FEB 04 1988

MEMORANDUM FOR: David J. Brooks, Section Leader
Geochemistry Section
Technical Review Branch, HLWM

FROM: Paul J. Bembia
Geochemistry Section
Technical Review Branch, HLWM

SUBJECT: TRIP REPORT FOR THE DEPARTMENT OF ENERGY/NUCLEAR REGULATORY COMMISSION GEOLOGY WORKSHOP AND FIELD CONFERENCE ON THE STRATIGRAPHY OF THE COLUMBIA RIVER BASALT GROUP AND ELLENSBURG FORMATION, SEPTEMBER 21-25, 1987

DATE: 88/02/04

The following are my comments on the Department of Energy/Nuclear Regulatory Commission Geology Workshop and Field Conference on the Stratigraphy of the Columbia River Basalt Group and Ellensburg Formation.

The primary purpose for Geochemistry Section participation in this meeting was to gain a better understanding of the BWIP's use of geochemical methods in basalt flow and basalt group identification and correlation. The primary geochemical tool used by the BWIP is whole rock chemistry.

There were several formal presentations during the first day workshop which addressed the use of rock chemistry in basalt identification and correlation. These were presented by Peter Hooper of Washington State University, Stephen Reidel of the Basalt Waste Isolation Project, and R. Dale Landon of the Basalt Waste Isolation Project. I also had the opportunity to informally discuss the use of rock chemistry in correlations with all of the principal investigators during the three days of field visits which followed the first day workshop.

These discussions gave me a much better understanding of the way the BWIP is using rock chemistry in stratigraphic investigations, and of the limitations of these methods. The presentations demonstrated that rock chemistry can be an important tool in identifying the Columbia River basalts. One point which was continually stressed, however, was that no single correlation tool is used independently, and the chemical information, without other tools (information on unit thickness, paleomagnetism, interbeds, etc.), is of very little value.

After hearing both the formal and informal presentations on correlation and identification, it was unclear as to what elements are being used on a regular basis to do identification and correlations. The formal presentations showed average flow compositions using 10 elements, 11 elements, 17 elements, 20 elements, and 37 elements. In addition, the BWIP document which is supposed to present the stratigraphic identification criteria for the Columbia River

Basalts (GS-GW-101, Preliminary Intraflow Structure and Stratigraphy Evaluation for Boreholes DC-23GR, DC-24CX, DC-25CX, DC-32CX, and DC-33CX) lists 5 elements which are to be used in identification and correlation.

I spoke with R. Dale Landon, Steve Reidel, and Peter Hooper to try to determine which elements are regularly used by the BWIP in their investigations. I was told that at the present time, the BWIP is contracting with Washington State University to analyze BWIP basalt samples for only 10 major element oxides. Work by R. Dale Landon, Peter Hooper, and Steve Reidel, however, shows that trace element chemistry data, when used with a standard statistical package for discriminant analyses, could be useful in further identifying individual CRBG flows. The BWIP technical investigators expressed a desire to have minor and trace element chemistry analyses for all Columbia River basalt samples, but it was not clear to them whether this would be possible soon because of contractual restrictions. Apparently, at the time the paperwork went in to Washington State University to contract to do the chemical analyses, Hooper's laboratory did not yet have the capability to do rapid analyses of minor and trace elements. Hooper now does have the ability to do these analyses using the same analytical technique (XRF) that is used for the major element oxides, but he is authorized to perform only the major element analyses.

At the close-out meeting which was held the final day of the conference, I commented that if minor and trace element chemistry is indeed useful in distinguishing between the basalt flows (and from the presentations we saw, this does seem to be the case), the BWIP should use minor and trace element chemistry to help identify and correlate the basalt flows. Sue Price, from the BWIP, responded that it was her understanding that sufficient flow discrimination could be obtained using only the 10 major element oxides. R. Dale Landon was not there to respond further to either my comment or Sue Price's response, so Sue said she would look into this matter further with Dale. Steve Reidel did comment that Peter Hooper had agreed to do the minor and trace element work on the DC-24 samples on a gratis basis, since he is working to develop the trace element data base for the Columbia River Basalts.

An item of potential concern to the NRC was noted during this trip. The question was asked whether another laboratory could take a BWIP basalt sample, rerun the analysis using the same technique (XRF is non-destructive), and get the same answer as the BWIP. The response was "probably not," due to analytical biases associated with different laboratory procedures, sample preparation, and instruments. Because of this, the BWIP has a sole-source contract with Washington State University for chemical analyses of basalt samples to make sure the samples are prepared and analyzed in the same manner. We were told of one study where researchers took results from another analytical facility and attempted to remove the analytical biases, hoping to come out with similar results. Apparently this effort was largely unsuccessful.

This raises a concern that was found during the NRC audit of the mineralogy/petrology program at Los Alamos National Laboratory, namely the

defensibility, in a licensing situation, of DOE data that can not be reproduced by any other analytical facility. It is my opinion that the NRC should give this item proper consideration, so that guidance, if it is necessary, can be given to the DOE. I do not believe that the DOE has identified this as a concern. If the NRC has a different view, the DOE should be made aware of it now. Even though the focus of the high-level program has shifted away from the basalt site, the issue does exist for Yucca Mountain work which is performed at Los Alamos National Laboratory. For example, quantitative XRD work performed at Los Alamos probably can not be reproduced by any other analytical facility at this time. This item was previously documented in the Technical Evaluation Section of the "Report of the Audit of the Mineralogy/Petrology Studies at the Los Alamos National Laboratory."

I was given a number of references on the application of the discriminant analysis method to identification and correlation of the Columbia River basalts, and began the process of accessing the BWIP whole rock chemistry data base. Darwin Marjanemi (of DOE Richland) informed me that the accessions list would probably be the best place to start, followed by a call to him personally if further assistance is needed.

After several discussions with Dr. Peter Hooper of Washington State University on the analysis of the rock samples and of the application of the discriminant analysis method, Dr. Hooper invited me to visit his laboratory and analytical facilities at Washington State. The reorganization of the HLW program will make this visit unnecessary at this time, however I feel that it would have been a valuable experience in learning more about the use and limitations of the analyses and methods.

I received a number of documents during this trip, including guidebooks, presentation viewgraphs, and technical papers and references. If you would like to see any of this information, or if you have any questions, please contact me.

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