.
A Oh, that's different.
Q Is that different?
A Yeah.
Q You do recall those written comments?
A I've written lots to the National Wildlife Foundation, yes, along those lines.

Q And you included in there your opinions as to the potential stability of the crown pillar, did you not?
A I really don't know which document you're talking about. Can you show me?
Q I could; I don't know that it's necessary.
A It's necessary if you want me to answer.
Q I don't know that that's necessary either, Mr. Parker.
A Okay.
Q Now, just to be clear, you were not aware that a permit had been issued?
A A permit for Kennecott to start mining?
Q Yes, sir.
A No.
Q Have you reviewed the permit?
A What permit?
Q The permit that's been issued for Kennecott to start the mining.
A How could I if I didn't know it existed?
Q I agree with you; I just wanted to be clear. As far as your slides here that we looked at today, Mr. Parker, did you prepare those slides?
A Prepare? We cooperated.
Q Who drafted the language on the slides, Mr. Parker?
A Drafted originally by Michelle, and then we talked it over and made some changes.

MR. LEWIS: That's all I have. Thank you.

MR. REICHEL: Mr. Parker? Happy birthday, sir. I have no questions for you.

THE WITNESS: Thank you.

MS. HALLEY: We have no more questions, Mr. Parker. Thank you.

MR. WALLACE: Nothing further, your Honor.

JUDGE PATTERSON: Thank you, sir. And happy birthday.

THE WITNESS: Thank you. No presents. Jeez.

JUDGE PATTERSON: You're free to go.

(Witness excused)

JUDGE PATTERSON: Next?

MS. HALLEY: Your Honor, petitioners call Dr. Stanley Vitton on rebuttal.

REPORTER: Do you solemnly swear or affirm the testimony you're about to give will be the whole truth?

DR. VITTON: I do.

STANLEY J. VITTON, PH.D.

having been called as a rebuttal witness by the Petitioners and sworn:

DIRECT EXAMINATION

BY MS. HALLEY:

Q All right, Dr. Vitton, you are back to testify on rebuttal and I'm wondering if you've had the opportunity to review

the testimony and the slides and new exhibits, some new exhibits and reports from the following witnesses on behalf of Kennecott, the intervenor: Dr. Stone?

A Yes.

Q Dr. Carter?

A Yes.

Q Mr. Beauchamp?

A Yes.

Q Mr. Ware?

A Yes.

Q Any others?

A I read through some of the others: Ms. Arlaud, Donohue; the other person for Foth and Vandyke, Stark. And I think that's all.

Q Okay. And in the course of reviewing their testimony and various submittals have you changed your mind about any of the conclusions you discussed the last time you were here about the stability of the crown pillar, among other things?

A No, I have not.

Q Okay. We're going to start, Dr. Vitton, by discussing backfill. And I believe that most of this rebuttal is related to the testimony of Dr. Stone; right?

A That's correct.

Q Okay. Why don't you walk us through the major points that you're going to discuss about the backfill testimony that

you've reviewed and then we'll move through each one individually?

A Okay.

MR. LEWIS: Excuse me. If I could, your Honor, I've made it a practice so far to give opposing counsel copies of supplies that are going to be used.

MS. HALLEY: I'm sorry, Mr. Lewis, I overlooked that. I do apologize.

MR. LEWIS: Oh, my goodness.

JUDGE PATTERSON: Careful what you ask for.

MR. LEWIS: I want to replay some of the strenuous objections about the length of our slides.

MR. HAYNES: It's not 95 pages.

MS. HALLEY: No, it's not. I do apologize to counsel. It was just an oversight.

Q Okay. Go ahead, Dr. Vitton.

A My rebuttal is going to center around the following points: the question Dr. Stone raised concerning quality control issues, specifically of cemented aggregate backfill. The issue of -- and it's not an issue; it's something we both agree on, that -- the relatively high void ratio material; meaning, it has a fair amount of voids in it, and that I support Dr. Stone in that point. The type and size distribution of what type of material is going to go into the backfill; I'll discuss something there on that point.

The next item will be settlement of the materials that's going to be put into the secondary stopes, which I'm referring to as unbounded; it's differentiated from the cemented, so we're clear on those two issues. The second to last would then be the issue of acid attack on the cemented aggregate fill. And the last issue is the issue of dealing with settlement of both backfills; not just unbounded but also cemented aggregate backfill.

Q Now, I believe the first topic we're going to cover is segregation, backfill?

A Yes. Yes.

Q And have you had the opportunity to review the materials related to the Kanowna Belle -- I believe it's a gold mine in Australia?

A Yes, I have.

Q And do you believe that that mine and the materials that come from it, particularly those related to Dr. Stone's testimony are enlightening for the purposes of this court?

A Yes. My rebuttal on the issue of quality control still centers around segregation of the cemented aggregate as it's deposited or placed in the stope. And the fact that it still is an issue, Dr. Stone indicated that there are ways in which you can prevent that and that a number of mines have found ways to prevent that. They attempted to do that at this Kanowna Belle Mine in Western Australia. They

decided to go with cemented aggregate backfill, but after trying to work with it for a couple years decided against it and then went with cemented paste backfill which Dr. Stone talked about. And this is a case, example of where segregation was a very extreme problem to which case the mining company went away from using cemented aggregate and went with cemented paste backfill.

Q Is the Kanowna Belle Mine a modern mine?

A Yes. Yes, it's a currently operating mine. I would also want to point out that this paper was in Minefill 2001, which was the seventh international symposium on mining with backfill, and Dr. Stone was the editor so he would be well -- very familiar with this paper.

Q Okay. Now, this is more information about that same mine; right?

A Yes, this is a picture of the Kanowna Belle Mine, in which case it's just a visual showing of some of the issues of the severe segregation that they were getting with the backfill, and very different amounts of strength variation throughout the backfill. This --

Q So this -- so maybe we could back up for just a minute. Could you just define what we're talking about when talking we're about segregation? I think we talked about it way back, but that was a couple of months ago at this point.

A The cemented aggregate -- the aggregate itself is coarse

aggregate and that's all that's put in. Cement -- and Dr. Stone made a comment that this is not concrete and I agree totally; it's more -- it looks like large particles that are cemented together at their contact points. That's why you have a very high void ratio with this material. However, the -- you still have a particle size distribution and the top size according to Dr. Stone and the permit is around two and a half inches roughly, something about that big. And then on down to smaller sizes. And if you look at a stockpile and you dump a stockpile out, when it forms the angle or oppose the larger particles go to the bottom and the bigger ones stay on the top. And so you get the segregation of particles. And that's what you see in that flow structure are these areas of segregation of the particle sizes and that's what we mean by "particle size segregation."

Q And your point here is that this process of segregation occurs naturally and it leads to some portions of backfill that are stronger and some that are weaker than others?

A Yes, that's the experience at this mine, in which case their testing of the actual cemented backfill had strength ranges from .5 to 4 megapascal, which is the -- a comparison the cemented aggregate designed for the Eagle project is 1.5 megapascal.

MS. HALLEY: The next slide please.

Q Now, this is from Dr. Stone and I will provide the citation to counsel as we're going. This is from transcript Volume 15, page 3,213. What is Dr. Stone saying here?

A Dr. Stone is stating in this point here that there are ways -- he does recognize segregation is a problem but that there are ways to improve it, and one of the ways is to add water. And the problem with simply adding water is that you weaken the cement. The cemented aggregate would actually be weaker if you started adding water. So there's a balance that you have to do here, and this mine could -- just for some reason could not get those balances properly -- could not get them the way they needed them and, thus, they decided to go away from using cemented backfill. And I think that's why you see very little references in the literature to cemented backfill, because a lot of mines are no longer using it.

Q Now, this is an illustration demonstrating that the Kanowna Belle Mine tried to fix their backfill strength problem through adding a little more water, as Dr. Stone put it. Were they able to do that?

A No, they were not. And this is basically a cross-section of the previous picture or one very similar to it; in which case they tested this and this is where they determined that they had a very broad range of strengths, from .5 megapascal. In the coarser, weaker bands we have very large

particles, limited cement to where the fines accumulated, which would be more like a paste type of fill which is around 4 megapascal, so you had these bands of segregation in there.

Q And I think perhaps you said it, but this mine actually abandoned the cemented aggregate approach?

A Yes, the next slide will -- they did a -- they did an -- this is their lab testing and I just wanted to point out where the Eagle 1.5 was. It would have been at the low end of their utilization of cemented aggregate fill. What this was pointing out is that they had a very difficult time comparing the laboratory tests that -- they assumed the strengths they were -- and the actual strengths they got in the field are quite different.

Q What does that indicate to you, Dr. Vitton?

A That they had quality control issues on creating the cemented aggregate in the stopes: mixing it, transporting it, and depositing it into the stope to get the design strengths that they were attempting to get.

Q Now, in the application or in the course of any of the testimony that you've reviewed, including Dr. Stone's and other witnesses who testified about backfill, have you seen any type of plan for monitoring the strength of the backfill?

A I believe -- I don't know if I saw -- I did not see a plan

in the permit. Dr. Stone does talk about it in his testimony about sampling, testing and then making changes to the process by which they're creating it and transporting it and putting it into the --

Q Does he talk about how that particularly related to this mine, or is he talking in a more general way about standard industry practices?

A Well, you'd have to define "this mine." Do you mean the Kanowna Belle Mine or the Eagle?

Q The Eagle Mine.

A Again, I believe that there's very little discussion in the permit concerning the -- there is a discussion but not to the extent that Dr. Stone provided in his testimony as to how it's done and how they would adjust parameters in the making of the cemented aggregate and putting it in the stopes.

Q Now, you saw that Dr. Stone talked a good deal about various ways of testing the strength of backfill once it's in the mine, the bucket test and that sort of thing; right?

A Yes.

Q Okay. Have you seen that that's part of this application or part of the requirements at all for this mine, that type of testing of the strength?

A No.

Q Now, this slide also relates to the same mine we were just

discussing, the Kanowna Belle Gold Mine. And maybe you could explain to us, sort of outline some of the disadvantages cemented aggregate backfill -- maybe you could explain what those are?

A Okay. I put both -- this mine initially evaluated cemented aggregate and cemented paste. That would be -- cemented paste would be cement with very, very fine particles. And that process can be transported to a mine by pipelines and slurry very much more easily than the cemented aggregate. They decided at the beginning to go with cemented aggregate. They listed both -- disadvantages to both systems, but then chose to go with the cemented paste. And I highlighted some of the problems with the cemented aggregate. One of them is that you have trucks coming down the decline; however, the Eagle will be a different process. But anyway, there were a number of cemented aggregate disadvantages as well as with the cemented paste. Both have problems. I would like to add that the design of the cemented aggregate did come from research at Mount Isa and the Kidd Creek Mines, which Dr. Stone did refer to.

Q Could you just read the other disadvantages of the cemented aggregate backfill?

A Well, for this mine, the Kanowna Belle Mine, the first one is that they had a lot of truck moving down into the mine on their decline was one of them. The second was the "higher

fill dilution due to segregation," and that meant that it was not -- the weaker parts were collapsing into the stope and, therefore, causing dilution of poor rock or the cemented aggregate became the dilution into the ore and they had to haul that out, and that's an economic cost to the mine to have dilution and Dr. Stone talks about that in his testimony.

The third one is wear of the fill pass is likely to continue causing problems, stability problems. And again, this is when you have so much traffic in these declines, the weight of the trucks are actually causing -- like our roads that have -- that occur in our roads to have the stresses and there's a maintenance issue. So that was the third issue. And the bigger problem was the future extensions of the CFA system would require excavation of new passes and loading stations, so it was a complex problem with the cemented aggregate.

Q Now, this is testimony from Dr. Stone, pages 3,210 and 3,211. And he was discussing there the materials to be used in the backfilling process. I think that later on we're going to come back around to the topic of the limestone amendment and what else is significant about the fact that the development rock would be used as backfill going into the secondary stopes?

A This slide here is just simply -- the next one is just

illustrating what Dr. Stone said. And I agree with this. This is what the permit said, this is what Dr. Stone stated. And the next slide will show just the illustration of that. Out of sequence a little bit. This is the primary and the secondary and I just want -- one of the points I want to make of -- on this backfill situation is that the primaries, which would be the cemented aggregate which are blue here, are all stacked on top of each other. The red ones are the secondary, which is going to be the unbounded material. They're standing -- stacked on top of each other, so there's -- they're all standing on top of each other. There's no mismatch of the cemented -- at the next level between the secondary and the primary. The primary stope will be filled with cemented aggregate; the secondary will be unbounded materials.

Q Okay. Now, the weight; I'm wondering if the weight of a stope, like this (indicating) one or this one, the very sort of taller stopes, would be greater than the weight of a stope like this (indicating). The weight at the base of those -- that that base has to support is much greater than the base -- than the weight that this base on a smaller stope would have to support.

A Yes. Each level will be resting on the previous level, so that will be adding to the stress at the bottom. So the bottom one will experience the weight at some point or some

fashion of the weight on top of it.

Q We're going to come back to this in more detail later, but would you expect more settlement in the taller stopes that have more weight piled on top of them?

A Yes.

Q I think this is just an illustration of what we were just looking at.

A Yes. I do want to state that -- again, that this was taken from Dr. Stone's testimony and it is in the permit that the primary stopes are cemented aggregate. The secondary stopes will be development rock, which is mostly the metasediments, some peridotites. And because they're also acid-generating they're also going to amend it with limestone. That will become the material that's going to be placed in the secondary stope.

Q You're not necessarily disagreeing with any of these things, but just refreshing our memory --

A Yes. I'm going to refer to these, and so I thought I'd put them all on one slide.

Q Sure. Why don't you go ahead and walk through those? And these are from Volume 15 of the transcript and the page numbers are -- well, provided. Go ahead.

A Yes. I wanted to -- these are statements that Dr. Stone made that I simply will be using later on in my rebuttal. The first one is -- and I've already stated this, that the

cemented aggregate is not like concrete. It's not as dense. It's got a lot of voids and you can actually look through it. Water would flow through it quite easily. The coarse aggregate top size, meaning the largest coarse particle, would be two and a half inches, similar to railroad ballast size. And his point that it has lots of voids is correct. Let's see. The cement aggregate stuff will be stacked on top of each other.

To help avoid the acidity attack on the cement in the permit they state that they will use flyash, which will help protect the cement from acid attack. So they will be using a 50/50 percent cement-flyash ratio. The permit I believe states a five percent cement contact -- content. I believe that Dr. Stone said it would be roughly six, but it's going to be five to six percent cement. The designed strength is -- the target strength is 1.5 megapascal, 218 psi and that is roughly a factor of safety of two based on his testimony. So again, these are points I took from his testimony.

Q All right. This is from Volume 15, page 3,229 and I think again we're talking about the voids in the backfill here, and particularly -- well, here he talked about damage from blasting in neighboring stopes and that it could -- I think he says "punches a little pocket" into the fill. What is the impact of those little pockets being punched into the

fill?

A What I'd like to -- as rebuttal to the issue of blasting is I think Dr. Stone misunderstood my statements as to blast vibrations moving through and encountering a void between the cemented aggregate and the backfill material. Let me back up. That's incorrect. The cemented aggregate primary stopes are created and they come and they blast the secondary stope out. It's in the process of blasting that secondary stope out which is right adjacent to the cemented aggregate. There will be some voids forming and Dr. Stone agrees with that. I don't disagree. But with the mechanism of how damage occurs is what I would like to discuss.

MS. HALLEY: Okay. The next slide please.

Q Now, based on Dr. Stone's testimony here, did he understand what you were really getting at when you were talking about voids between the primary and secondary stopes?

A I believe -- I don't believe that Dr. Stone understood what I meant with -- when I was talking about a void forming and the impact of having a void with vibrations moving -- blast vibrations trying to encounter a void between the cemented aggregate and the blasted -- the rock that was being blasted in the secondary stope. Or an account or one farther down. There could be -- you have a series of these, and so you could have voids in a number of them. So that's the point of this rebuttal.

Q And I think the next slide is an illustration with which you can explain to us again what you were talking about and the impact on the stability of the backfill?

A Yes. This is a paper that was again in a Minefill Conference 2007, which was last year, looking --

Q Dr. Vitton, I need to interrupt for just a moment.

MS. HALLEY: This is -- this paper is Petitioner's Exhibit 54.

Q I'm sorry for interrupting.

A This is deep mine, underground mine I believe in Coeur de Lain district in Idaho. And they have -- because of the very high stresses in this mine they have rock bursts, and when you have rock bursts it's like this ball -- seismic disturbance, somewhat not unlike an earthquake that occurs. And that stress wave comes and what happens -- if you have a void -- and this happens to be cemented backfill that's in this mine and it's bolted together because they do have these rock bursts and these waves that come through it. When you have a void and a rock burst seismic impacts a void what happens -- it's a compressional wave. It hits the void and it gets reflected backwards as a tension wave and that's how you fracture rock; that's -- you need -- you don't -- generally a free face will reflect the wave and cause fragmentation.

So anytime you have a free face -- and that's what

a void would be -- you can damage the surface of the void. And that's essentially equivalent the -- a void, the bottom part there, shows the wave hitting it. Not problem where it's tightly compacted, put against. But if there's a void below it, which this is, the whole wall got damaged and the roof bolts got ejected. And this is a documented case in this mine. And my point is, if you have voids and a stress wave encounters the void, the physics are such that it reflects but in the reflecting process damages the rock and puts -- pushes it out into the void. And my point being is that's how -- one of the mechanisms in which cemented aggregate could get damaged due to adjacent blasting. That's the point I was trying to make and I'm not sure Dr. Stone understood that the way I meant it.

Q And your opinion is that these little pockets that I think Dr. Stone described creates these voids in which that sort of phenomenon can occur and damage the backfill?

A Yeah.

MR. REICHEL: Objection; leading.

A My point is, is that the more fracturing you put into the cemented aggregate the more potential instability you're going to get with the -- and long term would accelerate the settlement of the cemented aggregate backfill.

MS. HALLEY: Okay. Next slide, please.

Q Now, we're going to move our discussion to talk about

settlement of the material in the secondary pillars, which in this case is development rock. Now, this is Dr. Stone's response to your testimony about settlement and the last line is his statement that he says he has trouble believing that there would be settlement, and I think in this discussion you were talking about a settlement rate of -- what? -- one to two percent; is that right?

A That's what the statement says, one to two percent. What I said I'm a little surprised by that. I would have expected I would have said five to ten percent.

Q Oh, okay.

A But I obviously used one to two percent and my statement was that the secondaries with the unbounded materials would settle. I mean it's loosely placed material and it's going to settle over time. We see this in many, many applications. Dr. Stone said that he had trouble believing that you would have settlement in the unbounded materials in the secondary stopes.

Q Okay. Now, are you familiar with this paper, Dr. Vitton, that in fact assesses the settlement of various different materials?

A Yes, I am.

Q Okay. You've read this paper; you're familiar with it?

A I have read this paper.

Q Okay.

MR. LEWIS: Just a moment. Is this a paper that's in evidence, Ms. Halley?

MS. HALLEY: No, it is not, Mr. Lewis. We are using it for demonstrative purposes.

MR. LEWIS: Well, do you intend to have the witness testify as to the contents of this paper?

MS. HALLEY: Well, we're not discussing the content of the paper or the truth of those contents; we are discussing them in light of rebutting Dr. Stone's lack of belief that settlement occurs.

MR. LEWIS: Your Honor, I guess I have some -- I'm somewhat troubled that --

(Fire alarm interruption)

MR. LEWIS: I guess I'm just objecting that to the extent that petitioners are attempting to introduce into evidence information from new exhibits that we've not been given copies of these, had no opportunity to examine them, and of course, it limits our ability to understand them and potentially cross-examine the witness on them when we're only given small -- apparently small portions which suit the petitioners' purpose on these slides, so I think it's a bit improper to attempt to introduce such material, your Honor.

MR. REICHEL: I would join in the objection. And further, although I understand that this slide is being offered for demonstrative purposes, it appears that counsel

intends to ask the witness questions about the contents of this article for the purpose of having that testimony rebut or attempt to rebut statements by other witnesses. That to me is not demonstrative; that is offering the substantive evidence.

MR. LEWIS: And I think it also is part of our continuing objection as to the scope of proper rebuttal, your Honor. This is a topic that petitioners covered at some length in their direct case and it should have been covered there.

JUDGE PATTERSON: Ms. Halley?

MS. HALLEY: Well, Mr. Stone discussed the settlement issue at some length and one of his primary arguments was that the settlement would not occur because the secondary stopes are compressed or limited by the primary stopes on both sides and that, therefore, he didn't believe there was any place for rock to go, so therefore, it wouldn't settle. This paper looks at the settlement of materials, a variety of materials -- we're only going to talk about waste rock, because that's the only thing relevant here -- in those containers. They look like silos. And they are obviously in a limited space; therefore, this is directly rebutting Mr. Stone's testimony that things can't settle in a defined space. He, you know, started talking about soil settlement and that sort of thing, and

this paper directly rebuts that. And we're only -- I think there are two -- we have two slides: one picture and one graph and that's going to be the extent of the questioning on this paper.

JUDGE PATTERSON: I'll overrule the objection.

Q All right. Dr. Vitton, while I just sort of explained a little bit about what this paper is, but maybe you could describe to us why this is relevant to Dr. Stone's testimony.

A I might be wrong, but I believe I did enter this as an exhibit.

Q We'll clarify that later. I could locate it but maybe between us we can, so we will clarify it. Okay?

A The point of this paper was simply to look at mine rock and big mine rock, how it settles, and then very fine tailings, which are -- which is typical products produced at a mine and simply how much do they settle. And so they created these bins about six meters high, one meter in diameter, put a number of meter -- sensors in there and simply measured how much settlement you get in this confined space with blasted mine rock from a mine. And the far one on the right column 4 was just waste rock only if you look halfway down. And then there was mixtures with tailings across the case 3 -- column 3, column 2, column 1. So they're different mixtures between fine materials and big coarse rock. That's

what they did and they simply measured -- well, they measured a number of things, but for this point, for this rebuttal point it was simply how much settlement do you get. And that would be the next slide, two slides. This is the results. In a hundred days they got upwards of 16 percent settlement in the tailings only, and about seven and a half percent in the mine rock in the first hundred days. And again, that's not uncommon. We understand that blasted mine rock settles. It's a common thing and it will settle in the secondary stopes.

Q So your -- when you testified on direct you were saying one to two percent, but this test actually indicates 7.5 percent?

A I would have predicted between five and ten percent on basically self weight consolidation. That's not meaning you're stacking on top of each other; that would simply be of a hundred feet you get seven and a half feet of settlement for that hundred feet. That's what this would tell me.

Q And what would happen to settlement when you stack all those up on top of each other, like what is proposed in the mine plan here?

A There are two -- in the geotechnical literature we discussed two types of settlements: primary and secondary. This is what we call primary; fairly immediate.

Q Within a hundred days?
A That's what I would call immediate. And then over time you're going to get secondary compression; that's the crushing of the particles. And when the mine gets -- when the pumps are turned off at this mine and the water gets saturated -- or the backfill gets saturated, the water comes up, you're going to see another dramatic lowering of the -- increase in settlement, because we're losing the unsaturated -- like sand when you make a sand castle out on the -- next to the lake, it stands up because there's water holding the particles together. That's the condition which this is at this point; when you put the material in there's water with this material. As soon as you saturate it you lose that strength. And it's the same way when the water wave comes in and -- the sand castle falls apart; you're going to see another dramatic increase in settlement. But that settlement won't stop there. Settlement will continue for a very long time. Rock fill dams that were built at the turn of the century have -- are still seeing settlement because the larger -- and the other issue is the larger the particle that you have in there the more settlement you're going to get, the longer it's going to take for it to settle.
Q Okay. Now, what's the practical implication of settling in the secondary stopes?

A Well, the implication is that you cannot maintain a tight backfill, which is what Dr. Stone talked about after this point.

Q I think we're going to talk about that more in a few minutes. Okay?

MS. HALLEY: All right. Next slide, please.

Q Okay. Now, Dr. Vitton, you also have reviewed Dr. Stone's testimony about acid attack; right?

A That's correct.

Q Okay. Now, his testimony was that you can generate acid from acid rock drainage in the oxidation of sulfides and make the water acidic; right?

A That's correct.

Q And we're talking about in the mine post closure during this time period -- during that time period?

A That's correct.

Q Okay. And he says that in the next little section here: post mining. All right. Now, he went on to say that in his experience he's never run across a mine that had degradation in cemented rockfill due to acid degradation of the cement and that he can't find anything in journals that talk about acid degradation of cemented rockfill. Have you seen any materials that have to do with acid degradation of cemented rockfill, using his terminology there?

A Yes. If I could comment on a couple of those points.

Q Okay.

A Clearly my testimony -- I am a civil engineer and I tend to look at the long-term affect. The mining industry obvious interest is in mining the ore, getting it out and completing the mine and it's more of a short-term view. Dr. Stone is correct; it is a post-mining issue and that's how I view it, as a post-mining issue. Not during mining; after the mine is completed and long term what's going to happen to the secondary stopes of the unbounded -- and this discussion centers around the cemented aggregate. What's going to happen to it when it encounters acid over the long time -- long term? So the issue -- I agree with Dr. Stone that it is a post-mining issue; number one. Number two, he states that, "I have not run across this cemented degradation in cemented rockfill." In general for two reasons: one is that a lot of mines aren't dealing with cemented aggregate rockfill; they're dealing with cemented paste. So that's -- most of the literature that deals with acid attack deals with cemented paste, not cemented rockfill. So he's probably correct on that point.

The second -- third point that I'd like to make on this is that there is significant literature on the effect of acid on cement. It's a deterioration of cement. There's a significant volume of literature on it and I will present some of it.

Q Now, you talked about the temporal difference in approach that you took from Dr. Stone. How long do you think the roof of the mine needs to stand up?

A It will depend on what I believe is -- you have clearly settlement of the secondary stopes -- and Dr. Stone does state his estimate is about two meters, which is six feet, seven feet long term. So your secondary stopes will settle, I think we both agree; we disagree on the main. This mine though is -- the cemented aggregate, there's been very little discussion on what will happen with it long term in this environment in which you have acidic waters, and which will be attacking cemented aggregate which has very void -- a very high voids. And I believe that long term it will also decompose, deteriorate and basically settle because it has very high void ratios. We'll talk about that in a little bit. Thus all of this will settle; the entire mining area with these backfill stopes whether primary and secondary -- and my belief -- long term will settle exposing the entire span, which in case will become unstable and collapse is my opinion.

MS. HALLEY: For the record, slide 20 of Dr. Vitton's presentation comes from Volume 15, page 3,235. Next slide, please.

Q I think you have two slides sort of giving more of the illustration about cemented aggregate acid attack?

A Yes. This is a significant problem with the civil engineering world and the mining engineering area; except again, civil engineering our projects tend to need to stand up a lot longer. But acid attack is a well-known phenomenon. It attacks the cement paste. Cement paste is going to be removed and dissolutioned exposing the aggregate. Eventually total disintegration will occur. That's the long-term affect of cemented cement in an acid environment. This figure here is -- basically your resistance against that attack is going to be directly proportionate of the permeability of the cemented aggregate, which in this case this is extremely permeable. It's got very high voids in it. Water will move through it very easily transporting both acidic waters in and dissolution materials out.

Q All right. This slide we're discussing the 50/50 mix of cement and flyash, and that seems to be a significant contributor to this concept of acid attack, the augmentation of flyash?

A No. I don't believe what you're saying is correct. The permit clearly understands that it's going to be an acidic environment. To try to counter that, to try to protect that cement they will add flyash, and flyash will help protect the cement from attack. But typically it's only a short-term phenomenon and that in the long term -- and the

research of the paper that I'm showing here shows that it -- you get into these high volumes of flyash in the 50 percent range, long term binder just doesn't hold up and that you have dramatic strength increases. The last statement that I highlighted at the bottom: "However, long-term strength values decrease significantly if the concrete mixture is over 30 percent flyash replacement levels." And what they're saying here is that it does work in the short term for preventing, and so for the short term it is an acceptable method; long term though, it doesn't seem to work.

Q For the record, could you read the title of the paper you're referencing?

A "Sulfuric acid resistance of high volume flyash concrete."

MS. HALLEY: All right. Next slide, please.

Q Now, Dr. Stone indicated that he was not familiar with this concept of acid attack on concrete; right? He said he didn't note it in the literature -- or in cemented backfill?

A I think Dr. --

MR. LEWIS: Objection to the form of the question, your Honor; misstates Dr. Stone's testimony.

Q Well, we just saw Dr. Stone's testimony that said he hadn't seen anything in the journals about acid attack on cemented rockfill; is that correct?

A That's correct.

Q Okay. Now, what is thaumasite and how does it relate to acid attack on, in this case, backfill?

A Dr. Stone acknowledged that --

MR. LEWIS: Your Honor, I'm sorry to interrupt, but it appears we're going into more articles. There's been no indication whether these are in the exhibits, whether they're new exhibits. So I have an objection on that basis. Again, they're apparently excerpts to support Dr. Vitton's opinions, but we have not been provided these articles, have no opportunity to cross-examine on them. And secondly, again, as to the scope of proper rebuttal, a major topic of Dr. Vitton's testimony earlier was the potential for acid attack on this backfill. He had all the information about the backfill then. This is an attempt to come in and bolster his earlier testimony. It's improper; it's beyond the scope of proper rebuttal.

MS. HALLEY: Well, your Honor, this is clearly rebuttal evidence to Dr. Stone's statement that there was no such literature to be found. There is literature to be found and this court ought to have the benefit of knowing that and seeing some of it.

JUDGE PATTERSON: I'll overrule.

MR. LEWIS: This is not, by the way, literature on (COUNSEL REVIEWS FILE). This is literature on some other subject apparently, your Honor.

MS. HALLEY: Well, Dr. Vitton will explain the relevance. It is in fact acid attack on cemented fill.

JUDGE PATTERSON: Well, all right, if he can do that.

A Dr. Stone does acknowledge in his testimony that the formation of enttranite, which is a calcium carbonate compound that forms in cement, that's a very common problem in concrete highway concrete, very well researched, very well understood. And I agree with Dr. Stone that the formation of enttranite will not be a problem in cemented aggregate backfill because there's so much voids there that it -- the reason you get distress with enttranite is the volume metric expansion and that cracks the concrete. And so I agree with Dr. Stone on the formation of enttranite. Another chemical that is now -- that's been found and it was found in a mine in Missouri was the formation of thaumasite, which is very similar to enttranite. This chemical that forms doesn't just cause concrete to be deteriorated by cracking; this one actually attacks the cement and turns it into a paste that just destroys the strength of the paste. And what's unique about this thaumasite is they discovered it only in underground concrete structures. And they're now excavating 80-year-old, 50-year-old concrete structures and there's no strength to them; they're mush. There's just basically no strength left and what's unique about the

thaumasite -- they're finding out that -- they've known about it since the '60's, but they didn't realize how much of a significant issue it is. And it's a very significant issue if a number of conditions exist. And there was a conference devoted to this back in 2003, and entire journal article was dedicated to the effects of thaumasite formation. Almost all of the papers given were in northern latitude countries: Great Britain, United States, Canada, because that's where most of these problems are now being found. This is one of the papers: "Occurrence of thaumasite in laboratory and field concrete." And they talk about during the last 15 years thaumasite is a form of sulfate attack similar to enttranite; has been found in over 80 UK field structures and buildings and is particularly prevalent in buried concrete. This form of sulfate attack completely destroys the cementatious binding ability of the concrete transforming it into a mush. This is a very serious issue for a lot of structures. The reasons for it is that they're finding that in particular where this occurs are in foundations that are placed in soils that have acid groundwaters moving through them; in particular where they put concrete foundations where the soils have pyrite that formed acid and then caused the concrete to decompose. Another requirement to have this --

These are the conditions for thaumasite to form.

You need a source of acid, and again, this statement here, groundwater basically where you've got sulfide-bearing -- sulfide, sulfide-bearing clay soils that occur in relative large sections of England; that's one of the sources. Another source is CIO, silica, which is in the cement. The next slide. A source of calcium carbonate, limestone. A source of water, a mobile source of water. And the last and more interesting issue is colder temperatures. This is roughly around 15 degrees C and can occur up to temperatures of 25 C. And again, that's well within the -- from the bottom of the Eagle deposit up to the top would all be in probably the five degree centigrade up to 15 degrees centigrade range. So all these conditions would exist at the Eagle project and would be a concern for the acidic attack on the cemented aggregate backfill.

Q Has this issue been addressed in the application or in any of the subsequent testimony or reports or exhibits?

A Not that I have read.

Q And what would the practical implication of the formation of thaumasite be?

A The formation of thaumasite would basically say that the paste holding the aggregate together in a high void ratio structure would collapse; it would come down. All those voids would be filled up and so you have settlement. So in other words, not only would you have settlement in the

secondary from the unbounded material, you now have an attacking process that's decreasing the strength of the cement to hold those particles together as well as being stacked on top of each other and all that would basically have significant settlement occurring with it. And again, it would cause the opening -- even if you had tight backfill at the end of mining, over time that could not maintain that tight backfill and you would thus create a gap between the crown pillar and the backfill that was put in the mine.

Q Now, this again is from Dr. Stone's testimony at page 3,236 and why don't you go ahead and read this, Dr. Vitton?

A Dr. Stone here agrees and I agree that you have to maintain the tight backfill and the tight backfill is essential to support the crown pillar. And another point that needs to be made -- and Dr. Stone really makes it. He said if you do have settlement, for example -- and I agree with him here -- with the secondary stopes, basically you're increasing your span width. And so that's the importance of tight backfill.

Q And why is the span width important?

A In the stability of the crown pillar, the wider the span then the higher the potential for the collapse of the crown pillar. This statement here is -- Dr. Stone, his statement is that he would expect about two meters of settlement in the secondary in the unbounded material.

Q This is page 3,244 of the transcript. So you and Dr. Stone

actually agree that the secondary stopes will settle; your disagreement is how much?

A That's correct, the magnitude.

Q Now, Dr. Stone talked a good bit about the Kidd Creek Mine. I think he'd done some work there. And he talked about also the void ratio in cemented aggregate fill, so the -- can you help us put that into context in looking at the Kidd Creek Mine?

A Yes. Dr. Stone mentioned Kidd Creek Mine as well as the Mount Isa, which are very large mines that have utilized cemented backfill as well as cemented paste backfill and they have significant experience. So I was looking for what the void ratio -- we've been talking about these voids in the cemented aggregate; how much are there? I mean, is there a number in the literature that I could look at to make an estimate? And there is a paper in the Minefill -- one of the Minefill journals -- I can't remember which one -- that actual measurements of the void ratio -- which I'll -- it's a term in which the ratio of the voids to the ratio of the solids.

Now, that's not very meaningful to most of us. However, it directly relates to a term called "porosity," which is the volume of voids to the total volume. So the Kidd Creek number that is in the literature is a void ratio .51, which is in the soils world about medium. I wouldn't

say it's loose; I wouldn't say it's dense. It's in the middle, if you will. So it's not an excessive number. That relates to about 34 percent volume of voids in the cemented aggregate. So in the stope that's filled that's ten meters across and a hundred meters high, and however long it is, 34 percent of that would be voids.

And so when I talk about settlement it's those voids that will settle. So you have roughly about 34 percent of room for the material to compress into. If you lose that binding strength in the cemented aggregate, you lose that cement, that strength. If you lose it, those particles are going to come together into those void spaces; and thus, you're going to create settlement. And that's the reason I included that number.

Q I'm going to change topics a little bit now and talk about the rock mass quality materials that have been presented during the testimony. I believe these are some of your major points and then we're going to spend a little more time on some of these. Why don't you go ahead and explain these points, and then we'll move on through the more detailed material.

A I don't want to describe RMR's again. I think the court is --

JUDGE PATTERSON: Thank you.

A I understand that's -- we've talked a lot about that. But I

did want to make some general observations as rebuttal to what I read in the testimony of Dr. Carter, Dr. -- not Dr. Stone, Dr. Carter, Mr. Beauchamp and Mr. Ware, those three testimonies. What I was looking for was their statements as to how the cores were handled and we questioned the -- for example, the eight centimeter scale versus the ten centimeter scale. I was affecting some testimony from Steve Coombes who put that all together, or someone of the drillers and I didn't see it in the testimony. I did not see a documented statement other than verbal testimony that we used ten versus eight and I think that's important. I was looking for that. At the point in which we -- I reviewed the permit and gave testimony on my opinions there were 109 exploration boreholes that had been done. There's more now, but 109. I want to make a point about that, is that -- and I was looking in the testimony for what geotechnical data came out of that drilling as I was specifically designated to look at the rock structure. All 109 exploration boreholes were to delineate the deposit and look at the economic value of the ore, to define the ore. The secondary purpose was to collect geotechnical data. There were no holes drilled in this project specifically to delineate the rock mass characterization or the characteristics of the rock. And so in the tabulation of the data from each borehole there was data collected on

geotechnical properties which created the information for the RQD and the ultimate RMR values, but none specifically given -- drilled just to look at the geotechnical stability of the mine. Again, they agreed that the major structural features that we discussed at length were not included in the RMR calculations. I believe that's what this testimony stated. I wanted to state that.

Again, the rock photos clearly show a point -- a number of the eight boreholes we looked at had what they called and referred to as major structural defects. If you look at those cores a lot of them don't have any markings on them, and that's critical. That means that nobody could determine the RQD or the RMR from them. And I think that's a critical point; that a lot of those did not have markings to tell the person who was going to do that -- which was the testimony of Mr. -- *2:15:14 to 2:15:50* -- to know which break was actual and was induced from the drilling operation or the drillers taking -- you know, if you -- the core just slips off onto the ground and it breaks up in pieces, you can't claim that those are fractures that were in the ground; you created them. So those are driller induced fractures. So you have to be at that site, or someone at the site has to mark those. So to clearly see no markings on the core boxes is troubling. So I'm sorry I sort of went a little farther than I want to, but that's --

Again, continuing on. I see no evidence that they actually did use the ten centimeter scale, which is the required scale, and in fact did use the eight centimeter scale. I don't see the documented proof that the ten was used. Again, you need to have markings on the core to even tell that. Another point Dr. Carter made discussed the use of the RMR '76 versus the RMR '89, a different version that I believe should have been used. I will discuss that. Another point I want to point out is that in those RMR calculations they used average values with the exception of the RQD values. And I'll discuss that. Again, if you include the discrete features in the RMR calculation, the RMR number will drop.

Q Now, this is a core -- boxed up core from hole 62 from 21.3 meters to 23.49 meters, and is this one of the photographs of cores that you reviewed?

A Yes.

Q What is remarkable to you about this photograph?

A Again, I acknowledge this is from the hole 62 that Dr. Carter talked about as not being representative in the crown pillar. I disagree with that. That's in the region. This was included in the crown pillar in the permit as a crown pillar hole. But nonetheless, I want to make a point here: is that that scale -- if my rock came all out a nice long core, that scale's irrelevant. I don't need it. It's only

when it comes out in pieces -- and small pieces at that -- that that scale becomes important and the person needs to take that scale -- that piece up there, put it up against the scale and see is it longer than ten centimeters or less, or not. And in this case they had an eight centimeter scale there, so when the person pulled it out to check, to calculate that number that we've been talking about ad infinitum that's the importance of that scale up there.

The second point again I've stated already, is you need to have markings. Is that -- did the driller induce that? Did the driller induce that? Now, where did they break it to put in this box? This is -- this represents ten feet or 3.3 meters from there (indicating) to there. When they got it in, is that all driller induced? That's an issue. So someone who's logging this core or calculating the RQD and filling out the data sheets to put this into the computer later on at the core shack needs to have those markings on there and they're not on here. So those are the two points that I wanted to make with this. Again, that scale is important when you have small pieces like this.

Q Have you seen in the course of the materials to come from this proceeding or from the testimony anything that convinces you that actually the proper ten centimeter scale was used rather than an improper eight centimeter scale to determine those?

A I went through a number of these that were like this and I took a -- I put a line across and -- this a picture; I agree this is a picture. In PowerPoint -- not PowerPoint -- in Adobe I could -- I can take and make a scale right up here and bring it down and check, so this piece clearly is greater than ten -- eight centimeters, greater than ten. I can tell. So I went through a number of them and it appears to me that in fact the eight centimeter scale was used when you look at these more broken up sections of core.

Q So are you convinced that they've used the ten centimeter scale?

A I'm convinced that the eight centimeter was used. My opinion would be that they eight was used.

Q Now we're moving into a discussion about which would be the better RMR system to use: '76 or '89. And Dr. Carter indicated in his testimony that they deliberately stayed with the 1976 version because of, in his words, "there are flaws that the industry has *2:20:56* in the 1989 RMR classification and it remains the subject of debate." Now, do you understand the difference between RMR '76 and RMR '89 and why there was a move to develop RMR '89?

MR. LEWIS: Objection to the form of the question, your Honor. Ms. Halley has not properly characterized Dr. Carter's testimony. He did say that, I believe, but the other point he made that Ms. Halley did not include is that

in order to do the scale span stability analysis they need to use the RMR '76. So the question was not fairly put to the witness.

MS. HALLEY: Well, for the purpose of this topic Dr. Carter's response was limited to what I just read. He didn't go on and talk about that particular issue at this time. Although we can certainly revisit that, because we'll address that too. But for right now I want to talk about the differences between RMR '76 and RMR '89; why RMR '89 was developed.

JUDGE PATTERSON: All right.

Q Go ahead, Dr. Vitton.

A The intervenor's counsel's question is included in what I'm going to state, so the issue of comparing it to the use of the Q values is in my rebuttal discussion. So I do have Dr. Carter's point on that in there. So my point with this point -- or this slide is that they stayed with the 1976 with the statement that there were some issues with '89. With all these systems there's debate. There's debate as to which one is -- but in all cases there is not just RMR '76 and RMR '89; there's been a series of them, each one trying to improve on the previous one. And the way they improve it, by simply adding more data. And so if you go to my next -- this is a paper that looked at those -- the rock mass characterization for underground mines and basically

between 1976 system there were 49 tunnels and 62 coal mining projects to improve on -- and to move into the 1989 system -- the RMR '89 as we call it -- increased that database to 351 civil engineering projects and mining case histories. So it should have improved it because we've included far more numbers to try to verify that system. So in this case the '89 system has got significantly more case histories in it. And the other thing in -- change between '76 and '89 was that the waiting factors for the spacing of the fractures and the influence of water were both increased, indicating that water is an extremely important element in the stability of these -- of a rock mass, whether it's a tunnel or a mine or whatever type. So that was one of the changes. And one of the issues that was discussed in the permit was the use of the -- how many points does that water term get. And in the '89 it's increased to 15 points of that hundred we keep talking about for RMR versus 10 in the '76. That was one of the big changes that would put more emphasis on water versus '76.

Now, this is the point that I want to make about the relationship -- the statement that Dr. Carter made was that the '76 is a better representation for the Q system, which is what the scale span system was based on. That is not correct. Basically RMR '89 brought the RMR and the Q system closer together. And that's why I believe the RMR

'89 system should have been used. If you're going to use the scale span system, which was used in the permit analysis of the crown pillar, the '89 system is clearly a better system.

Q We're going to talk a little bit about in situ stress measurements and the importance of horizontal stress. Do you know this Dr. Haimson who wrote this paper?

A Yes. Dr. Haimson.

Q Okay. Thank you. And how do you know him?

A Dr. Haimson is a professor at the University of Wisconsin. He was originally with their mining department when -- the University of Wisconsin, the mining department. I had applied to graduate school there and had been given a offer to work with Dr. Haimson on in situ testing of stress conditions on the -- in Iceland, and so we interacted on that. I chose not to go there, but I did meet him through that.

Q What year was that?

A 1976, 1977.

Q Now, I believe that -- are you aware of underground projects where in situ stress measurements have been made?

A Yes. This paper by Dr. Haimson discussed two cases in which both civil engineering, underground projects in which they went and did hydraulic fracturing analysis to characterize the rock. We've been discussing at length what are the

horizontal stresses? What are the lateral? What are the clamping stresses? They went in and actually measured them. And this paper discussed the issue that they did those measurements and it did all through design of their structure -- underground structures.

Q So it's your opinion that it is possible to do -- to perform in situ stress measurements?

A Certainly it is. Certainly they drilled a 109 boreholes; they could have done hydraulic fracturing in any one of them.

Q From above ground?

A From above ground.

Q They don't have to wait?

A No. No, they can certainly -- that's how these were done. They drilled a hole -- exploration hole, and then they packed the packers in it and they pressurized it and they saw the response of the rock.

Q Okay. This is page 3,510, again from Volume 17 of the transcripts. And are you familiar with Mark Betournay and his work?

A Yes, I've met Dr. Betournay.

Q Okay. And can you describe for us what this testimony from Dr. Carter is discussing? He's referencing Mark Betournay's work and how they worked together and what they did.

A One of the analyses -- there were two analyses in the permit

to look at the stability of the crown pillar. One was the scale span method that we've talked about, and the other one was the program called "CPillar" which was created by Dr. Hoek -- and that's Dr. Hoek there -- created CPillar which was used in the permit. And this is basically a plug design program that looked at shear on the four sides of a crown. But Dr. Carter and Mark Betournay from CANMET were looking at gathering data from the old mines and forms collapses and to help create that scale span method that they were looking at. But Dr. Betournay actually created a -- there's a manual in Canada called Canadian Manual for Metal and Mine Shallow Stope Decommissioning that was written by Dr. Betournay. And Dr. Carter references work that was done.

Q Is this from Dr. Betournay's work?

A Yes. In this manual they discuss the Athens Mine and Dr. Betournay makes a point about the fact that one of the most important things or lessons learned, the relevance of the Athens Mine -- analysis of the Athens Mine plug failure showed that most of the potential confined benefits from redistribution in ground has occurred in the area immediately above the stope. The effects of the original stress field, the stope depth and the size defined in the values of redistributed stresses are therefore very important, but they weren't discussed in his testimony. And that's what I believe some of -- the relevance of

understanding the stress field around the mine.

Q Including horizontal stress?

A Yes. And one of the points that's implied here or may be somewhat subtle here is that he's also talking about what -- once you open -- you mine down to the bottom. What was unique about the Athens Mine is that they mined to the bottom and then mined upward -- is that once you make that opening in the ground you're redistributing the stresses; you're changing the stresses in the mine. And that's one of the points that this Athens example is giving you; that once you start mining you change the stress field from the initial to whatever you've changed it to. And that again was not discussed in that -- in the testimony of Dr. Carter, and also the fact this came in the Canadian manual for crown pillar analysis.

Q Now we're going to move into discussing the probability of failure testimony from Dr. Carter and the next slide will show us a table that we've seen several times. But before we go to that why don't you describe for us -- well, maybe we should just go to the table. Let's go to the next.

A Again, this is Dr. Carter's testimony. And I agree with it; that's -- I'm just -- I'm agreeing with this point. We're going to talk about a red line is the number one line and basically the red line down the middle there is a factor of safety of one. That has a probability of failure of 50

percent. And again, we're going to be talking about probabilities of failure. A probability of failure of 50 percent is failure; it means that basically you have a factor of safety of one. If you have a higher factor of safety, like 1.5 or 2, then your probability of failure will go down. It will go down around 20 percent, ten percent, five percent. Dr. Carter uses in his testimony .5 percent as the acceptable probability. That correlates to a factor of safety of two. So you really need to have a factor of safety of two or above if you want to keep in that probability of not having a failure. So that's basically what he's saying here.

So this figure that he's going to talk about is the next slide. So this is his red line, and as I put on here -- and these are my notations -- this is Dr. Carter's slide from the permit. This was figure 28. And again, this deals with the scale span assessment for the crown pillar. The first method used in the analysis. This is the red line. If you plot above it you're in the failure; unstable zone if you plot below it. So Dr. Carter in his testimony showed this line and then he showed various lines of probability of failure. So if you're above here you're at 60, 70, 80, 90 then at a hundred percent. It's coming down. If you're below the line your probability of failures are lower: 40 percent, 30 percent. These down here

(indicating) would have a probability of failure of one percent or half a percent so that these are ones that never fail or have not failed, and these are ones that have failed. So that's where this whole method came from. It came from actual mines and he scaled them. And that's the term "scaled." So we could normalize them, put them all on the same figure and that's what this value is. Across the top are the Q values that we just previously mentioned. And so the permit uses RMR and then Dr. Carter, Mr. Beauchamp in their analysis then convert them to Q. So we go from RMR to Q, so they're a one-to-one correlation essentially. There's an equation that transforms it from RMR to Q. So you can take your RMR -- and I put -- this is 85, 75 and I believe -- and my numbers are down there of 51, 45, 30 are the ones that I calculated or expected based on my analysis of the data, and their analysis 75 and 80. So you clearly see theirs are right below the red line and mine are over the red line, and that's my -- again, my analysis when I looked at this and my opinion that this has serious problems, issues.

Q Is that with the crown pillar thickness of the permitted level, 87.5 meters?

A I'm sorry?

Q Your calculation, was that incorporating the 87.5 meter crown pillar?

A Yes, if you go back -- I'm sorry. This scale is roughly about ten; that's the scale crown pillar is -- these are the -- they're all on the same scale; they're all the same. They're all -- I have to -- I can't have different thicknesses. I have to have the same basis that Golder used, why is -- they're all in the same -- that's what's meant to be, all on the same line so we're all using the same scale span.

Q Okay. This is slide 41 and this is -- well, the base table there comes from the application and Dr. Carter's presentation and then you've made some additions to it?

A Yes. I didn't have a copy of Dr. Carter's figure that he had.

MS. HALLEY: All right. The next slide, please.

A I just want to explain briefly again what a factor of safety is and -- we have -- basically it's very simple: the rock strength has to be stronger than the load pushing on the stress. I mean that's obvious. And it's how far apart those are determines your factor of safety. The farther apart they are, the safer you are. And that area underneath where they come together is where you have the probability of failure. So the smaller this is -- when I said a hundred percent, those two would come together and that's why we said it's a 50 percent probability of failure. It could go either way. So those come together. If they fall -- go

apart you're getting a larger factor of safety and a lower probability of failure. That's what this means. I'm just trying to illustrate what I said verbally here. That's the probability -- a factor of safety of one. Above it you're getting a very high probability of failure; below it 50 percent, 5 percent you're getting lower. So you want to be down here (indicating). That's where you want to be. And in Dr. Carter's testimony he's using a .5 probability of failure. .5 percent. .005 percent -- or number; .5 percent. This is an example. This came from -- this is Figure 29 of the CPillar. That's the second method they used and basically a very, very simple method.

Q Okay. Just for the record, this comes from the mining permit application and this is slide 43.

A Yes, this comes from Appendix C-2, the first geotechnical study and this had a crown pillar thickness of 27 meters I believe. Yes, 27 meters. So this was the first one they did in Appendix C-2, geotechnical report. They've since enlarged it. But I want to sort of give an example of what that probability means. So this is a very simple thing. You've got the weight pushing down and you have the load or those illustrations of the hands clamping, holding it up. So if you know the load pushing down and the strength of the material holding it up, you can come up with a factor of safety. This factor of safety was 2.0 -- factor of safety

of 2.01, but the probability of failure was about 20 percent with this example. And so that would have -- even though the factor of safety was 2 in this example, the CPillar program was saying the probability of failure was 20 percent. Now, I just want to compare that to a typical bridge in the United States. The probability of failure is around one times ten to the minus seven in terms of probability of failure. And bridges do collapse as you know. But I just wanted to make a comparison between these two.

Now, the next slide. This is a crown pillar risk assessment by Dr. Carter. So this is where he tabulates his probabilities of failure. If you look at this column here (indicating) 50 to a hundred percent, 20 to 50, 10 to 20, in that example would have fallen in this -- what I outlined as a red block and then five to ten, 1.55. You go to the bottom, there's the .5. What's very useful about this table that Dr. Carter has put together is that it gives you the minimum factor of safety, not the actual. This is a minimum factor of safety. So a factor of safety of 1 would have that 50 percent between 1 and 1.2 it drops to -- from 20 to 50 to 10 to 20 and so forth; it goes on 1.5. So things are getting a lot better as you go down. And there's 2; that's the minimum. Greater than 2 then has that .5.

If you come down here (indicating) then, this is

the expectancy. Okay? Basically it's going to collapse. If you go down to the 20 to 50 probability, very short term. Very short term. As you keep going down, as your probability -- factor of safety goes up, your probability goes down. If you go down here medium term, long term, very long term; it's going to -- you're not going to have a problem long term. These are the years in which you could expect it to stay up. And this typical hundred years is the standard number we use in engineering. We always say a hundred years.

But public access. For example, if you had a hundred percent -- you don't want anyone over it. If you go down to 10 to 20 percent actively protective or -- but you don't want people in there and so forth. Between .5 and 1.5 you can allow people -- and that's -- I'm sort of going on. But the next column is "Regulatory Position on Closure." What should the regulatory authority do in terms of these probability of failures. And, for example, 50 to 100 is totally unacceptable. 20 to 50 would have been not acceptable. So that figure 29 would not have been acceptable. 10 to 20, high level of concern; 5 to 10, moderate level of concern; 1.5 to 5, low to moderate, and so forth. .5 is of no concern, and that's where we need to be with analysis.

Q So you point -- I think one of your points here is that as

the application was first submitted by the company, they themselves predicted a 20 percent failure, which put them in the very short-term stability range and only predicted to stand up for 2 to 5 years?

A No; no.

MR. LEWIS: Objection to the form of the question. It's leading. It also mischaracterizes the testimony of Dr. Carter and Mr. Beauchamp and the reports themselves.

A I believe --

JUDGE PATTERSON: Let me rule on that. Can you rephrase that?

MS. HALLEY: Sure.

Q What I'm wondering, Dr. Vitton, is if we look at your slide 43 -- maybe we should go back. I'm looking here at the failure probability 20.23 percent. Is that what it says?

A Yes.

Q Okay. Now, let's go back to the other slide. Now, 20.23 puts us right up in what's here called line B, Class B; right?

A Yes.

Q Now, I'm just clarifying my understanding that the failure rate -- crown pillar or the failure rate predicted in the Kennecott application of 20.25 percent was what was originally proffered by the company in their application -- is that correct? -- the 27-meter crown pillar?

A No, that's not correct. I believe that that figure was only an illustration. In the permit I believe they were working between 5 and 10 percent in the permit application. I believe that's the case. Which 5 to 10 percent would be in the next one down.

Q Okay.

A I believe that's the case, the permit was 5 to 10 percent. I'm not sure why they put figure 29 in there, because I -- they didn't use the C pillar as their basis for the -- they used the scaled span method, not the C. They for some reason said "we used C pillar" but didn't really use it later on. The stability analysis I believe they used was a scaled span method, not the C pillar.

Q All right. Next slide. Dr. Vitton, are you familiar with this slide?

A Yes. I created this slide. In Dr. Carter's testimony I had -- in my testimony I had prepared some numbers that were presented in my testimony, and Dr. Carter went through those and stated that I had made a mistake with those numbers. And, in fact, he is correct. I did make a mistake in my calculations. I have redone them, and my numbers correlate exactly with Dr. Carter's. So this is -- so this table would replicate Dr. Carter's testimony and mine. This is what I'm stating now as how I recalculated my numbers, so we're in agreement.

Q Can you explain to us what the case 3, case 1 and case 2 -- what those represent?
A In my testimony, I used -- we've been talking about a 10 meter span. And I have used a 15 meter span. Because in the permit, it's in there both times, but for whatever reasons, my case 1 was 15 meter span, my case 2 was a 68 meter span and Dr. Carter, out of the third case, which would then have been the 10 meter span. So I put them 10 meter, 15 meter, 68 meter, so the case numbers are not in the right order. But they're all for a crown pillar thickness of 87.5 meters.
Q The permitted level?
A The permitted level is 87. So the number --
Q And then in the left-most column below the crown pillar thicknesses RMR, which is simply the same RMR concept we've been talking about for a long time now; right?
A Yes. Using the scale span method that Dr. Carter talked about, that I talked about and that I'm using here, again we both -- we all agree this is his table and my table together -- or we both -- I guess I'd say we agree. I got his numbers, so I would say we're in agreement.
Q Okay. Now, I see that part of your table -- this table is shaded in sort of a red color. What does the red shading indicate?
A Again in the permit they have stated they wanted to have

factor of safety greater than 2. And again going back to Dr. Carter and from the Carter-Miller paper, that would require -- that would give you a probability of failure of less than .5 percent. So all the red would not meet that criteria. Everything in white would meet that criteria.

Q So could you just summarize for us this case 2 column looking at the full span of the crown pillar and an RMR of 75, what's the factor of safety?

A The factor of safety is 1.97.

Q Okay. And so from there, what happens to the numbers as we go down that column to the lower RMR's?

A Again, the Rock Mass Rating, the RMR, 85 is very, very good rock, good rock and so forth. It's going downward. It's still considered relatively good rock here. But the factors of safety are dropping down into lower values, and thus the probability of failure is going upward above the .5 percent probability failure. So again if you have very good rock and the span were to be 68 meters, the factor of safety would be relatively high of 4. If the rock quality dropped, more fractures, lower compressive strength, whatever -- water in the joints, things of that sort, the factor of safety would drop below the factor safety of 2, which would be that .5 percent probability.

Q Now, Dr. Vitton, did you have the opportunity to review Dr. Carter's report related to the hydraulic conductivity of the

crown pillar?

A Yes.

Q And his testimony related to that report?

A Yes.

Q Now, did you arrive at some conclusions based on your review?

A Yes, I did.

Q Could you describe those for us?

A Dr. Carter's report, just a couple of points I'd like to make. It included five boreholes. So he went into the database. I believe there was 109 available. He used borehole 47, 54, 73, 77 and 83. And those all have relatively high RQD/RMR boreholes. They're relatively high values.

Q Do you believe that using only five holes was appropriate?

A I don't believe that's appropriate in the sense that you have a false -- all 109 available to you. He used five out of the 26 that are considered the crown pillar holes. He used five of them. And they tend to be relatively high RQD and RMR. He also came up -- he was looking for a number. And that was how many fractures, how far apart are the fractures. So in his model he could put that into his model to see how the stress changes would affect that distance. And he came out with an average fracture spacing of 2.08 fractures per meter, which means that's roughly -- you got 1

meter, you have two fractures. It's a 30 -- roughly 30 meters. And that's why it's approximately 30 meters -- I'm sorry -- 30 centimeters between the fractures. If it was perfectly two fractures in a meter, you'd have roughly 30 centimeters of fracture length. That would be the distance between the fractures. He also made a statement that, "All right. I looked at these five boreholes" in his testimony. And those looked pretty good compared to the RMR values that were presented. And I would say, yes, they certainly would be if you're only taking five good holes. You're still not considering the discrete features they're missing. His analysis doesn't include those highly fractured zones that were found in those crown pillar holes.

Q Is it your opinion that those areas would be the most water conductive areas?

A Oh, certainly. The highly fractured -- you're not talking at least two fractures per meter. You're talking many, many fractures per meter. So I would -- I have a problem with again only using five very good holes.

Q We've talked a little bit about RQD's and maybe if we want to just --

A Well, I just want to -- I use this to show -- when we're talking about that fracture, the distance between fractures between, for example, here -- if that was a solid core, it'd be here (indicating). That's what I'm talking about. So

when I said roughly 30 meters, there's 38 meters -- I'm sorry -- centimeters. Excuse me. 30 centimeters roughly would be what I'm talking about, the distance between a fracture here and if this was a fracture up here.

Q And I think you've done a little comparison of the average RQD's for the rocks that Dr. Carter used on the left-hand side for the hydraulic report and then the eight crown pillar holes that you reviewed; correct?

A That's correct.

Q And these are simply averages of the RQD's provided by Kennecott; right?

A Yes; yes. These are for the top 88 meters. So we're looking just at the crown pillar -- just the crown pillar. His RQD average was 92 for those five holes, and these are -- again, these are the numbers that came from their information. This is nothing I created. So 55 was that very good hole. And Dr. Carter mentioned in his testimony that our actual RMR came higher than theirs for this hole. And that's correct. We also had a very high RQD. But as you can see, the rest of them included the discrete features. And so they went down very dramatically. The average of these eight was 76 versus 92 for the holes that were used in this hydraulic report. So you're using very good cores compared to the other eight. And again there were 26 total, eight crown pillar holes that we looked at,

all the ones we were able to look at, and he selected five out of those 26. And my point is simply they seemed to be pretty good boreholes. I don't know what the other holes look like.

Q Okay. Because we haven't had access to them?

A We haven't had access to them.

Q Now, is it your opinion, Dr. Vitton, that we should just accept that these five holes are somehow representative of all 26 that are said to be in the crown pillar?

A No. Again you have 26 total. You select five. We still have those other eight of the 26. So my point would have been to have used all 26. Because he used a computer to get his data. I don't see why using a computer to cue this data up would have been any more difficult to come up -- he was just looking for that number. What was the distance between our fractures to put into this numerical model to look at how the stress changes are going to occur.

Q So given the fact that only five holes were used and, in your opinion, those are very good holes with high RQD's compared to others that he didn't use for whatever reason that had lower -- significantly lower in some cases RQD's, is it your opinion that the conclusions he arrives at in that hydraulic report really should be taken as representing hydraulic conductivity of the crown pillar?

A No, not even close. I have other serious issues with the

report.

MS. HALLEY: This is Intervenor's Exhibit 278, not the whole thing; a portion of it. But I think Dr. Vitton just wants to point out a few key features of this exhibit.

A This was Dr. Carter's exhibit. He presented the -- all the data for the five holes that he used in that report. And this is just a sampling of borehole 54. And again all this information was -- somebody went into the core shack, took the box and collected the information off of the core. And it was put onto this table. And that table went into a computer. And then all of the analysis that was done was based on this data. So again this is the hole ID. There's your 54 Eagle and so forth. But this is the information -- all of the information that came for, for example, this section from 13.11 to 15.24. Let me back up. It's not all the information, but the stuff related to stability is in this section here. For example, I'll just point out here. I know it's sort of hard. But rock type, well, peridotite, that's the "PER." Total core recovery, that's how much core they got out. Solid core recovery, essentially the same, 1.8, 1.8, if you're following me. I apologize. But the important thing over here is RQD, the number. And this line here, 1.8 was core, 1.8 -- 1.8 came out of the core barrel. The length was 1.8. And everything was above 10 centimeters, so it was 1.8. So that had an RQD of 100. So

you can go forth. And this again was a very good hole. This was a very good hole, so very few fractures in here. But if you keep on going and you look where there's another term over here called "RRS," that's internal rock strength. And it's a column over here. Anyway all this information is on here. One other piece of information here, if we go over here, is OF. That's the number of fractures. How many fractures that were non-driller, meaning the drilling operation induced. So we know for each section of core how many fractures there were. Somebody determined that for this core except for the sections that had no markings. You couldn't have determined that. So anyway I took this data, and I -- the next slide will -- I put it -- I just looked at the crown pillar. I went from 13 meters down to roughly 88 meters, rock type. And I just took the data out of that. And I put it in columns. And so I just -- this is their data. I just simply looked at it a little bit. I wanted to see -- there's a number -- I wanted to see how many average number of fractures there were. And if I divided by the length of core, I wanted to know roughly how long each average fracture. And, in fact, for this good hole, it's about 31, which is exactly what Dr. Carter stated roughly for the average for his model.

But I noticed two more interesting things on this data is I have red numbers here. This is the core run

length. that means the drill drilled X amount, pulled it out. You should get that amount of core or less. But where the red ones are, they're actually higher. They drilled 1.22 meters but got 1.33 meters out of the core barrel. That's a mistake. And it's probably a simple mistake. It's probably a field mistake. But somebody should have caught that, because that's in the computer now. And if you calculate the RQD, you get 109. So again I don't know how all that calculated, but this is the data on that table.

The second thing and more troubling to me is the fact that intact rock strength only has one number all the way down for the crown pillar. They only have one number. They used one strength for that entire borehole. I'm sorry. For that crown pillar which goes from 13 to 87, they have one rock strength.

Q Would you expect that the rock would all have exactly the same strength for a distance of that far?

A No; no. You've got peridotite, you have semi-massive peridotite, semi-massive. I would have expected some variation. But that number 3 correlates with a Rio Tinto's geotechnical manual according to the Exhibit 303, which is the drilling manual they used. And I have no idea what 3 means. But I can assume that it's all the same, whatever that value is, it's put into the computer.

This is the second hole that I wanted to look at

was 73. Now, 73 was the lower RQD hole that he used. And this was all the sediments -- were all the way down. Again we had the same problem with -- you got 1.07 length of drilling and you got 1.15 out. But the other thing is you got all the same number for strength, so it all has one number, 2, whatever that means. And --

Q Do you think that's realistic?

A Pardon?

Q Is it realistic?

A Not for the sediments. Clearly if you're going through 87 meters of rock, that's basically the Baraga formation, which is inner-bedded shale, slate, sandstones. You would expect variation in the strengths. Again -- but what you want to notice here is that these lengths of core were a lot lower because the rock was highly fractured. It's fairly fractured. And so the numbers of fractures are up quite a bit. I think the average here is around 16 for length. But if you go to the -- so I want to take this data and plot it. So this is the good hole RQD 99. I plotted it all out. There's my 30 rough average. And the data pretty much follows that. So for the good holes, that number 2.08 fractures per meter, is probably pretty good. So I can't argue there. But the next one is the RQD 80 hole where your fractures increase.

This is quite a bit different story. 37 meter

average, we're way below that. Again this is the 88 meters that I went down to. So the point here is that the number of fractures is a lot greater in the poorer holes than the really good hole which is the RQD of 99, and that's the average Dr. Carter used for this model.

MS. HALLEY: We're moving to a different area. It might be a good time for a short break.

JUDGE PATTERSON: Okay.

MS. HALLEY: We'll be back real shortly.

JUDGE PATTERSON: Okay. About ten minutes.

(Off the record)

JUDGE PATTERSON: Okay.

Q Now, Dr. Vitton, we're going to discuss Dr. Carter's hydraulic conductivity model. You've had an opportunity to review, I believe?

A Yes.

Q Okay. Now, this is from volume 17 of the transcript, page 3,636. And I believe you did some highlighting on this slide?

A Yes.

Q Okay. Now, why don't you describe why these portions are important?

A Dr. Carter used two models. The second model I had somewhat -- I was familiar with the second model. He used a model from a paper Bai, I think it's pronounced, B-a-i,

and Elsworth, 1994. I was a reviewer of that paper, and I had rejected it. So it caught my attention. And the question that was raised in the testimony of Dr. Carter was stated that it was -- the model was based on a long wall -- underground long wall mining operation. And there was discussion after that. And he claimed it doesn't matter; the equations are ubiquitous. And basically the equations could be applied in any mining operation. So he's correct. I'm not sure I'd use the word ubiquitous. But the equations are the equations; the model is the model. The problem I have with Dr. Carter's report is that the verification does -- I can create a model. I can write a model. The question is how accurate is it. And this paper took their model and applied it to a long wall mining operation, in which case a coal mine seam is mined continuously, and the roof behind it drops below it behind it. And this could be a 5-foot seam, a 6-foot, a 7-foot, an 8-foot. Either case the ground on the surface is dropping 2 to 3 feet, in some cases, some cases more, some cases less. But, in fact, you're creating a tremendous movement of earth from the coal seam up to the surface. And that's -- so he took that data set and applied it to this model. And so I looked at that analysis. I did not look at the mathematics of it. I did look at did it meet reality. Did it fit the field data. And the reason I rejected the paper was this is the

information from that -- from the paper. This is exactly the model that Dr. Carter is using, the parallel plate model in which it's assumed that all the fractures are parallel in one direction and then orthogonal or normal in the other direction. And again the model he used again could be used anywhere. But the verification of it was based on a long wall mine.

So this -- the data came from another paper that was from -- the reference is up on top -- three authors, 1988, a hydrogeomechanical study of overburden aquifer response to long wall mining. So that's where the data set came from. So Bai and Elsworth said, "Okay. Here's my model. Just put that data in and see if we can replicate what happened to this aquifer. Can we affect it?" And that model was trying to show that the permeability is increasing so that the net effect of that paper says that, in fact, as a long wall mine goes through, we're increasing the permeability of the rock between the coal seam and the aquifer and you could lose -- or increase the hydrologic conduits for the aquifer to be lost into those fractures that are being created. And I reject -- I had a problem with that. Coming from the mining industry, the coal mining industry in particular is that -- okay -- is that model really valid. Because I didn't want this going out into the public into archival journal article to be used in

proceedings like this.

So there's his model. And the real problem I had with his paper was, to model it, you had to have a value for the stiffness, now stiff is this rock. And this rock here is sedimentary rock, quite a bit weaker and a lot more -- not quite as stiff as the rock we're talking about at Eagle. Even so, the table below was the stiffness values, how stiff is it. If I press on it and let it go, how stiff is it? Their modulus that they were using -- and this is -- the numbers in table 1 of the paper by Bai and Elsworth are my -- I just converted their modulus, which is the stiffness value which is the issue that Dr. Carter is using, that Bai and Elsworth -- if it's really stiff matters how the stress changes, how much movement I'm going to get. The modulus were roughly about 1,000 psi. That's the stiffness modulus that was used in this paper. The reason it was -- okay. That's what was used, roughly 3,000, 5,000 psi. Is that realistic? The answer is no, absolutely not. That's a stiffness of soil, of clays and sands. What is the stiffness of rock that we're using at Eagle or this mine? So I went over to the far column using my -- this is my calculation -- or not -- what does -- if I have an RMR, it's really high, I have really stiff rock. If it's low, it's not as stiff. So I went from an RMR of 80 and I calculated the stiffness using a standard equation that's in the

literature. And I get in the millions. So the stiffness of rock should be like 2 million psi, 1 million psi, 3 million psi. That's roughly what the rock in this mine should be. The rock at Eagle should be more in the 10 million, 12 million psi range. They're using 1,000. And so the reason they used 1,000 is they couldn't get the model to replicate the field results. So they kept lowering and lowering and lowering the modulus until the field results met the model results. And I said that's not verification of that model and thus rejected the paper. That was my reasoning for rejecting the paper. So I have a problem with the model that was used in Dr. Carter's, because I do not believe it was verified. It's a model, but I do not believe it was verified with field data.

Q Okay. Now, Dr. Vitton, you have prepared some slides that incorporate Dr. Carter's conclusions; correct?

A That's correct.

Q And I think his conclusions are what's in black or brown, something like that, though; right?

A That's black, yes. His concluding remarks I've put in in black letters and my response in red.

Q Okay. Now, let's start by discussing this conclusion that Dr. Carter drew at the end of his presentation.

A Okay. The order of my responses are directly related to the concluding remarks of Dr. Carter's testimony. And the end

of his testimony, his concluding remarks were stated on a slide that I took -- or I basically put onto my slide. So his first concluding remark was, "Probablistic check on RMR's for 26 holes" -- that's the crown pillar holes -- "validate the general range of RMR's assigned in Appendix C2 and C3." My response -- my first response is, "That's not valid. While the probablistic analysis considered the 26 holes, the RQD values appear to have been incorrectly calculated using the 8 versus the 10 centimeter scale." So that's point one.

Two, "The comparison" -- in other words, his probablistic check was only on five of the better holes of the 26. So therefore it did correlate with the RMR's in the permit, which I'm not sure exactly what you're saying there, if you're taking the five best holes. It didn't include those eight holes with all the structural defects in them even though those had RQD's assigned to them. Again did not include the highly fractured zones in the last -- in at least eight of the boreholes. He had the RWD's of those. But again those were based on cores in which there was no markings. And I still don't understand how they calculated those RQD's.

The next point they assumed dry conditions for all RMR values. That 85 assumed no water in the -- absolutely dry conditions. I said, "However, in the application and

Mark Logsdon's testimony states the crown pillar will be saturated." So that, to me, is a big disconnect and stating that the RMR's are validated. I do not agree with that.

MS. HALLEY: Just for the record, Mr. Logsdon's comments at the crown pillar being saturated is in volume 20 of the transcripts, pages 4,224, and the applicable citation to the application is Appendix C3 and on page 14 the application states, "The water depth that was used in the analysis assumed the crown pillar was completely saturated with water," just to clarify the record where that point is coming from.

A Again if you saw my evaluation of those two holes, they only used ones that appeared -- and I can't directly state the entire RMR calculations -- but it appears that they only used one strength parameter for each rock type. So it's peridotite. It all had one value everywhere. If it had -- if it was sediments, it had one value. If it was a semi-massive, it had one value. There was no variation in that value either upper or lower. There are no RMR values included for the highly fractured zones. More importantly again in that RMR calculation there's one value they did not put in there, and that was the correction factor at the end. I call it AB parameter -- was not considered, which even in the most minimal case would have lowered the RMR values.

And the last point I would make is again the RMR

89 system should have been used instead of the 76. It's a more valid system. It's got more data and it relates better to the Q system that was used in the scale span system.

The next concluding remark Dr. Carter made was, "Scale span calculations for permitted crown pillar of 87.5" -- that's the permitted -- the DEQ permitted value -- " and permitted maximum opening" -- that's an important point -- "is only 10 meters." So -- and he does show -- and my numbers do verify that you do have a factor of safety greater than 2 and probably a failure less than .5 percent. I agree with that statement. But it's only valid for the 10 meter span and not if settlement occurs in the secondaries or the primary pillars in long term. This analysis does not consider long-term effects.

Q Just for the record, the rest of that sentence is just there by an accident; right? Just a typo?

A Yes, it's just a typo. I've explained what I said previously. I did not want to --

Q Just so we don't leave anybody wondering if there was supposed to be something else.

A Yes.

Q Okay. All right.

A The next concluding remark, "Calculations even for poor quality rock RMR of 30," which is extremely poor -- very poor -- "show a factor of safety greater than 1." And that

is a correct statement. That is correct. However, factor of safety for RMR of 30 has the following factor of safety of 1.04. That's cutting -- that is technically correct. It's greater than 1. But 1.04 is essentially at a failure. Our numbers are not that accurate that we can claim a 1.04 is greater. I think that's being someone disingenuous.

Q Now, Dr. Vitton, could you explain why in these slides we're talking about a factor of safety of greater than 1 and in Carter's slides, we're talking about a factor of safety of greater than 2 -- 2 or greater?

A Okay. Again in his analysis -- again I'm basing it on his work in the paper cited Carter/Miller 1994 paper, probability table. Those are based on a specific model. Okay. So exactly how the factor of safety relates to the probability is based in that paper. And I don't have that at this point. But what they're saying is, a factor of safety greater than 2 has a probability that would be at or below .5 percent, which is the -- what you should get for a long-term analysis or a long-term -- analysis for long-term conditions.

Q So is there any reason you can see about why we're now talking about a factor of safety of greater than 1 instead of greater than 2?

A I do not understand this. It's technically correct. But it's -- in my opinion, it's disingenuous. To say that it's

greater than 1 and then have a 1.04, essentially a probability of failure of near 50 percent, is again -- you're essentially at failure there. If you look at the other spans, you're way down -- you're up near 99 percent probability if you had an RMR of 30.

Q For the factor of safety RMR 30 at 68 meter span, what is the factor of safety there?

A The factor of safety again according to the analysis that Dr. Carter put in and I verified with my calculations is .21, again which would have an extremely high probability of failure up in probably the 90 to 100 percent range.

Q Is it your opinion, Dr. Vitton, that, at some point, the span actually will be 68 meters and not 10 and not 15, but 68?

A In my opinion, based on my analysis, I believe that you will see settlement in both the secondaries and in the primary pillars, which would then create about a 68-meter span long term, over time. Once the mine is done and down the road in the long term, I believe that span will be created by the settlement of the backfill. That's my opinion.

If you'll go back, again the RMR of 30, if you look at the table in which this RMR comes from -- all of this calculation comes from, and RMR 30 would only have a stand-up time of ten hours if the span was 2.5 meters. So we're talking about hours of how long that span would stand

up. It's referred to a stand-up time. So it's not even really logical to be talking about an RMR of 30.

And the next concluding part, "Calculations for full width span" -- that's the 68-meter span -- "for a mean of RMR of 70 shows a factor of safety greater than 1." Again it's less than 50 percent. So if you actually look at the numbers based on that table, an RMR of 70 has a factor of safety of 1.49, which is a probability of approximately 10 percent. If the RMR number just drops 4 points to 66, the factor of safety drops to 1.24, probability of failure goes up to 20 percent. If the RMR drops to 60, the factor of safety is .9 and it's failed. You have between 50 and 100 percent probability of failure if that span of 68 meters is created based on Dr. Carter's analysis.

So simply in my -- right here is if we just simply assume that water in the fractures just -- not moving water, not water under pressure, that's going to lower that RMR down to around 62, which is a factor of safety of 1. So even based on their analysis, if settlement occurs and the span of 68 is created, it's very likely to have failure of the crown pillar.

Again I'm just showing what those probabilities of between 10 and 50 represent in terms of both regulatory response, which should be not acceptable and high level of concern. Again I'm just trying to relate it back to Dr.

Carter's table.

Q So even looking at the previous slide with the 68-meter span and an RMR of 70, we're still in the probability of failure range --

A Of 10 to 20.

Q 10 to 20, which high level of concern, stand-up time of 35 years, very short term. This is the range that scenario was in; correct?

A Yes. The next statement, he listed under a new heading called "precedence relevance." And this section again dealt with the long often discussed Athens Mine. He states, "Soft ore mine (Mather A Mine) are not relevant to mining the Eagle." And again I don't agree it's correct. The soft ores are actually harder, stronger than the ores at Eagle. And the hard ore mines at Cliff or Sudbury basin provide much more relevant precedent cases. There have been crown pillar collapses at the Cliff Mine. If you remember Dr. Carter's testimony, he separated the mines into yellow mines and green mines. The yellow mines were the soft, and the green mines were the ones that were in hard ore, the Cliffs Mine being the one that he discussed at length. That mine has had crown pillar failures. And that's the one Mr. Parker was referring to that I pointed out on our trip down here to this proceedings. So as far as relevant court cases, there are many relevant mines to study. And the one

I think is very relevant to this would be Rio Into's Palabora Mine in South Africa whose crown pillar failed in 2004. That has a lot of similarities in terms of analysis, not necessarily in terms of the mine plan or the mining that they were planning to do but certainly in terms of the analysis, how they viewed their water, the fracturing of the crown pillar were all incorrectly analyzed resulting in the failure of the crown pillar. So I do have some slides that refer to that case. And the point -- again talk about precedence relevance is Dr. Carter states that the Athens Mine -- if I could read some of his testimony -- "Many of the failures that we're talking about occurred in the 1930's. They occurred when mining was in a very uncontrolled state. People were in depression mentality. A lot of the mining was that I would call cavalier. They were mining extremely close to the surface and they pushed beyond the envelope, so the collapse occurred because of lack of control, lack of design and so forth." And his concluding point is, "But a lot of it comes down to poor design." And again I'm going to go from the 1930's to four years ago in which case we had a crown pillar -- major crown pillar collapse at a Rio Into Mine.

MS. HALLEY: Before we go on, for the record, this testimony comes from volume 17, page 3,511.

A The Palabora Mine in South Africa, it started in 1954 and

operated as a surface mine. And then they got too deep and they decided to mine down underneath it, come under the mine and mine upward. And so they had a crown pillar -- they were actually planning to mine through the crown pillar. And the ore is vertically dipping just like Eagle. It's an igneous -- different type of rock, but it's igneous. The compressive strengths were relatively -- the carbonites were roughly the same as Eagle, 17,400 for the strongest rock. Some of it's higher. But the RMR overall at this deposit was 60. That's what they state in the literature was 60. And this was the cross-sections. You have the big open pit mine and then they're going to mine down -- vertically down, come across and then mine underneath it. This was an extraordinarily challenging -- but they had a lot of knowledge of this. They had 50 years of mining. They mined millions of tons of rock. They had drilling information. They did extensive analysis of this mine. And I'll show you a picture of what it looked like.

Q Before we go on, is the green --

A The green is the crown pillar -- the crown pillar.

Q Okay.

A So -- and so the crown pillar would have been at the bottom of that downward. And they mined underneath the bottom of that mine. And they were going to mine it upward using block caving, which is discussed extensively by Dr. Carter

in the Athens Mine testimony of what he called block caving. And what happened is the crown pillar failed, and the whole slope collapsed putting about 130 million tons of diluted ore -- of poor rock into the crown pillar because it failed.

So basically modeling done by external consultants indicating the pit walls would be stable. However the crown pillar failed in 2002. It finished failing in 2004. I said earlier it was 2004. But it finished. History has shown that these models were not accurate. During 2004 that's when the collapse occurred of the walls of the surface mine.

The big issue was water and water in the crown pillar. They assumed they get roughly 21 inches of rainfall a year. It was considered the storm runoff would be substantially attenuated within the crown pillar releasing flood water at a rate that could be managed by the underground pumping system. So they understood that they had fractures and the water would be moving through those fractures. So they designed their pumps accordingly. However the actual storm event showed that the water moved a lot more rapidly through the crown pillar in less than 12 hours indicating the cave material had some very high hydraulic conductivity, several orders of magnitude greater than was originally estimated.

And basically the lesson by the mining technical manager there -- an excellent lesson learned from the

experience is always the question of status quo. In other words, we did this modeling, but we didn't really ask enough questions about it. There's the references that this information came from.

Q Now, Dr. Vitton, we're on to your concluding remarks. And I'd like you to read them indicate whether you are in agreement with these conclusions still after reviewing all of the testimony in this case, after reviewing the exhibits, all the material that's been provided during this contested case proceeding.

A Okay. My concluding remarks are, "No exploration drilling was conducted to specifically collect and determine the rock mass values or characteristics." Number 2, "RMR values were incorrectly calculated using highly optimistic, unrealistic assumptions." The assumption that you have no water in those cracks, fractures, fault zones, gouge zones. shear zones, all those identified in the discrete features of the eight boreholes of the crown pillar are not addressed in the RMR values. In my opinion, there was no real consideration of long-term effects. There's significant discussion and analysis short term, while you're mining, not long-term analysis. I believe that point 4, "Significant settlement will occur in both primary and secondary stopes, the primary being the cemented aggregate. The secondary stopes will be the unbounded material, leaving a void below the crown

pillar."

My next point -- concluding remark is, "Tight backfill against the crown pillar will not be able to be maintained over time." My next remark is, "Calculations indicate that the potential for crown pillar collapse is high." And my final comment is, "The permit, in my opinion, is believed on more of a gamble and hope strategy. Gamble by putting the mine in first and hoping the raw conditions will be able to be dealt with once underground." That's what I would refer to as more of a gamble and hope strategy. My last point is, "None of the testimony or reports presented during this case changes my opinion that the crown pillar is likely to fail."

MS. HALLEY: Thank you, Dr. Vitton. I have no further questions.

MR. WALLACE: I think I just have one brief area.

DIRECT EXAMINATION

BY MR. WALLACE:

Q We looked at an exhibit. Maybe we can look it again. Slide 44. And I think, when you were testifying -- and this is from a Carter publication, is it, sir?

A That's correct.

Q Okay. And when you testified you took a step below the red line area to a scenario where the probability of failure would be 5 to 10 percent; correct?

A Yes.
Q And what I want to ask you is, let's take the 5 percent probability of failure. And that's more conservative than 10 percent, is it not?
A Yes. You'd rather than 5 percent probability than 10 percent that it will fail.
Q You'd rather have 5 percent. Okay. And then you gave us a figure for the average probability of failure of a bridge in the United States; correct?
A That's correct.
Q Okay. And I think the figure you gave us was 1 times 10 to the minus 7th; correct?
A That's correct.
Q Could you compare for us, sir, the probability of 1 times 10 to the minus 7th for a probability of 5 percent?
A It's an order of magnitude of 10 million roughly -- no -- 1 million.
Q Okay. 1 times 10 to the minus 7th is one chance in a million, is it?
A Well, that's not how this probability of failure should be characterized. It's more that the information we have on the strength of the rock versus how much loading it's going to get. Obviously if the loading equals the strength, it's going to failure. Those two distributions, we don't know that information well enough. We have what Dr. Carter

referred to as a probability distribution function. In other words, my data is scattered all over, but I have a mean. I have that mean. And I have the additional data. It's how close those distributions come together. And the 1 times 10 to the minus 7th is that is how much they overlap. So we've very confident a bridge won't fall down, because we have very little uncertainty of the strength versus the loading with the case of a bridge. 5 percent means that that -- the knowledge of our strength which is RMR's and again that's a big debate -- and our loading overlap by at least 5 percent. So that's a very high probability in relation to the bridge example.

Q Okay. And could that probability be as much as 50,000 times greater probability? In other words, 5 percent is --

A Again I --

Q -- 1 in 20, is it not?

A Again I don't -- I cannot say that you have 1 in such and such chance. What I'm looking at is again the -- how strong the rock is versus how much loading it's going to receive. So I can't relate it to 1 in --

Q And I'm not really asking for a calculation. I'm just trying to understand a proportion between 1 time 10 to the minus 7th and 1 in 20.

A Okay.

Q Roughly, understanding these are not exact calculations but

to understand the difference between the probability of failure here and the probability of failure of the average bridge.

A Again we're using the word "probability." I'd like to use the word "uncertainty."

Q Okay.

A Our uncertainty is in the crown pillar analysis a million times greater than it would be with the design of the bridge.

Q That's what I wanted to know.

MR. WALLACE: Thank you. I'm done.

MS. HALLEY: I just have housekeeping items. I'd like to offer Dr. Vitton's slide presentation as a demonstrative exhibit. And I think I also failed to do the same with Mr. Parker's slides. Dr. Parker's would be Petitioner's Exhibit 185. And Dr. Vitton's would be 186.

MS. LINDSEY: I would restate our objection based on the improper scope of rebuttal, your Honor. Other than that, I have no other specific objection.

JUDGE PATTERSON: Mr. Reichel?

MR. REICHEL: Subject to objections that I made to the testimony at certain points, I have no objection to P185, the Parker.

JUDGE PATTERSON: Right. P186, Dr. Vitton's?

MR. REICHEL: Same position.

JUDGE PATTERSON: Same position. All right. I will admit them over the objections and concerns for the limited purposes.

(Petitioner's Exhibits 632-185 and 632-186 received)

MS. LINDSEY: Your Honor, if we may, I have Ms. Lindsey here. And since, as you know, we broke up the subject matter, she has a few questions on the factual areas pertaining to Dave Stone and Tracey Arlaud. And she handled that part of our case. So with the Court's permission -- I think we've allowed opposing counsel that on at least one instance -- we'd like to have her do those. And then I'll turn to the rest of the cross-exam.

MR. WALLACE: Based on the prior precedent, we wouldn't object.

JUDGE PATTERSON: Reciprocity.

MS. LINDSEY: Good morning -- good afternoon, Dr. Vitton. My name is Sara Lindsey. I just have a couple of questions for you.

CROSS-EXAMINATION

BY MS. LINDSEY:

Q You testified earlier that you have no experience -- personal experience with this type of mining; correct?

A "This type" meaning?

Q With the stopes and the use of the cemented aggregate fill.

A Not directly. My master's thesis was going to be in the copper mines in the Keweenaw, which was looking at hydraulic fracturing in the 30th level in a stope underground mine. Other than that, I do not have experience in that type of mining.

Q Okay. No personal experience with the use of cemented rockfill proposed here at the Kennecott Mine?

A That's correct.

Q In the literature you cited, one of the slides -- and I don't know if you have the slide in front of you, but your slide number 8 was some quality control issues that you cited to. And one of them is the -- and I believe you said the high decline in traffic due to backfill trucks. But that would be an issue here because they're not going to be using that method of delivery of backfill; correct?

A That's correct.

Q Okay. Your understanding of dilution is that that's an operational issues; correct?

A In general, it is.

Q Okay. Dilution has nothing to do with segregation or with settlement; correct?

A Yes, it does. The problem with segregation is that it creates weak zones in the cemented aggregate fill and therefore, when they got to blast out the secondary stopes, the cemented aggregate then falls into the same -- with the

ore and gets mixed in with it. So that's what we call dilution. So, yes, there is a connection.

Q So what happens with dilution is that some piece of the fill could fall into what you're trying to mine out?

A Yes. The Parabola Mine would be a classic example. In this case, that was again not designed. I mean, that was a design flaw that created a high level of dilution into the crown pillar and the ore.

Q The dilution, though, just so I'm clear is the fill falling into the ore that you're trying to mine out?

A Anything that falls into the ore that has to be hauled out is called -- it would be considered dilution.

Q Okay. And then you fill the secondary stope after you've mined it out; correct? You're filling it with this -- you've referred to it as the loose -- you're going to fill the secondary stope after you've mined it out; correct? You understand that?

A Yes; yes. I understand that.

Q All right. The other issues that you've cited or were cited in this article for quality control issues, the wear of the fill pass is likely to continue causing probably stability problems later in the mine life also would not be relevant because of the methods that the fill would be delivered in this case; correct?

A That's correct.

Q And so finally the future extensions of the CAS system would require excavation of new passes and loading stations also would not be relevant because of the method of delivery of the fill here?

A That's correct.

Q Okay. Now, you talked about the literature and the effect of acid on cement; correct?

A That's correct.

Q None of the literature that you referred to specifically referred to acid effect on cemented rockfill; correct?

A That's correct. I stated that, that cemented aggregate -- cemented aggregate backfill, there's no literature that I found as well as Dr. Stone stated that, and I agreed with him.

MS. LINDSEY: Okay. That's all I have.

MS. LINDSEY: Dr. Vitton, I'm Rod Lewis. We met before.

CROSS-EXAMINATION

BY MR. LEWIS:

Q As to the acidity of the water in the mine -- and that's more my area, as I understood the gist of your testimony -- and correct me if I'm wrong -- that your concern or your perhaps important concern about the stability of the backfill is that it will be placed in what you feel will be acidic conditions; is that true?

A That's correct.
Q Are you aware, sir, of what pH is predicted for the water in the mine after mining?
A My understanding that the permit states that the acidity will be -- it will be acidic. I do not remember what the actual value was.
Q Do you know what the acidity -- average acidity of rainwater is?
A Yes. In the Upper Peninsula of Michigan it's 5.5, roughly.
Q And have you reviewed Mr. Logdston's reports on the characteristics of the water in the mine after mining?
A Not fully, no.
Q And you're not aware that Mr. Logdston says in there that the pH of the water in the mine after mining is predicted to be 6.8?
A No.
Q Seven is neutral pH, is it not?
A That's correct.
Q You talked at some length also about this mineral thaumasite?
A Thaumasite.
Q And the gist of that that I recall is there's been some degradation of concrete associated with this thaumasite when concrete is placed under water; is that true?
A The conditions for formation of thaumasite are that the

foundation was placed in soils that had acidic waters in them and also had -- it was cooler temperatures more in the 15 centigrade range, and they're finding that these foundations are basically losing their strength and decomposing.

Q So once again associated with acidic water?

A Yes.

Q And once again in cement rather than the backfill we'll be using in this mine?

A I'm not clear what you mean by that. My acidic -- my discussion --

Q Well, the cement -- these papers have to do with cement as opposed to the CRF we intend to use in this mine.

A Oh, I see. You're asking --

Q What Ms. Lindsey just asked you about.

A Okay. The -- yes. Technically the question is, yes. My answer would be yes.

Q Now, it's true, is it not, Dr. Vitton, that many bridges around this country have pillars that go down into the water that are composed of cement or concrete?

A Yes.

Q Can you tell me, Dr. Vitton, where are you have ever done a scaled span analysis similar to that which was done by Golder and presented for this mine?

A In other -- in cases other than the Eagle project?

Q In any -- yes -- other mines.
A I used it when I looked at the spans at the gypsum mines in the Grand Rapids area, specifically the Kentwood mine.
Q These were the post-collapse investigations I think you talked about, or just post-mining, weren't they?
A Yes. The Kentwood mine shut down in 2000, and they were going to put a subdivision -- they were planning to build a subdivision over that mine. And they wanted to look at the stability of that mine, so we looked at where it fell on the scaled span. We also looked at the Domtar Mine on the west side of Grand Rapids which actually has collapsing and sinkhole formations in that case. And then I recently looked at it for the Michigamme Mine, in which -- which is up in the hard ores of that Dr. Carter referred to. The State of Michigan Department of Transportation wants to reroute a highway through the abandoned iron mines that were mined from 1872 up to 1905, and they're concerned about the stability of those workings. And so, again, I looked at the scale span method there as well as using C-pillar, the two analyses used in the permit application.
Q Okay. On a number of your slides and during your testimony, Dr. Vitton, you talked about at various times the factors of safety both greater than one and factors of safety greater than two. And I wanted to see if you had the same understanding I do about the Golder reports and testimony

about their various calculations of factor of safety. And first of all, my understanding is that where they reported a factor of safety of greater than two, that that was meant to indicate a crown pillar that could be self-supporting. Do you have that same understanding?

A I agree with that.

Q And do you also understand as I do, sir, that where they reported a factor of safety of between one and two that they also indicated and included in their reports and testified about it when they were here that they were also recommending additional stability controls be used during the mining?

A That's correct.

Q And that included the rock bolts and the Shock-Crete and some of those things that we talked about earlier?

A That's correct.

Q And you're also aware, are you not, sir, that when they did their various calculations and reported the various factors of safety in their tables and so forth that they assumed in all those scenarios that there would be no backfill?

A No, I don't -- state that question again. I'm confused by --

Q Well, you know they calculated various factors of safety for various spans of the mine, and they reported them in tables in their reports; right?

A Yes.
Q They did not in any of those computations of factors of safety take into account the use of backfill. Do you understand that?
A No, I don't.
Q Okay. Is it your recollection that somehow the use of backfill was included in their factor of safety calculations?
A Yes. Their factors of safety, they're in Appendix C3, used a specific span and a specific rock mass rating. And specifically that span was ten meters.
Q Okay. So that's where they assume only one stope open at a time and the rest will be backfilled?
A That's correct.
Q Okay. And then given that we understand that Golder was recommending that for a crown pillar or a roof with a factor of safety between one and two that additional stabilization be added, and given that if we looked at your chart where you recomputed RMR's and several of those numbers also have factors of safety greater than one, you don't disagree, do you, Dr. Vitton, that for roofs with a factor of safety between one and two that they can be stabilized?
A Yes, I agree with that. It states -- and Dr. Carter states that for areas, for example, where we do have low RMR's they will have to do supporting just to maintain the ten meter

span. I agree with that, yes.

Q You referred in your testimony to a paper that was referenced by Mr. Carter as something as a model that he used on in one of the two, I believe, models that he did in his latest report on the hydrological effects on the crown pillar; do you recall that?

A Yes.

Q And you said that you had been asked to review that paper at one time and had rejected it?

A There were two models he used. The second model that he applied, the parallel plate model, I was familiar with 'cause the paper -- the model he used came from a paper that I had reviewed. I'm not familiar with the first paper and the first model that he used.

Q And as to the paper that you had reviewed and said you rejected it, it was in fact published?

A The journal that I rejected it did not publish it. It was later published in a different journal.

Q Doctor, Mr. Beauchamp and Dr. Carter also testified and you indicated you reviewed their testimony?

A Yes.

Q They testified, and I assume that you read this and can recall it, first of all, they explained why not all the RQD data was used in the RMR reporting. And I assume you read their reasons for that?

A Yes. I think -- yes.
Q That's all I'm looking for right now.
A Okay.
Q And I understand that you must apparently disagree with their rationales, but I wanted to ask you if you also understood from the testimony that when they computed the predicted stability of the crown pillar they also did it with the RQD data. Do you understand that?
A Yes. I understand what they did.
Q And they testified that, when they did those assessments, that modeling, that all of the RQD data was utilized. Do you understand that as well?
A Yes; yes.
Q So at least for that aspect of the modeling we don't have this missing RQD data issue that you have raised?
A That's not correct in my mind in the sense that I do not understand how they got their RQD datas in any of those zones in which it's highly fractured that were identified as the eight boreholes with discrete features. There's no markings on many of those boxes of core. So I do -- I did question in my testimony how some of the RQD's, especially in the areas with the discrete features were calculated. But I do understand that they did look at the -- did analysis of the RQD, because that's the only value of all five of the RMR values that they have. All the others are

assumed.

Q All right. And then your point on the cores, you're talking about the photographs that you had to look at; right?

A That's correct.

Q And you're making an assumption based on those photographs, as I understand it, that the core drillers, the team up at the mine site that Mr. Ware educated us about and the drillers did not properly mark those cores? Is that your opinion?

A I can't say whether they were proper or not, but the areas -- there are boxes that were not marked, so somebody did not mark them.

Q From the photographs, that's the basis of your opinion?

A From the -- yes, from -- yes.

Q And you said you read Andrew Ware's testimony, did you not?

A Yes.

Q And did you read all the detail that he provided here about how those cores were logged and the process they go through and his review of the published protocol for doing that and his characterization of the people and the training that was involved?

A Yes.

Q And it is still your position that based on your looking at those photographs that they did not do the job? Is that your testimony?

A They did the job, but in portions they, in my opinion, did not do the job properly.
Q One of your points in your concluding remarks and one you talked about earlier was that -- and I'm not sure I understand this. I wanted to ask you about it. You said that no exploration drilling was conducted to specifically collect and determine rock mass values; right?
A Yes.
Q You do understand that there were over a hundred holes drilled out there; right?
A Yes. There was a hundred -- from my understanding, there were 109 up through this past year and there's been additional -- there's been more drilling since that time.
Q And you do know, I think, that there were at least some 26 holes specifically drilled through the crown pillar area?
A Yes.
Q And again, if you read Andrew Ware's testimony, you do understand, don't you, that for all those cores and those -- that they painstakingly logged all of those cores, including the rock mass values?
A No.
Q You don't?
A Well, they drilled those holes. They certainly put them in the core boxes, but they did not calculate RMR values for the discrete featured zones of eight of those holes that I

could tell. So I can't say that your question -- that I could affirm that, your question.

Q Well, my point is, though, they did a lot of drilling and they did a lot of characterization of the rock; true?

A When you say "a lot," that's a speculative term. And this -- but what I'm -- what I will say is they drill 109 holes and they drilled those holes specifically as exploration holes to determine the location and to delineate the ore reserve. So the most important thing of the drilling was to identify the orebody and, therefore, be able to take those cores, analyze them, get the amount of the value of those, how much ore we have there, the semi massive, the massive, that's the information that was primary for those 109 holes. In addition, they did collect structural detailed data that would go into the RMR and subsequently the -- I'm sorry -- the RQD and subsequently the RMR. But that was secondary to the main purpose of those 109 holes.

Q Well, if you have a hole that penetrates the crown pillar, let's say, whether it's for exploration or whether it's drilled specifically to determine rock mass values, and you nevertheless collect all the data for the rock mass values and the characteristics of the rock, what's the difference, Dr. Vitton?

A The difference is is that when you say you drilled through

the crown pillar, you're still delineating the orebody. You're not even sure where the crown pillar is until you have the hole drilled. And so what I'm saying is the primary purpose -- I'm not disagreeing in general with what you're saying. What I am saying, there were no specific holes that were drilled where you could have done, for example, put a ProbeX down and measure the stiffness of the rock for Dr. Carter's hydrologic model. That would not have been a difficult thing to do. You had 109 boreholes. You could have done many things in those boreholes that --

Q So is it your point that they should have collected some different kind of data?

A Yeah, they could have. They certainly could have.

Q And is it your point that they should have?

A I think once they had -- once they had an orebody they knew that was economically viable, that they were actually going to be able to do additional drilling, that's -- they did these in stages. That was the whole idea. They drilled some holes, they found some ore. They need to do some additional drilling. And the additional drilling was specifically done to delineate the quality of the orebody and delineate the features of the orebody subsequent to the -- that could then be designed for a mine. My point is, is simply that those were exploration holes, not holes to delineate the rock mass structure specifically.

Q We had, again, Dr. Ware in here testified -- or Mr. Ware testified at some length about the voluminous data that they collected on the characteristics of the rock and those drill holes. Dr. Vitton, did you review that testimony?

A Yes, I did review the testimony.

Q And we spent quite a lot of time with Mr. Ware talking about the, again, voluminous data that they collected that was in various tables, computerized data with various codes. We had extensive discussion amongst counsel here about Petitioners wanting to get various of that data and so forth. And we introduced a lot of exhibits with that data. And I guess one of my questions to you is, sir, in all those holes and in all that data collected and logged by Mr. Ware and the people who did that logging, how is it you're able to identify and label these various holes as a, quote, "exploration hole" versus a hole to help characterize the conditions around the crown pillar and the characteristics of the rock?

A The -- well, just based on what you said. The entire drilling program was done by a geologist who delineate -- Mr. Ware, to delineate the orebody. Your point of a lot of data -- and I agree, it's a tremendous amount of information -- what was the quality to control on that Mr. Ware did discuss points, how is it that they missed that they put an eight centimeter scale that should have been a

ten? With all that, --

Q Well, your changing subjects on me.

A -- somebody should have noticed that.

Q You're changing subjects on me, Dr. Vitton. Now, I understand your testimony on the eight centimeter and the ten meter scale, and you presented that the first time you were here, didn't you?

A That's correct.

Q We talked about that?

A That's correct.

Q And then you read Mr. Ware's testimony. He's the geologist up there. He's the one that's actually up there doing that work and supervising the crew that does that work, and you read his testimony. And he said, "Absolutely, no. We used a ten centimeter scale." And you still know better than that based on your review of those photographs --

MR. WALLACE: Is there going to be a question here? Excuse me. I'm objecting to this speech.

MR. LEWIS: It is a question. It is a question.

MR. WALLACE: Well, I've been looking at my watch. When's the question coming?

MR. LEWIS: Well, you've got a fast watch, Counsel. I had to suffer through a lot longer questions than that, I can tell you.

Q My question is, Dr. Vitton, despite reading his testimony,

what he had to say, in the position that he's in up there actually doing the work and supervising those people, you still base your opinion on your looking at that photograph with that eight centimeter scale on it?

A That's correct.

Q On your RMR opinions, Dr. Vitton, on one of your slides you talked about, again, as you did the first time you were here that you disagree with the moisture parameter used by Golder in their RMR calculations; right?

A That's correct.

Q And I'm looking at your slide, and you indicate that -- and you're talking about the RMR 76. That's the one Golder used; right?

A That's correct.

Q Which, as I recall, a ten is what Golder used indicating dry conditions; right?

A That's correct.

Q And you indicated here in your slide and in your testimony that if we went to instead and assumed, quote, "or to some water in the joints" is what you said instead of the dry condition, that it would lower the RMR by six points under the 76 scale; right?

A That's correct.

Q Mr. Beauchamp testified about that as well. You read that testimony?

A Yes, I did.
Q And he said that the next notch down on the scale, so to speak, was what I believe was called a damp condition; is that correct?
A That's correct.
Q And that would lower the RMR by three points rather than six points?
A I'd have to have the table in front of me. You've got the 76 which is -- you're correct -- it's ten points. The 89 is 15 points. And then the 89 has various stages of reduction going from dry to moist. I believe the moist is in the 89, not the 76.
Q So it's possible that your six reduction here that you confused the 89 with the 76?
A The numerical value is correct. The terminology might not be.
Q Well, Mr. Beauchamp testified that in fact if you went down and the next notch on the scale of water on the RMR 76 that it was called damp, and that would reduce the ten to a seven. Did you read that testimony?
A That's -- yes; that's correct.
Q Okay. So do you agree or not agree or don't know about what he said?
A Well, I agree with what he said.
Q Okay. I was a little confused too about this Palabora Mine,

Dr. Vitton. You kept referring to a crown pillar there, but I guess it was the photographs that was confusing me. It looked like a big pit in the earth. And on the one photograph it showed apparently a slide that came down from the top of the pit wall; --

A Yes.

Q -- right?

A Yes; yes.

Q Is that an open pit mine?

A We would call it, yes, a surface mine, open pit mine. They had a vertical deposit similar to Eagle, but they used surface mining methods to mine it. But it was getting so deep that they had to mine out so much non-ore or waste rock that they decided to go mine down -- mine next to it; go down, come underneath it and mine upward to get the ore zone.

Q Okay. So it was supposed to cave at some point?

A They were planning -- they were attempting to use a caving method that Dr. Carter used in the -- that discussed in the Athens Mine.

Q You read the Golder report and probably reviewed Mr. Beauchamp's testimony about the unraveling analysis he did?

A Yes.

Q And he used -- I'm trying to find it. I think he used a couple different models to do that analysis, Dr. Vitton. Do

you recall that?

A Yes.

Q I don't think I heard you present any results of any modeling analysis that you performed on the unraveling potential, did I?

A I did not look at the unraveling potential.

Q And the unraveling, as I understand it, is where let's say we did have a gap between the top of the backfill at the end of mining and what we've been calling the crown pillar. If there was a gap in there, if the rock started falling out, that's in general what we're talking about as unraveling?

A That's correct; that's correct; yes.

Q And it's been your position that in fact the backfill will settle so much that it would allow this unraveling to happen due to a void between the top of the backfill and the bottom of the crown pillar?

A Yes. That's one of the mechanisms that was discussed, the unraveling. And, yes, it would unravel and fill up the void.

Q So it would be of some relevance, then, to do that analysis and predict how much space that unraveling would take up and, therefore, how much of a void one would have to have before it could possibly be expressed at the surface?

A That's correct; that's correct.

Q It was a little unclear too, Dr. Vitton, in your testimony

as to whether you were taking the position that Golder had ignored these so-called structures in their crown pillar analysis. Is that your understanding?

A I stated that they did not include them in the RMR calculations. I didn't state that they didn't consider them.

Q You understand they did consider them in their crown pillar stability analysis, do you not?

A They discussed them. I don't see in the -- in their analysis -- which analysis are you referring to? C1 or C2, Appendix C2, C3?

Q Well, I'm looking at slide 38 of Mr. Beauchamp's presentation, Dr. Vitton.

A I can't remember which one that is.

Q And he's talking about the crown pillar major structure assessment. He says 40 zones were identified in 22 of the 26 crown pillar boreholes. Were you aware of that?

A Yes, I am.

MR. LEWIS: And then can we show Mr. Beauchamp's slide? I believe it's 43. Let's go back two slides, please.

Q That's the slide I referred to earlier, Dr. Vitton, where he says 40 zones were identified. Do you see that?

A Yes.

Q You probably reviewed that testimony as well, did you not?

A I did.
Q The next slide, if we could look at that please, those are the eight boreholes requested by the DNR. And you understand, do you not, from the testimony that those were in fact of the 40 zones that Golder identified in the 26 crown pillar boreholes that those were the zones of the greatest dimensions, that being greater than one meter?
A Yes.
Q And those were the holes that you got to review; right?
A Yes.
MR. LEWIS: And if we could go to the next slide, please?
A I got to review the pictures of those holes.
Q The pictures. Thank you. Yes.
A We requested the drilling information and driller's logs, but were not --
Q I understand; I understand, Dr. Vitton. We've heard that many times.
A Sorry.
Q Now, as to these structure zones identified as gouged, sheared or broken that we looked at earlier, Mr. Beauchamp also testified about what they did with this information and how they looked at it. And you reviewed that testimony as well?
A Yes, I did.

Q Did you have a chance to look at Mr. Beauchamp's slides in preparation for your testimony here today?
A Yes.
Q So you've seen this slide before?
A Yes, I have. This is in the permit. This was the one that's virtually impossible to see.
Q All right. Well, you understand now, do you not, that Mr. Beauchamp testified that they identified these zones of structure, and they did some spatial orienting of these zones and spaced throughout the crown pillar and on the -- and going through the crown pillar?
A Yes.
Q And if we go to the next slide, Dr. Vitton, you're aware, are you not, that they did in fact analyze all these so-called structures that they identified in these 26 boreholes through and outside of the crown pillar and came up with the conclusions represented here?
A That's what they presented, yes.
Q That's what they presented.
A I can't -- they did.
Q And they observed, among other things, that there was no alignment of the zones observed; right?
A That's what they state.
Q And they conservatively state, do they not, "Nevertheless, the potential presence of any structure should be further

determined as part of the planned underground drilling program"?

A Yes, that's what they state.

Q You don't have any disagreement with that, do you, Dr. Vitton?

A Not that they -- no; no, I don't. They stated it. That's correct.

MR. LEWIS: That's all I have.

MR. REICHEL: Dr. Vitton, my name, again, is Bob Reichel. I represent the DEQ. I just have a few questions I want to ask you about your testimony earlier today on direct exam.

CROSS-EXAMINATION

BY MR. REICHEL:

Q During your testimony, you referred to a substance called thaumasite. Do you recall that?

A That's correct.

Q And I believe your slides, slides 24 and 25, contain some references to two articles that talked about thaumasite formation in concrete. Do you recall that?

A That's correct.

Q I just want to go over those. The first one that appears, slide -- do you have your slides there, or do you --

A I have them in front of me.

Q Okay. Can you turn to 24 rather just to save time? Do you

have it, sir?

A Yes; yes. Sorry.

Q Okay. Slide 24 you referred to a paper presented at a meeting that occurred in 1965; is that correct?

A That's correct.

Q And so presumably this document was published sometime at or near 1965; is that correct?

A Yes. I have the date January 11 and 15th, 1965.

Q Okay. And turning to 25, you refer there to another article that talks about the occurrences of thaumasite in laboratory and field concrete. And the date on that document was published was 2003; is that correct?

A That's correct.

Q Were you aware of the existence of these documents when you first testified in this case several weeks ago, whenever that was?

A Well, no.

Q I'm sorry.

A When I --

Q You recall, sir, you testified several weeks ago?

A Yes.

Q You recall that as a part of the Petitioner's case in chief?

A Yes.

Q Okay. I'm not trying to confuse you. Okay. The first time you testified as --

A In May.
Q -- a witness -- in May -- thank you -- were you aware of the existence of these documents in May of this year?
A Yes, I was.
Q Perhaps my memory is mistaken, but I don't recall you testified about either of these references at that time; is that correct?
A At that time, no. I was --
Q You did not, did you, sir?
A I did not. Yes.

MR. REICHEL: I have nothing further. Thank you.

JUDGE PATTERSON: Redirect?

MS. HALLEY: Yes.

REDIRECT EXAMINATION

BY MS. HALLEY:

Q Dr. Vitton, how many types of crown pillar failure are there? Can you name some? Well, Mr. Lewis talked about unraveling. That's one type?
A That's one technique would be unraveling. The other would be a plug-type failure.
Q Okay. Are there others?
A Those would be the two basic failure mechanisms, but there's many combinations. And there's an issue that Dr. Carter talked about in terms of the stability of the side walls moving. It's a complex failure mechanisms. But the two

that are generally considered that are discussed in the permit are unraveling and the plug-type failure.

Q Now, did Kennecott's application analyze I likelihood of a plug-type failure?

A They used the C-pillar, the second method discussed in the permit. And Appendix C2 has the C-pillar analysis in it. And I showed the example with the 27 meter thick crown pillar. But they relied on the scale span method for their analysis. So they looked at it. You saw the -- my one slide, figure 29, I believe, which showed the higher probability of failure. But that would have been a plug failure analysis.

Q Did they look at regional occurrences of plug failures in order to assess the likelihood of a plug failure at Eagle in the application?

A No.

MS. HALLEY: Okay. I don't have any more questions, Dr. Vitton, but I think Mr. Wallace has one or two. Thank you.

REDIRECT EXAMINATION

BY MR. WALLACE:

Q Dr. Vitton, I was a little bit confused by the questions and the answers about Palabora Mine Mr. Lewis asked you. You used the term actually earlier, or Mr. Lewis did, whether a crown pillar failure might or might not be expressed to the

surface; correct?

A Yes.

Q Okay. And what does that mean "expressed to the surface"?

A Mr. Lewis was discussing the -- Mr. Beauchamp's analysis of what's called unraveling. And so if the -- if a void forms below the crown pillar, one mechanism is that chunks of -- little chunks of rocks can fall out and start fall down. And as they break off, they fill -- start filling the void up. And then it's a question of whether it's going to work its way all the way to the surface before -- in other words, is there a big enough void there such that when the rock starts falling that you still maintain a void and that will work its way right to the surface and that will be an expression of the -- making its way to the surface.

Q Okay. In this case, the surface being the floor of the Salmon Trout River?

A Yes. That would -- yes. The analogy of the Palabora Mine would be that would have been the Salmon Trout River.

Q Okay. The Palabora Mine, the failure of the crown pillar was expressed to the surface; correct?

A Yes. That was the -- yes. That worked all the way up.

Q Okay. And what confused me was it sounded like he asked you a question as to whether it was suppose to cave in. Now, the mining method was block caving; is that right?

A Yes.

Q Okay. But does that mean that the crown pillar was supposed to fail at Rio Tinto's mine at Palabora?

A It depends on how you define "failure." The plan at that mine was that it would be controlled; that you would allow it to fail gradually and take the ore out, not fail all at one time, which is what it did. That's not -- it failed over time, but basically the water in rushing -- it failed because of the in -- part of the reason was the in rushing water caused it to fail all the way up within two years, uncontrolled failure.

Q It wasn't designed by Rio Tinto to fail that way, but it did?

A Yes; that's correct.

MR. WALLACE: Thank you. I have nothing further.

MR. LEWIS: Nor do I.

MR. REICHEL: Nothing further.

JUDGE PATTERSON: Thank you. You're done.

MR. HAYNES: Your Honor, we have to do a line change for our next witness. But I notice it's 20 to 5:00, and I will take at least an hour with the witness. So I wonder if it would be appropriate to start tomorrow.

JUDGE PATTERSON: Probably.

MR. HAYNES: It's at your pleasure.

JUDGE PATTERSON: Refresh my memory. How many more witnesses do we have?

MR. HAYNES: We have three.

MR. LEWIS: For this week.

JUDGE PATTERSON: This will be the third.

MR. HAYNES: Total five. The next one -- we have three more to go.

JUDGE PATTERSON: Yeah. Okay. And you were thinking if you got three in today you could finish tomorrow?

MR. HAYNES: That was our hope. It's possible that we will finish tomorrow even with the three tomorrow.

JUDGE PATTERSON: I'd be grateful if we could finish before Thursday. That's looking likely -- right? --

MR. HAYNES: Oh, yes.

JUDGE PATTERSON: -- under any scenario?

MR. HAYNES: I think under any scenario that's -- well, depending on Mr. Lewis' cross-examination.

MR. LEWIS: Well, you know, if we have to take mine versus yours, I think we're in good shape.

MR. WALLACE: Well, then, we'll do it.

JUDGE PATTERSON: Why don't we start tomorrow, then, if we're --

MR. WALLACE: Then after that we're coming back the 24th for the last two witnesses, then; is that --

JUDGE PATTERSON: Right. Can we get them both done on the 24th?

MR. WALLACE: I believe we can, yeah.

MR. EGGAN: Judge, there was one thing that I was hoping that we could discuss today, and that is post-hearing briefing. Have you given any thought to post-hearing briefing and what you're looking for and time periods?

JUDGE PATTERSON: No.

MR. EGGAN: Well, we would propose findings of fact and conclusions of law.

JUDGE PATTERSON: I would encourage that.

MR. EGGAN: And we will certainly do that.

JUDGE PATTERSON: As far as a time frame, I'll go along with whatever you can agree to among yourselves. You're the ones that have to do it, not me.

MR. EGGAN: Well, we are prepared to request 60 days.

JUDGE PATTERSON: Okay. That's fine.

MR. LEWIS: We're prepared to request 30 days.

MR. EGGAN: So that would be a total of 90?

JUDGE PATTERSON: Do we hear 45? See if you can agree to something. If not, I'll --

MR. LEWIS: We will.

JUDGE PATTERSON: I know it's going to take some time.

MR. LEWIS: We're also going to suggest that that not be delayed pending those last few witnesses on the 24th,

whatever the time frame is, that those could be supplemented thereafter. But when we get a briefing schedule in put in place, in other words, we'd like it to start running from the end of the testimony this week.

MR. EGGAN: From the end of the testimony this week?

MR. LEWIS: Yeah, with the idea both can supplement later as to those last few witnesses then as necessary, you know, or won't have to file a supplemental, but --

MR. EGGAN: Understood. I understand what you're saying.

MR. LEWIS: Yeah.

MR. EGGAN: Okay. Well, maybe we can talk about that.

JUDGE PATTERSON: Okay. Talk about that.

MR. LEWIS: Yeah; yeah. All right.

JUDGE PATTERSON: See if you can work it out.

(Proceedings adjourned at 4:44 p.m.)

-0-0-0-