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**FINAL REPORT: DIAMOND DRILLING FOR GEOLOGIC
INFORMATION IN THE MIDDLE PRECAMBRIAN
BASINS IN THE WESTERN PORTION
OF NORTHERN MICHIGAN**

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**MICHIGAN DEPARTMENT OF
NATURAL RESOURCES**

Geological Survey Division

October 1979

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY
Assistant Secretary for Resource Applications
Grand Junction Office, Colorado

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**PREPARED FOR
U. S. DEPARTMENT OF ENERGY
AND
BENDIX FIELD ENGINEERING CORPORATION
GRAND JUNCTION OFFICE
PROJECT NO. 20-77-2132**

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INTRODUCTION

Drilling Conceived and Completed

In April, 1977, Robert C. Reed and David W. Snider of the Geological Survey Division of the Michigan Department of Natural Resources submitted a preliminary unsolicited proposal to Merle E. Crew of ERDA concerning the diamond drilling of mainly Precambrian X Michigamme Formation in four separate structural basins in Marquette and Iron Counties. The two major justifications for this proposal were the need for probing new unexplored geologic environments considered favorable for uranium deposition, and the need for basic geologic information, in the traditional function of governmental agencies. Previous work by the AEC (in the 1950's), by Cannon and Klasner (1976), by Kalliokoski and Johnson (1976), by Mancuso, Loughheed, and Shaw (1975), and by Vickers (1956) had indicated a potential for uranium and phosphate in these strata, even though they are not well exposed in the four basins. The proposal was accepted and implemented with funding by ERDA (now by the U. S. Department of Energy), contracted by the Bendix Field Engineering Corporation, and subcontracted by the Michigan Geological Survey Division of the DNR, with the result that between September 26, 1977, and May 11, 1978, six initially vertical holes probed a total of 9896 feet (1109 feet or 11.2% in overburden, 155 feet or 1.6% in Precambrian Y mafic dikes, 8386 feet or 84.7% in Precambrian X Goodrich Quartzite and Michigamme Formation, and 246 feet or 2.5% in Precambrian W basement lithologies). In addition to normal examination of core, logging, and storing of core, the holes were extensively logged geophysically, acidized core was tested for phosphate content by ammonium molybdate, splits from five out of every thirty feet of core were subjected to chemical scrutiny, thin sections of all lithologies were examined, and radiometric determinations of geologic age were made for confirmation of Precambrian W basement which was encountered in each of the three basins in Marquette County.

Locations of Drill Sites

Figures 1 and 2 illustrate the drill locations in Marquette and Iron Counties, Michigan. Proceeding generally from north to south:

The East Baraga Basin was probed by three holes: Initially vertical DL-1 in the NW¼, SW¼ section 5, T.50N., R.28W., Marquette County, terminated at 2148 feet, deviating from the vertical by 56° , N. 14° E. Initially vertical DL-3 in the NW¼, NW¼ section 14, T.50N., R.29W., terminated at 1634 feet, deviating from the vertical by 44° , N. 18° E. DL-1 and DL-3 failed to penetrate to the Precambrian W basement as a consequence of overburden-concealed structural complexities, and as a consequence of deviation of the holes from the intended vertical as the bits attempted to penetrate the pervasive slaty cleavage perpendicularly. Therefore, an originally unplanned hole, DL-7 in the SW¼, NE¼ section 4, T.50N., R.28W., was drilled $1\frac{1}{2}$ miles east of DL-1 to overlap lower strata encountered in DL-1. The hole encountered the Precambrian W basement at 659 feet, before terminating at 679 feet deviating $14\frac{1}{2}^{\circ}$ from the vertical. An inclined hole, DL-2 planned between DL-1 and DL-3, was never drilled because of budgetary considerations, and will not be further discussed.

The Clark Creek Basin was tested by DL-5 in the NW¼, SE¼ section 16, T.49N., R.27W., Marquette County, where the hole was terminated at 1148 feet with a deviation from the vertical of 3° , S. 10° W., after penetrating the Precambrian W basement at 997 feet.

The Dead River Basin was cored at DL-4 in the NW¼, NE¼ section 2, T.48N., R.28W., Marquette County, where the hole was terminated at 3176 feet with a deviation from the vertical of 12° , S. 30° W., after encountering the Precambrian W basement at 3119 feet.

Figure 1.--Location map of DL-1,
DL-3, DL-4, DL-5, and DL-7.

EAST PART IRON COUNTY

Figure 2.--Location map of DL-6.

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SCALE IN MILES

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The northwest flank of the Amasa Oval was drilled at DL-6 in the NE $\frac{1}{4}$, NE $\frac{1}{4}$ section 30, T.46N., R.33W., Iron County, where the hole was terminated at 1093 feet deviating from the vertical by $4\frac{1}{2}^{\circ}$, N.55 $^{\circ}$ E. Fractured ground caused binding of the rods and abandonment of the hole before the base of the Michigamme Formation was attained.

Details on drilling practice are covered in six 7 - 16 page engineering reports on the six holes, obtainable from Bendix Field Engineering Corporation Technical Library, P.O. Box 1569, Grand Junction, Colorado 81501. GJBX-50 (79). Such details will not be reported here. In five of the holes, core recovery was almost 100%, whereas at DL-6, core recovery averaged 96%.

The drill sites were selected by the Michigan Geological Survey on the dual criteria determined by a gravity survey of the region by John Klasner of the U. S. Geological Survey, and by the location of State land or land open to the State for drilling, and by proximity to available roads. These criteria, which will not be repeated here in detail, are completely covered in the April, 1977 33-page preliminary unsolicited proposal to ERDA, "Drilling for Geologic Information in Middle Precambrian Basins in the Western Portion of Northern Michigan," by Robert C. Reed and David W. Snider of the Geological Survey Division of the Michigan Department of Natural Resources. Emphatically, it should be re-emphasized that this project was not designed as mineral exploratory drilling guided by geological, geophysical, or geochemical anomalies, but rather this project was designed to provide fundamental geological information in areas where a thick cover of Pleistocene sediments prevents adequate coverage by normal governmental areal geologic mapping. The drill sites were selected so as to yield a maximum stratigraphic section of the Precambrian X strata in each of the four basins.

Personnel Involved

Overseeing the entire project on behalf of DOE at Grand Junction was John R. Ellis, Subsurface Project Officer of the NURE Project Office. For the Bendix

Field Engineering Corporation subcontract details and financial matters were handled by J. A. Papania, Director of Procurement, and by D. C. Grove, Subcontract Administrator. Frequent telephone and written communication was maintained with T. J. Price, BFEC Drilling Superintendent. Charles F. Hajek and Jack McCaslin of BFEC observed the drilling for extended periods. BFEC geophysical logging was originally planned by Mike Callihan, and was implemented by Kirk Hayer and Wayne D. Gisler.

For the Geological Survey Division of the Michigan Department of Natural Resources the manager of the project was Robert C. Reed, Chief, Mining and Environmental Geology Section. Day-to-day administration and complete planning for chemical analyses were carried out by the assistant manager, David W. Snider, Research Staff Unit Coordinator, who also completed well sitting at DL-4 and submission of samples for chemical studies. Jack Van Alstine, Regional Geologist, supervised all environmental considerations, local public relations, coordination with area foresters, and geophysical logging. The cores currently are under his jurisdiction at Marquette, at DNR Region 1 Headquarters. Placing and surveying monuments near drill sites was accomplished by David B. Babbitt and Arthur O. Enger. Financial matters were administered by Raymond D. Schofield, Erna E. Dennison, and Marian Speerbrecker.

The Longyear Company was represented by Walter Newbauer. During the drilling J. E. Stubblefield and J. W. Kivela were foremen.

The Birdwell Division of S. S. C. geophysical logging at DL-1 and DL-3 was carried out by G. Rigdon, the logging at DL-5 was carried out by Mike Stefanov, and the logging at DL-4 and DL-6 was carried out by J. Morehead.

The Barringer Magenta Ltd. chemical analyses were supervised by Romana B. Cruz.

Radiometric age dates of Precambrian W rocks from DL-4, DL-5, and DL-7 were accomplished by Dr. W. R. Van Schmus and Roger D. Hammond of the Department of Geology, University of Kansas.

Originally, when the author was retained as geologist-in-charge of the project by the Michigan Geological Survey, it was assumed that the drilling would be accomplished during summer months and would not occur during winter teaching responsibilities at Michigan State University. When Grand Junction approved the project for an autumn 1977 start, Jack W. Avery was retained to monitor drilling at the rigs. Mr. Avery therefore logged most of the holes and dealt with the drillers daily. Much of the author's time was utilized in coordinating various efforts, communicating, obtaining core boxes, chemicals, sample bags, and other supplies, and in coping with numerous agencies. To pick up the core at the drill rigs, to slab it on a diamond saw for thin sections and chemical samples, to split core, to test it with ammonium molybdate for phosphate content, and to clean and store the core methodically, William T. Swenor was hired as a technician. The six engineering reports and the six preliminary geologic data reports were prepared by the author in addition to the present report.

Purpose of the Present Report

This report does not repeat the details presented in the six engineering reports with microfiche copies of geophysical logs, obtainable from Grand Junction; this report does not repeat the details presented in the six preliminary geologic data reports with on-site logging of the core by Jack W. Avery and David W. Snider, and the author's observations, interpretations, and exploration recommendations, obtainable from Greg Wilson, Michigan Geological Survey Division of the DNR, Stevens T. Mason Building, Box 30028, Lansing, Michigan 48909. Instead, this report covers 1) chemical and age-dating data not yet presented, 2) correlation among all holes, and 3) a summary of the significant aspects of regional geology learned from drilling data. The serious reader interested in the region should obtain the six engineering and the six preliminary geologic data reports to augment topics

covered here. Undoubtedly, industry, government, and academia can and will extract many more meaningful bits of information from the cores, so that eventually further publications may ensue.

CHEMICAL ANALYSES

Program Design

David W. Snider designed a statistically unbiased program of sampling the core by arranging for 2 pounds of "walnut"-sized pieces of split core every 3 to 6 inches in a 5-foot-long segment from every 30-foot-long segment of footage. If the core was taken from DL-1 between 734-739 feet, the sample was labeled 1-734-739; the next sample, 30 feet deeper, was labeled 1-764-769. Because only nine digits or dashes could appear on computer print out, the drill location number was dropped for footage beyond 999 feet, so that for DL-1 between 1004-1009 feet the computer print-out would indicate 1004-1009, but at least it would appear in the same vertical column below location-specified footage less than 1000 feet deep. Therefore, in the accompanying appendix of tabular chemical data, to find the hole number for depths more than 999 feet where dashes appear in the read-out, the reader should look higher in the same vertical column to find the hole number specified as a prefix to the span of footage for depths in that hole less than 1000 feet. In some instances no dashes appear, as in 4B16091614 which means that the analysis refers to DL-4 in the B sequence, drilled after a major wedging, between 1609-1614 feet. The prefix S refers to special samples collected for economic interest between routinely sampled intervals: S5-713-714 refers to a special sample at DL-5 between 713-714 feet. The prefix EX refers to Exxon core, not discussed here, which is in the possession of the State.

Analytical Procedure

The samples were submitted to Romana B. Cruz of Barringer Magenta Ltd., Rexdale, Ontario, where they were prepared and subjected to hydrofluoric/nitric/perchloric acid digestion, and then submitted to multi-element radio frequency argon plasma emission analysis for 1) whole-rock determinations of rock-forming oxides consisting of Al_2O_3 , CaO , Fe_2O_3 , K_2O , MgO , MnO , Na_2O , P_2O_5 , and TiO_2 (SiO_2 was determined in a separate atomic absorption analysis), and 2) trace elements consisting of Ag, Ba, Be, Cd, Co, Cr, Cu, Ni, Pb, Sr, V, Zn, and Zr. Colorimetric analysis of As and Mo, analysis of organic carbon, and analysis of U and Th were conducted separately after only nitric/perchloric acid digestion (to exclude such constituents in silicates which would have dissolved in the hydrofluoric acid digestion, above) were separately determined. The relatively low Mo analyses reported indicate that technician William T. Swenor carefully cleaned the cores after testing them for phosphate content with ammonium molybdate before submitting lumps from splits for chemical analysis. Twelve special samples from possibly economically interesting core from DL-4B, DL-5, and DL-7 and not systematically sampled were subjected to the same type of analysis, except a determination for gold was substituted for the determination of organic carbon in some samples.

Data Presentation

The chemical data in the appendix appear in two forms: 1) in graphic profiles printed as horizontal sequences of asterisks (to simplify comparison with geophysical logs in microfiche which accompany each engineering report for each hole, available from Grand Junction), and 2) in digitized vertical columns. In both profiled and digitized statements of data, depth appears on the y-axis and magnitude of constituents appears on the x-axis. It is suggested that the reader should grasp the significant trends by perusing the profiled plots first, and after that the reader should confirm specific values of interest on the digitized columns. Both whole-rock and trace element analyses are shown in both profiled and

digitized form. For the benefit of economic geologists, a special combination of analyses has been designated the trace element indicator group for potential mineralization (As, Cu, Ni, P_2O_5 , Pb, Th, U, V, and Zn). These data are plotted in the profile form as the sum of unit values of adjusted and normalized analyses of the above-mentioned constituents, based upon the maximum occurrence of each in this project.

Some Interesting Examples of Chemical Values

The analyses reveal some general and specific observations:

Organic carbon of the slates and argillites of the Michigamme Formation commonly ranges between ½%-3%. Higher carbon content in some instances correlates with maxima of other elements, presumably precipitated in a reducing environment. For example, the highest organic carbon content noted in the project, 8.01%, occurs in a special sample from a 2-inches-thick conglomerate within cherty carbonates (presumably the Bijiki Iron-Formation Member) of the Michigamme Formation at a depth of 3011 feet at DL-4B, where uranium content, 130 ppm, is the highest observed in any metasediments in this project. A duplicate determination after hydrofluoric/nitric/perchloric acid digestion yielded 260 ppm uranium, thereby suggesting that half of the total uranium was available in readily leached compounds whereas the other half was not easily leached, but possibly was bound within silicates. This core causes a scintillometer to register almost five times background count. In the same special sample vanadium attained a peak of 862 ppm, and P_2O_5 attained 2.79%. In the same hole, a regular sample of massive carbonaceous argillite of the Upper (Slate or Argillite) Member of the Michigamme Formation between 2899-2904 feet contains 6.02% organic carbon and 612 ppm copper. At DL-6 the maximum organic carbon content of 3.56% at 848-853 feet, again within slaty and cherty iron-formation of the Michigamme Formation, correlates with the maximum copper content in that hole of 971 ppm. The first instance probably was syngenetic sedimentary reduction whereas the second and third probably involved some epigenetic remobilization, according to textural and

structural evidence. As indicated in the section on base metals, page 33, even in bedding planes where sulfides appear to be syngenetic, maximum mineralization is adjacent to Keweenawan Precambrian Y faults and breccia zones which transect bedding planes and Penokean slaty cleavage. Further, the sheets of sulfides within slaty cleavage clearly formed after sedimentation. Such slaty cleavage-related stringers of sulfides are most abundant adjacent to Keweenawan faults and breccias. An exception to the occurrence of organic carbon with other elements appears at DL-5 in a special sample of basal Bijiki carbonate-rich conglomerate at 713-714 feet, where organic carbon is reported to be 4.05%, but uranium content is only 0.8 ppm. However, carbon-seamed stylolites at the base and two inches above (confirmed by Jack Van Alstine) imply considerable removal of soluble materials, possibly including once-present uranium. Jack W. Avery determined that the core registers approximately 2½ times background count on a scintillometer.

The highest uranium content noted in five-foot routine samples from this project occurs at DL-5 between 1024-1029 feet with 76 ppm, and between 1054-1059 feet with 72 ppm in a Precambrian W green porphyritic metarhyolite tuff. These values exceed those from more commonly celebrated Precambrian W source rocks for Precambrian X strata, such as granite, and they suggest that perhaps some of the uranium in the Precambrian X strata was originally derived from the weathering of Lower Precambrian rhyolites. It is of interest to compare the 76 and 72 ppm chemical determinations to Bendix KUT geophysical probing for the same footage, averaging 57 and 24 ppm respectively (see DL-5 engineering report, available from Grand Junction). In general, the uranium content of Precambrian X strata is much lower, mainly between 0.2 - 5.4 ppm after nitric/perchloric acid digestion. Presumably, hydrofluoric/nitric/perchloric acid digestion would yield values twice as high, as at DL-4B at 3011 feet. As detailed in the DL-5 preliminary geologic data report, available from the Michigan Geological Survey, the most interesting potentially economic possibility determined by drilling relates to presumably volcanogenic strata-bound sulfide mineralization in Precambrian W metabasalt from 1059-1148 feet, with copper ranging between 124-2010 ppm and gold ranging between 20-50 ppb. While this is definitely not ore, it may be the pyrite-rich and

pyrrhotite-rich fringe characteristic of strata-bound massive sulfide ore bodies. Recommendations for exploration are stated in the preliminary geologic data report for DL-5, pages 4 - 6.

AGE DATING AND CORRELATION OF PRECAMBRIAN W ROCKS

In an August 20, 1978, report on age dating, W. R. Van Schmus stated that U-Pb ages from zircons separated from Precambrian W rocks are as stated in the following observations:

Dead River Basin

DL-4B gneissic tonalite or quartz diorite (without much potassium feldspar) composite sample from 3166-3174 feet yielded an age of 2700 ± 15 m.y. Deeper portions of fresh rock (as sampled for age dating) megascopically resemble numerous surface samples of the Compeau Creek Gneiss. Upper portions, up to the apparently unfaulted unconformity with the Goodrich Quartzite at 3119 feet, appear to grade into the Goodrich through a chloritic metaregolith zone. This transition is reminiscent of the transition between the Precambrian W granite gneiss and the overlying Ajibik Quartzite west of the Republic Trough, described by Villar (1965, p. 17 - 18). That transition misled Lamey (1937) to the interpretation that the base of the Ajibik Quartzite was locally granitized by an intrusive granite, presumably of late Precambrian X age. Fortunately, at DL-4B tapioca-like grains of clastic quartz, presumably derived from quartz phenocrysts of Precambrian W porphyritic metarhyolite, occur in the basal Goodrich Quartzite to a depth of 3119 feet, so that upon careful examination the major unconformity can be located. This transition zone and metaregolith at DL-4B imply deep pre-Goodrich weathering, and imply that abundant feldspar grains in the Goodrich Quartzite are more the result of rapid erosion, transportation, and deposition than a result of desert or glacial climate.

Clark Creek Basin

The DL-5 composite sample of Precambrian W porphyritic metarhyolite tuff from 1000-1059 feet yielded an age of 2700 ± 15 m.y. The determination was based upon one-tenth the minimum abundance of zircons previously used at the University of Kansas, as a consequence of the paucity of zircons in this rock. This sample is a green slightly sheared unit presumed to correlate with the Sheared Rhyolite Tuff Member of the Mona Schist, or with felsic rocks in the Lighthouse Point Member of the Mona Schist (Puffett, 1974, p. 14 - 15, p. 19 - 20). The underlying metabasalt with massive sulfide mineralization is presumed to correlate with more typical units of the Mona Schist. The contact between these two units is almost perpendicular to the base of the Precambrian X basal Goodrich Quartzite. The 2700 m. y. metarhyolite tuff directly beneath the Goodrich Quartzite does not appear to be a deeply weathered metaregolith, as is the 2700 m. y. tonalite directly beneath the Goodrich at DL-4B. The basal Goodrich at DL-5 is a $\frac{1}{4}$ -inch-thick black carbonaceous seam (unslickensided and presumably unfaulted) at the bottom of the basal conglomerate of the Goodrich (996-997 feet). Perhaps this indicates local reduction rather than oxidative weathering immediately preceding Goodrich Deposition.

The 2700 m.y. ages of Precambrian W basement at DL-4B and DL-5 are consistent with those which Dr. Van Schmus has obtained from surface exposures of Precambrian W rocks nearby in Marquette County.

East Baraga Basin

The DL-7 granite from a split section from 687-697 feet yielded an apparent age of 2600 ± 15 m. y., which is similar to some ages which Dr. Van Schmus has obtained in Dickinson County. Megascopically the DL-7 granites resemble granites exposed farther south in Marquette County. The DL-7 microcline-rich granites could be the source of the abundant clastic microcline found in the Goodrich Quartzite and in the Lower (Slate or Argillite) Member of the Michigamme Formation. The

uppermost granite with supergene veins of chert and carbonate unconformably underlies conglomerates and cherty carbonate of the Bijiki Iron-Formation Member of the Michigamme Formation. This is similar to veined granite underlying iron-formation northwestward along strike at Big Eric's Crossing, NW¼, NW¼ section 35, T.52N., R.30W., Baraga County as shown by Johnson (1976, p. 100). Ms. Johnson correlates the iron-formation with the Greenwood, following the usage of Mancuso, Loughheed, Seavoy, and Shaw, 1975, p. 25. As at DL-4 and as at exposures at Big Eric's Crossing, the core at DL-7 indicates that the Precambrian W rocks immediately below the unconformity constitute a metaregolith, weathered prior to Precambrian X deposition and mildly metamorphosed after Precambrian X sedimentation. The unconformity at DL-7 occurs at a depth of 659 feet.

Inexactness from Rb-Sr Determinations

Dr. Van Schmus reported that Rb-Sr determinations on rocks from these cores were inexact as a consequence of either insufficient Rb relative to Sr, or it may be a consequence of apparently younger ages caused by open chemical systems which must have operated during various geologic events.

CORRELATION WITHIN PRECAMBRIAN X BARAGA GROUP

Basis for Correlation Among Holes

In the Dead River, Clark Creek, and East Baraga Basins of Marquette County, strata of the Baraga Group rest directly upon Precambrian W rocks with profound unconformity. In the following stratigraphic correlation among the five holes in Marquette County, depth intersections have been converted trigonometrically to stratigraphic thicknesses, the numbers stated without parentheses. In contrast, numbers in parentheses are depth intersections in feet, as actually logged. The main basis for correlation is the presence in all three basins of two stratigraphic

units: 1) Ten feet of cherty carbonate, graywacke and conglomerates (3008-3019 feet) at DL-4B, 10 feet of gray-green carbonate-rich conglomerate and agglomerate (702-714 feet) at DL-5, and 10 feet of carbonate-rich conglomerate (648-659 feet) at DL-7 are overlain by 2) phosphatic cherty carbonates and clastics as 40 feet of sulfide-bearing light gray cherty carbonate and carbonate-rich argillite, graywacke, and thin conglomerates at DL-4B (2966-3008 feet), as 37 feet of white cherty carbonate with algal stromatolites, chert, and light gray carbonate-rich argillite at DL-5 (660-702 feet), and as 76 feet of sulfide-bearing light gray cherty carbonate with algal stromatolites, and several thin conglomerates at DL-7 (569-648 feet). The latter occurrence, at DL-7 appears to be continuous westward into Baraga County along the northern margin of the Baraga Basin into phosphatic cherty iron-formation tentatively correlated by Mancuso, Loughheed, and Shaw (1975, p. 586) with the Negaunee Iron-Formation. This was later correlated by Mancuso, Loughheed, Seavoy, and Shaw (1975, p. 25) with the Greenwood Iron-Formation Member of the Michigamme Formation, and correlated by Tyler and Twenhofel (1952, p. 148) with the Bijiki Iron-Formation Member of the Michigamme Formation. The current drilling tentatively favors the latter correlation because 1) no stratigraphically higher phosphatic-cherty correlatives of iron-formation were encountered in these drill holes in the overlying half-mile-plus thickness of Michigamme Formation, and 2) because abundant (Clarksburg) volcanics were not found above the cherty beds in these drill holes, only obscure 5-inches to 2-feet thick pyritic and chloritic beds (possibly propylitized andesite tuffs) at DL-1 (1718 feet) and at DL-3 (315, 317, 418, 909, 1119, and 1123 feet) were intersected. The most conspicuous marker of possibly partial volcanic origin is the 10-feet-thick agglomerate and conglomerate at DL-5 (702-714 feet) below the cherty beds. On the south limb of the Marquette Synclinorium the Clarksburg Volcanics overlie the Greenwood Iron-Formation Member of the Michigamme Formation. If the cherty carbonate beds in the drill holes are correlatives of the Bijiki Iron-Formation Member of the Michigamme Formation, the following stratigraphic nomenclature applies to these holes, whose critical stratigraphic relationships are summarized in figure 3.

Figure 3.--Stratigraphic sections of Marquette County holes:

Dead River Basin

DL-4 contains 93 feet of Goodrich Quartzite (3019-3119 feet), 10 feet of possibly Bijiki cherty carbonate, graywacke, and conglomerate (3008-3119 feet), 40 feet of Bijiki cherty carbonate and carbonate-rich argillites, graywackes, and conglomerates (2966-3008 feet), and 2630 feet of argillites and graded-bedded turbidite graywackes of the Upper (Slate or Argillite) Member of the Michigamme Formation (76-2966 feet). It is here suggested that at the phosphorite locality in the NE¼ section 15, T.49N., R.28W., described by Cannon and Klasner (1976, p. 3 - 5), 3½ miles northnorthwest from DL-4, that their unit #2, rusty-weathering dolomitic quartzite, is correlated with the Goodrich Quartzite. Further, their cherty phosphate-bearing unit #3 probably is the Bijiki Iron-Formation Member of the Michigamme Formation, and their thinly laminated gray-green argillite unit #4 probably is part of the Upper (Slate or Argillite) Member of the Michigamme Formation.

Clark Creek Basin

DL-5 contains 94 feet of Goodrich Quartzite (884-997 feet), 146 feet of argillite and graywacke of the Lower (Slate or Argillite) Member of the Michigamme Formation (714-884 feet), 10 feet of possibly Bijiki green-gray carbonate- and chlorite-rich conglomerate and agglomerate (702-714 feet), 37 feet of Bijiki chert, cherty carbonate, and carbonate-rich argillite (660-702 feet), and 233 feet of argillites and graywackes (339-660) feet of the Upper (Slate or Argillite) member of the Michigamme Formation.

East Baraga Basin

DL-1 and DL-7 contain neither the Goodrich Quartzite nor the Lower (Slate or Argillite) Member, but start with 10 feet of possibly Bijiki carbonate-rich conglomerate (648-659 feet), followed by 76 feet of Bijiki cherty carbonate with thin conglomerates (569-648 feet), and 2203 feet of graded-bedded graywackes,

argillites, and slates of the Upper (Slate or Argillite) Member of the Michigamme Formation (243-569 feet at DL-7 and 71-2148 feet at DL-1). The 400 feet stratigraphic section of slates at DL-3 (163-1634 feet of low-angle intersection plus duplication) cannot precisely be correlated with units in the other holes. Probably the finely-grained slate units at DL-3 are higher in the Upper (Slate or Argillite) Member of the Michigamme Formation than any units observed in the other holes: Concentric-circle Busk structural projections, based upon dips observed in outcrops and upon the unexpectedly high dips at DL-3, imply that the Michigamme Formation may be more than five thousand feet thick in the East Baraga Basin. Of course, Busk constructions are more appropriate for parallel folding than they are for similar folding such as occurs in the Lake Superior region, but they are the best that can be utilized with the scarce data available, and they do give us an order of magnitude for depth to Precambrian W basement. By any standards, the Michigamme Formation is thick.

Northwest Flank of Amasa Oval, Iron County

The 286 feet of Michigamme argillites and slates alternating with thin iron-formations (236-1093 feet) at DL-6 cannot safely be correlated with stratigraphic units observed in the Marquette County holes. However, the presence of thin iron-formations favors a correlation with Bijiki or older strata, so that probably the Iron County cores correlate with Bijiki or the Lower (Slate or Argillite) Member of the Michigamme Formation.

A Major Unconformity in the Michigamme Formation?

While no angular discordance was noted at the base of the Bijiki cherty carbonates and clastics in the three Marquette County basins probed, a major break in pattern of sedimentation and paleogeography was indicated at that horizon: Figure 3 implies that during Goodrich and Lower Slate or Argillite "time" the three basins experienced independent histories, with deposition of the Goodrich Quartzite in the center of the Dead River Basin, with deposition of the Goodrich Quartzite and the

Lower (Slate or Argillite) Member in the Clark Creek Basin, and with erosion on the north fringe of the East Baraga Basin. Apparently just before Bijiki "time" the entire area was covered by a common sea, so that hitherto isolated sedimentary basins were then interconnected, and all three thereafter received Bijiki and Upper (Slate or Argillite) Member sediments. Subsequent Penokean and later deformations apparently re-isolated the three into the present structural basins. The configurations of the pre-Bijiki sedimentary basins may have been quite different from the configurations of the present structural basins as suggested by the following correlation: Instead of resembling the section at DL-4, in the central Dead River Basin, Puffett's (1974, p. 35) section for the eastern Dead River Basin more closely resembles the sequence at DL-5, in the Clark Creek Basin, thereby suggesting a possible connection between the latter two. Figure 4 applies the names used in the present report to the strata described by Puffett. Presumably, during the Lower (Slate or Argillite) "time" the eastern end of the Dead River Basin (with DL-5-type stratigraphy) was not connected to the central part of the Dead River Basin, at DL-4.

The discrepancies among sections of Goodrich and Lower (Slate or Argillite) Member strata in the various areas contrast with the relative universality of Bijiki and Upper (Slate or Argillite) Member strata throughout the region. This implies a major tectonic and sedimentary break at the base of the Bijiki Member, with a disconformity between the Goodrich Quartzite and the Bijiki at DL-4B, and a nonconformity between the Precambrian W granite and the Bijiki at DL-7. The break at the base of the Bijiki at DL-5 (714 feet) represents less erosion than the two above-mentioned examples, however, even at DL-5, the lowest foot or so of the Bijiki is a basal conglomerate, the lowest two-inches-thick portion of which contains carbon-seamed stylolites which presumably indicate a considerable post-depositional and pre-metamorphic removal of material by solution. Such stylolites should not be confused with the disconformity.

A major break in the middle of a formation such as the Michigamme appears to violate the principles of classical stratigraphy. Perhaps new stratigraphic names

DL-5, Clark Creek Basin, (Trow)

Eastern Dead River Basin, (Puffett)

Name of Unit	Depth (feet)	Thickness (feet)	Name of Unit	Thickness (feet)
Upper (Slate or Argillite) Member (carbonaceous and pyritic argillite and graywacke)	339- 523* 602- 660	>233	Metasiltite and slate (carbonaceous and pyritic)	>500
Bijiki Iron-Formation Member (cherty carbonate and clastics)	660- 714	47	Chert conglomerate and Iron-formation	320-450
Lower (Slate or Argillite) Member				
Thin-bedded graywacke and argillite	714- 750	31	Thin-bedded graywacke (chloritic, carbonaceous, and pyritic)	300-500
Thin-bedded argillite (upper 73 feet very chloritic, and possibly correlate with Clarksburg Volcanics?) (pyritic)	750- 866	99		
Absent (possibly Greenwood or unnamed Iron-Formation Member)			Magnetite-rich argillite	<100
Thin-bedded argillite, graywacke, and quartzite	866- 884	16	Thin-bedded graywacke (chloritic and sericitic)	300-500
Goodrich Quartzite with argillite layers (feldspathic and conglomeratic)	884- 997	94	Basal quartzite (sericitic, feldspathic, conglomeratic)	100-250

Figure 4

Comparison of Baraga Group strata at DL-5, Clark Creek Basin, and approximately nine miles southeastward in the eastern Dead River Basin, as measured by Puffett (1974, p. 35). Note significant thickening of each unit to the southeast.

*At DL-5, a Precambrian Y mafic dike occurs between depths of 523-602 feet.

are in order. However, to avoid confusion, traditional names are used and attention is called to the significant tectonic and sedimentary changes which occurred just before Bijiki sedimentation in areas north of the Marquette Synclorium. Such changes may not have occurred in the Marquette Trough which may have experienced uninterrupted sedimentation throughout Michigamme "time".

With regard to the release and movement of uranium, this major change in sedimentary pattern in the middle of the Michigamme Formation mainly resulted in a decrease in the available source areas which could have provided uranium, and which hereafter were locally completely inundated. Therefore, the Bijiki Iron-Formation Member, deposited immediately after such universal inundation, probably is the latest (the youngest) Precambrian X unit that might contain significant syngenetic uranium derived from those source areas. This sedimentary break is not a typical unconformity and has no relevance to unconformity-related uranium deposits, such as those in the Northern Territory of Australia, in Saskatchewan, in Ontario, and in the Rand. In Michigan this change in sedimentary pattern diminished, rather than increased, opportunities for uranium ores.

It should be pointed out that in the five holes in the three basins in Marquette County, the shallowest bedrock encountered in all holes is here correlated with the Upper (Slate or Argillite) Member of the Michigamme Formation. This interpretation is at variance with the interpretation depicted on Cannon's (1977) preliminary blue-line Map Showing Precambrian Geology in Parts of the Baraga, Dead River, and Clark Creek Basins, Marquette and Baraga Counties, Michigan. This map suggests that the shallowest bedrocks at the drill sites are portions of the Lower (Slate or Argillite) Member of the Michigamme Formation. The drill sites are located on sandy plains with few outcrops. If continuous surface exposure, comparable to the almost 100% core recovery in the holes, had been available to Cannon, he might have inferred the same stratigraphic interpretations proposed in this report.

SIGNIFICANT MICROSCOPIC AND MEGASCOPIC OBSERVATIONS RELEVANT TO PRECAMBRIAN X SEDIMENTATION

Goodrich Quartzite

Thin sections from the two holes penetrating this unit, DL-4B (3019-3119 feet) and DL-5 (884-997 feet), contain clastic quartz, chert, microcline, plagioclase, altered orthoclase, minor leucoxene, and considerable quantities of interstitial carbonate. Clastic quartz near the base of the formation in DL-4B contains very well-rounded "tapioca-like" sand grains which are presumed to be derived from quartz phenocrysts of Precambrian W porphyritic metarhyolites and tuffs, similar to such rocks encountered at DL-5 (997-1059 feet). The presence of clastic microcline at both DL-4B and DL-5 is significant, inasmuch as that mineral is missing from the Bijiki and Upper (Slate or Argillite) Members of the Michigamme Formation with only two exceptions: 1) In the lowest foot of the Bijiki at DL-7, clastic microcline unconformably overlies microcline-rich Precambrian W granite, 2600 m.y. old; 2) In the lowest 12 feet of what is here called the Upper (Slate or Argillite) Member, Burns (1975, Unit A, p. 22) reports the presence of clastic microcline in north-eastern Baraga County. Precambrian W granites, such as at DL-7, may have been a site of erosion and a source for clastic microcline found at DL-4B and DL-5. The disappearance of microcline at higher stratigraphic levels than cited, and the persistence of plagioclase, generally a less stable mineral, throughout essentially a half-mile thick sequence of Upper (Slate or Argillite) strata at DL-4, implies that the source of the microcline may have been inundated by early Upper (Slate or Argillite) "time", whereas the source of the plagioclase was not covered until much later.

At DL-4B minor scattered phosphate occurs in the Goodrich Quartzite. The base of the formation is there a highly chloritic reworked regolith which appears to grade into the unreworked regolith developed on the 2700 m. y. old tonalite and gneiss. Metamorphism of the regolith apparently occurred during the Penokean

orogeny, hence it is called a metaregolith. The actual unconformity at 3119 feet is selected on the basis that the deepest clearly clastic sand grains of "tapioca" quartz occur at that level.

At DL-5 a ¼-inch-thick bed of carbon and sulfides occurs (900 feet), and another ¼-inch-thick carbon seam is found at the base of the formation (997 feet), at the base of a one-foot-thick basal conglomerate with a gray-green matrix surrounding chert, quartz, and black phosphate pebbles, mostly ¼-inch in diameter. Perhaps this carbon seam, lying directly upon a major angular unconformity with the underlying 2700 m. y. old green porphyritic metarhyolite tuff, suggests locally reducing conditions and explains the relatively slight degree of weathering and oxidation displayed by the metarhyolite which possesses no deep fossil regolith comparable to the one developed on the tonalite at DL-4B (+3119 feet).

With regard to uranium, at DL-4 the metaregolith developed on tonalite, unconformably below the Goodrich, is significantly lacking in uranium as a consequence of pre-Goodrich oxidation and weathering. In contrast, at DL-5 the porphyritic green metarhyolite tuff unconformably below the Goodrich contains from 72 - 76 ppm uranium, and was not oxidized or depleted as a consequence of the local reducing nature of the basal Goodrich. Elsewhere, such green metarhyolite tuffs must have been oxidized, depleted, and eroded as suggested by the tapioca-like quartz grains (from porphyry phenocrysts) which occur as clasts in the basal Goodrich at DL-4. The erosion of such clasts implies oxidation of uraniferous matrix metarhyolite, and implies that such volcanics served as sources of uranium, although not at DL-5. Significant clastic microcline and orthoclase in the Goodrich show that generally favorable granitic source areas were exposed to erosion and could have served as sources of uranium during Goodrich deposition.

Lower (Slate or Argillite) Member of the Michigamme Formation

In the Marquette County holes this stratigraphic unit apparently is present only at DL-5 (714-884 feet) where it is stratigraphically 146 feet thick as shown in figures

3 and 4. It consists of three parts, from bottom to top, as follows: 1) 16 feet (866-884 feet) of quartzite and graywacke alternate upward with increasing amounts of straight thin bedded argillite with tan 1 - 2 mm grains which appear in thin section (868 feet) to be rhombs of iron carbonates replacing feldspars; 2) 99 feet (750-866 feet) of gray-green straight bedded argillite, the upper 73 feet of which are strongly chloritic (perhaps a volcanic admixture). (A routine chemical sample (844-849 feet) shows that this unit contains some phosphates which were missed by the ammonium molybdate tests, presumably as a consequence of neutralization of the acid used.); 3) 31 feet (714-750 feet) of light gray thin straight bedded hard siliceous argillite and graywacke are vuggy and brecciated, perhaps as an indirect indication of pre-Bijiki erosion and slumping. Thin sections of all three lithologic types contain clasts of quartz, chert, microcline, and plagioclase. Carbonaceous matter is present, and carbonates are abundant. Chlorite and sericite have recrystallized probably from clayey and other original constituents obliterated by mild metamorphism. Sulfides, mainly pyrite, are present.

With regard to uranium possibilities, the presence of clastic microcline grains suggests that granitic generally favorable source areas were still exposed to erosion during the deposition of the Lower (Slate or Argillite) Member.

DL-6, in Iron County, contains a true stratigraphic thickness of 286 feet (236-1093 feet) of alternating carbon-rich and carbonate-rich chloritic graywackes and argillites alternating with cherty and slaty iron-formation layers. At DL-6 the graywackes and argillites are non-phosphatic, whereas the iron-formation layers are conspicuously phosphatic.

Bijiki Iron-Formation Member of the Michigamme Formation

This formation appears to be the lowest stratigraphic unit common to all three, the Dead River, Clark Creek, and East Baraga Basins. In all three, the base of the formation shows ten feet of sediments with significantly coarse clastics, above which are from 37 - 76 feet of cherty carbonates with stromatolites and additional

clastics. Some of the chert is bedded and is presumably of chemical or biological origin; whereas some chert occurs in clasts.

At DL-4, 10 feet (3008-3019 feet) of cherty carbonate alternate with sulfide-rich graywacke and two 2-inch-thick radioactive conglomerates (3008 and 3011 feet) with quartz, chert, black phosphatic (apatite), and broken phosphatic (collophane) algal stromatolites. These are overlain by 40 feet (2966-3008 feet) of cherty carbonate, conglomerates, and argillites which display carbonate clasts as well as interstitial carbonate. Conglomerates contain carbonaceous black phosphatic pebbles and chert pebbles.

At DL-5, the lowest foot of 10 feet (702-714 feet) of slightly radioactive gray-green conglomerate contains chloritic argillite, chert, and black phosphate pebbles in a chlorite-carbonate matrix with stylolites at the base and slightly above. This grades upward into a carbonate- and chlorite-rich agglomerate or reconstituted water-laid volcanoclastic bed. This unit is pyritic and is overlain by 37 feet (660-702 feet) of cherty carbonates with algal stromatolites and carbonate-rich chloritic or sericitic argillites. The top of the cherty carbonates (660 feet) is slightly chloritic and slightly radioactive.

At DL-7, 10 feet (648-659 feet) of carbonate-rich finely grained conglomerates and grits are arkosic and contain microcline and plagioclase in the lowest foot, where the Bijiki rests with major unconformity directly upon Precambrian W microcline-rich granite. The clastic microcline in this basal Bijiki is stratigraphically the highest clastic microcline observed in this drilling, although clastic plagioclase continues upwards throughout the overlying half-mile thickness drilled of the Michigamme Formation, at DL-4, and in shorter segments at DL-1, DL-3, and DL-5. The upper portion of the Bijiki consists of 76 feet (569-648 feet) of cherty carbonates with algal stromatolites alternating with conglomerates with black phosphatic pebbles, clastic chert and clastic carbonate in a marble matrix. In addition to the typical 1-inch by 6-inch algal stromatolites, 1/8-inch spheroidal organic features (at 569 feet) occur at the top of the formation.

With regard to uranium deposition, this phosphatic unit is the first to represent complete inundation of the entire local region, including the inundation of the preexisting granitic microcline-bearing source areas. The Bijiki therefore represents essentially the last opportunity for the incorporation of debris from those good source areas into syngenetic sedimentary uranium concentrations in the Michigamme Formation. While this drilling project revealed no encouragement for commercial uranium mineralization in any of the units probed, it did reveal that the Bijiki Member appears to be the most favorable Precambrian X stratigraphic unit of all those drilled.

Upper (Slate or Argillite) Member of the Michigamme Formation

Like the Lower Member, the Upper Member consists mainly of slates, argillites, metasiltites, and graywackes with conspicuous organic carbon and sulfides, and with large amounts of carbonates as chemical and clastic constituents, and with clastic quartz, chert, and plagioclase, and with sericite and chlorite derived from the mild metamorphism of clastic clay minerals. However, unlike the Lower Member, the Upper Member contains 1) thin (less than one foot thick) marble beds with algal stromatolites, 2) numerous carbon-seamed stylolites in such carbonates revealing considerable dissolving of apparently plastic carbonates, 3) graded-bedded turbidites as graywackes with ripped-up clasts of argillite or slate, characteristic of Bouma's or Stanley's lowest units of geosynclinal flysch cycles, rapidly deposited in deep water, 4) phosphates restricted to the lowest portion of the Upper Member (stratigraphically the lowest 140 feet at DL-4, the lowest 130 feet at DL-5, and the lowest 72 feet at DL-7), and 5) no clastic microcline in these cores. However, as noted on page 21 of this report, Burns (1975) observed clastic microcline in the basal 12 feet (his Unit A) of what is presumed to be the Upper Member in Baraga County, in the western portion of the Baraga Basin. This difference suggests a slightly later continuation of exposure and erosion of the microcline-rich source rocks in Baraga County than is recorded in Marquette County. Another distinction between the rocks of Baraga County and Marquette County relates to Burns' observation on his pages 91 and 92 that plagioclase does

not occur in the uppermost 265 feet thickness (his Units E and F) of his 847-feet-thick sequence in the Baraga County cores which he studied. In contrast, in Marquette County clastic plagioclase occurs in a half-mile thickness of this member at DL-4 (from 226-2966 feet), and at still higher stratigraphic levels at DL-3 (at 416 and 429 feet).

The Upper Member constitutes a generally upward-fining sedimentary sequence. Further, this member appears to be more coarsely grained in the southernmost hole, DL-4, than in any of the others. A metamorphic corollary of this sedimentary observation is the most intensive development of slaty cleavage (which significantly deflected drilling) in the northernmost holes, DL-1, DL-3, and DL-7, which contain the highest proportion of fine clastics. All the holes in this project penetrated rocks of relatively low metamorphic rank. The northward fining of clastic sizes suggests a source to the south, in harmony with the observation of Burns (1975, p. 84 - 86) for Baraga County that such strata thicken southward. Note in the above paragraph that the thickness of basal phosphates likewise increases to the south.

At DL-4 coarsely grained "salt and pepper" graded-bedded graywackes from 2 inches to 7 feet in thickness occur (142-2966 feet) as do such graywackes with ripped-up fragments of interbedded black slates or argillite (187-2966 feet). Soft-sediment deformation and penecontemporaneous fragmentation and brecciation are abundant in these turbidites, which extend throughout most of this member from its base (2966 feet) almost to ledge (at a depth of 76 feet). A singular upward-narrowing wedge-shaped veinlet of chamosite with a maximum thickness of 3/4 inch extends obliquely across 8 inches of core (at 2829 feet). This slightly limonitic aggregate of spherulitic masses is less isotropic than greenalite, and it causes a blue reaction with cobalt nitrate to confirm the presence of combined aluminum. Other chlorites are present in the surrounding rock. Dark carbonaceous marbles with algal stromatolites and stylolites are from 3 - 5 inches thick (at 2761, 2769, 2774, 2856, 2861, and 2907 feet). Presumably, these correlate with marbles in Burns' (1975) Units C, c, and d in Baraga County. The youngest massive quartzite-

graywacke bed at DL-4 (2358-2375 feet) occurs relatively near the base of the member; the youngest conglomerate is a 6-inches thick zone with pyrite and chalcopyrite at even greater depth (2832 feet).

At DL-5 (320-660 feet) penecontemporaneously deformed argillites predominate over graywackes, in the reverse of their proportions at DL-4. Clastic plagioclase is present throughout. Carbonate veinlets rather than marble beds occur in the expected footage for marble, perhaps as a consequence of the intrusion of a Precambrian Y mafic dike (523-602 feet) which apparently has rendered the argillites hornfelsic and has concentrated considerable pyrite in adjacent strata.

At DL-7 (243-569 feet) oxidation has modified originally black or gray carbonaceous and pyritic argillites and slates into green and red strata, at shallow depths (less than 313 feet). Such rocks are devoid of pyrite, whose oxidation presumably produced sulfuric acid. Such acid may have dissolved the carbonates of marbles and related algal stromatolites rendering such criteria inappropriate for correlating with marbles and stromatolites observed at DL-1. Below the level of obvious oxidation, 2-inches thick marbles with stromatolites occur (483 and 536 feet). Loose correlation between these two holes was based upon the occurrence of light gray argillite with ripped-up clasts of black slate (315-332 feet at DL-7 and 2100-2104 feet at DL-1). Post-metamorphic conformable clay seams, 1-inch thick, occur within the zone of oxidation (276 and 286 feet). Interesting feathery and crenulated carbon streaks are found in light gray argillite below the oxidized zone (518-519 and 563 feet). Elsewhere, the carbon is more evenly dispersed, below the oxidized zone.

At DL-1 black and gray slates and argillites including black and gray "poker chip" slates are most common in the upper portions of the hole. In such strata plagioclase is rare or absent. Slate is the most common rock at the top, and argillite and metasiltite become more common with depth, as does clastic plagioclase. Graded-bedded graywackes occur at intermediate to maximum depths (665-2148 feet). Ripped-up clasts of black slate or argillite in coarse turbidites

occur at maximum depths (1894-2148 feet). Clearly, clastic grain size increases from top to bottom. Dark gray marbles with algal stromatolites and stylolites occur as minor 6-inches thick (1992 feet) and 1-inch thick (2039 feet) beds. A particularly interesting band (2137 feet) of welded very well rounded carbonate intraclasts approximately 2 mm in diameter suggests that weakly consolidated carbonates behaved plastically as they were eroded from unlithified slightly older lime muds, and redeposited a short distance from their source. Another very interesting bed occurs a short distance (83-86 feet) below ledge (71 feet), where a black carbonaceous bed has developed 30% porosity apparently at the expense of original pyrite and carbonates which have been oxidized and leached. The remaining major constituents are approximately equal amounts of quartz and carbon. The impermeable underlying gray to black slate (86-89 feet) registers radioactivity twice background count, to suggest that the porous zone transmitted uranyl solutions downdip, and that some were reduced at the footwall of the porous zone, in contact with pyritiferous slates. Review of evidence in all the holes impels the author to withdraw the suggestion made in item #13 on page 2 of the report on preliminary geologic data for DL-1 that the 6-inches of pyritiferous chlorite and calcite at 1718 feet are possibly correlative with the Clarksburg Volcanics: Subsequent holes have indicated that these are much higher strata, portions of the Upper (Slate or Argillite) Member of the Michigamme Formation.

At DL-3 the most abundant lithology is black slate with some gray argillite. Very little graywacke is present. Fresh clastic plagioclase occurs (416 and 429 feet). Presumably, these strata represent higher stratigraphic levels than cored elsewhere during this project. Again, review of evidence gathered in the drilling of subsequent holes suggests abandonment of the suggestion made in item #13 on page 2 of the report on preliminary geologic data for DL-3 that thin pyritiferous chlorite layers may correlate with the Clarksburg Volcanics: Instead, these beds probably are relatively high in the Upper (Slate or Argillite) Member of the Michigamme Formation.

The southward thickening of sedimentary units and the southward coarsening of clastic sizes implies that the highly uraniferous Precambrian W Republic area granitic rocks, to the south, should have provided an excellent source of uranium for these sediments. Unfortunately, the maximum 5.4 ppm uranium and average 2.5 ppm uranium from the 5-feet-long chemical samples suggest that such was not the case. The preponderance of clastic plagioclase and the almost universal absence of clastic microcline and orthoclase in the Upper (Slate and Argillite) Member suggest that the favorable granitic source areas may have been inundated and hence were no longer sources of debris.

METAMORPHISM

With chlorite and sericite, the Precambrian X strata drilled during this project belong to the chlorite zone of metamorphism according to the classification of James (1955), and in the muscovite-chlorite subfacies of the greenschist facies (Hietanen, 1967), in agreement with the observations of Burns (1975, p. 94) for Baraga County. This low metamorphic rank is reflected in the presence of chamosite at DL-4B (2829 feet). Talcous pyrophyllite (confirmed by blue cobalt nitrate tests for aluminum) as gouge and as fracture fillings in the upper portions of some holes, DL-1 (129-134 feet), DL-3 (236-240, 255 feet), and DL-4 (84-116 feet), is thought to have formed after the Penokean orogeny. (See paragraphs on structural style.)

There is no evidence of significant remobilization of uranium during Penokean metamorphism. With the exception of 130 ppm uranium in one 2-inches-thick conglomerate of the Bijiki Member, the highest uranium chemical analysis from Baraga Group strata was 5.4 ppm, and the average value was 2.5 ppm.

PRECAMBRIAN Y DIABASE AND GABBRO

Magnetically negative unmetamorphosed mafic dikes with chilled borders occupy two orientations: 1) essentially east-west with vertical dip, as at DL-3 (1545-1551 feet), and parallel to $N.70^{\circ}-80^{\circ}W.$, $45^{\circ}-60^{\circ}SW.$ slaty cleavage in the Michigamme Formation, as at DL-4B (2286-2358, 2825-2827 feet) and as at DL-5 (523-602 feet). The presence of pyrite and other sulfides in association with the magnetically easily located dikes may be relevant to reduction and precipitation of down-dip-migrating uranyl solutions in very rare permeable beds of Precambrian X age.

The close spatial relation between sulfide mineralization and Precambrian Y Keweenaw faults parallel to both sets of Keweenaw dikes suggests that this gineous activity may have provided heat to energize convection cells of available brines and waters. Drilling suggested that sulfides have been remobilized in this way. Uranium also may have moved during these events, but proof of this is lacking in the drill cores.

STRUCTURAL STYLE AND TIMING

Much structural information appears in the six preliminary geologic data reports, and such data will not be repeated here. However, comparison of these data reveals late Precambrian X Penokean and Precambrian Y Keweenaw regional tectonic styles. In Marquette County, all three basins apparently were subjected to NNE-SSW compression during the Penokean orogeny, resulting in the development of these gently-plunging synclines with originally rather uniformly oriented axial-plane slaty cleavage, $N.70^{\circ}-80^{\circ}W.$, $50^{\circ}-55^{\circ}SW.$ Minor Keweenaw faulting encountered during the drilling in Marquette County consists of two orientations of gravity faults which are parallel to the two orientations of Precambrian Y mafic dikes: 1) East-west vertical faults with north blocks downthrown occur at DL-1 (129-134, 592-622, 999-1000, 1775-1784, 1895-1897, and 2085-2088 feet) and these faults drag both bedding and slaty cleavage. 2) $N.70^{\circ}-80^{\circ}W.$, $15^{\circ}-90^{\circ}SW.$ faults

parallel to slaty cleavage and with downthrown southwestern blocks occur at DL-3 (236-240, 647, 803-805, and 1252 feet), DL-4B (1053-1056, 1316-1318, 1394-1402, 1540-1545, 1685-1706, and 2098 feet) DL-5 (462-463, 477-498, 729, 743, 744, 792, 796, and 1056 feet), and DL-7 (500-502 feet). The latter observation, at DL-7, is based upon a re-examination of the cores and differs from the vertical fault pictured on figure 1, page 4, of the preliminary geologic data report; instead the fault apparently dips almost 40° SW. The slickensided graphite, pyrophyllite and clayey gouges of these faults are unmetamorphosed, implying post-Penokean movement. Randomly oriented slaty cleavage in fragments in fault breccias likewise indicates some post-Penokean movement. Both orientations of faults are consistent with Keweenawan north-south horizontal tension suggested by Cannon (1978). If major faults of these two sets are also present in this region, then Keweenawan horst and graben structures may exist in these basins of Baraga Group strata. The present lower (20° - 40° SW.) than average (35° - 65° SW.) dip of Penokean axial-plane slaty cleavage in the Clark Creek Basin (DL-5) suggests rotation of that block during Keweenawan tensional events.

In Iron County, at DL-6, the highly fractured nature of the ground confirms the presence of nearby faults. Phyllosilicate and clayey gouges suggest that some of the movement is post-Penokean, with again, an east-west strike for the faults.

POSSIBILITIES FOR ORE IN PRECAMBRIAN W STRATA

Gold and Copper

The most promising opportunity for finding ore implied by this drilling occurs in the vicinity of DL-5, as described on pages 4 - 6 of the preliminary geologic data report for that hole. As discussed in those recommendations, metabasalt (1059-1148 feet), presumably of the Mona Schist, contains massive and stringer pyrite and pyrrhotite with 20 - 50 ppb Au and 124 - 2010 ppm Cu. Such materials appear to be strata-bound volcanogenic mineralization of Precambrian W age rather than

epigenetic Precambrian X or Y impregnations, inasmuch as the immediately overlying Precambrian W porphyritic metarhyolite tuff (997-1059 feet) is devoid of any mineralization. It is suggested that the traces of gold and copper in the massive pyrrhotite and pyrite may be part of the iron-rich fringe of a possible gold and copper ore body. Specific recommendations for exploration are presented in the preliminary geologic data report.

POSSIBILITIES FOR ORE IN PRECAMBRIAN X STRATA

Base Metals

The universal absence of silver in sulfide mineralization in Precambrian X Baraga Group carbonaceous and pyritic strata diminishes the possibility that such concentrations are solely of Keweenawan hydrothermal origin. However, the presence of such mineralization in sheets along Penokeyan slaty cleavage as well as along bedding planes adjacent to faults and dikes of Keweenawan age, and in breccia zones parallel to such faults and dikes as well as parallel to bedding indicates that the present location of mineralized patches is related to Keweenawan events. Therefore, the most likely origin involves a combination of 1) precipitation of dispersed iron, copper, lead, and zinc sulfides in the reducing environment of Baraga Group carbonaceous sediments during Precambrian X "time", followed by 2) remobilization and reconcentration of such sulfides during Keweenawan igneous and tectonic events during Precambrian Y "time". Much mineralization is accompanied by quartz and carbonate veinlets.

Jack W. Avery has reported megascopically discernible base metal sulfides at the following depths: at DL-3 in the Upper (Slate or Argillite) Member (343, 805, 965-1123 feet), and DL-4 in the Upper (Slate or Argillite) Member (1388-1506, 1685-1706, 2827-2947 with a 6-inches thick conglomerate at 2832 and a 5-feet chemical sample at 2899-2904 with 612 ppm Cu), at DL-5 in the basal Bijiki Member (713-714 feet) and in the Lower (Slate or Argillite) Member (at 792 feet), and at DL-7 in

the Bijiki Member (573-575 feet). In Iron County, at DL-6, base metal sulfides occur in the slates and argillites (266-376 feet) and in the cherty iron-formation layers (the 848-853 feet chemical sample contains 971 ppm Cu, and 965-977 feet core contains visible base metal sulfides). The 612 ppm Cu at DL-4 and the 971 ppm Cu at DL-6 appear to be the best base metal traces routinely collected in five-foot samples from the Baraga Group strata drilled in this project. Recommendations for exploration near each hole appear in each preliminary geologic data report.

Phosphates

Ammonium molybdate tests of acidized core and routine chemical analyses of five-foot samples reveal that minor quantities of phosphate occur in rocks ranging in age from Precambrian W tonalite and granite at DL-4 and DL-7 up through all Baraga Group stratigraphic units. However, the uppermost phosphates occur in the lowermost portion of the Upper (Slate or Argillite) Member of the Michigamme Formation: the lowest 140 feet at DL-4, the lowest 130 feet at DL-5, and the lowest 72 feet at DL-7. Phosphates are not reported from younger strata. The four greatest amounts of phosphate are reported from correlatives of iron-formation: The greatest abundance reported from this study is for 2.79% P_2O_5 from a 2-inches-thick conglomerate near the base of the Bijiki Iron-Formation Member at DL-4B (3011 feet), 3½ miles southsoutheast from the section 15 phosphate occurrence (with more than 15% P_2O_5) described by Cannon and Klasner (1976, p. 3 - 5). At DL-5 the maximum phosphate analysis from a 5-foot-long sample (664-669 feet) of 0.43% P_2O_5 also is obtained from the Bijiki. The maximum analysis from DL-7 (575-580 feet) of 0.28% P_2O_5 also is in the Bijiki. In Iron County, at DL-6 P_2O_5 ranges between 0.32% - 0.69% with an average of 0.50% in the iron-formation layers of the Michigamme Formation. No commercial encouragement was encountered in these drill holes except for the scientific observation of stratigraphic continuity of slightly phosphatic rocks which may grade laterally into phosphate deposits elsewhere in the region, presumably to the northwest of the Marquette County holes. However, the presence of phosphate

within these strata is relevant to the ready dissolving and redistribution of oxidized uranium as uranyl phosphate complex ions, as implied by the chemistry of Langmuir (1978).

Uranium

In the 5-foot-long routine chemical samples, collected from every 30 feet of core, the highest uranium content in Baraga Group strata was 5.4 ppm, and the average value was approximately 2.5 ppm uranium, both values obtained from readily soluble uranium dissolved by nitric/perchloric acid digestion (not including hydrofluoric acid). By the same technique, the highest value obtained from the cores was 130 ppm uranium from a 2-inches thick conglomerate in the Bijiki Iron-Formation Member at DL-4 (3011 feet). When digested in nitric/perchloric/hydrofluoric acids, the total uranium in the latter sample was 260 ppm, suggesting that 50% of the total uranium was present as readily dissolved species. This is the same order of magnitude determined by Vickers (1956, p. 40 - 41) who demonstrated that 31% - 42% of the Michigamme Formation total uranium could be easily dissolved from crushed rock by distilled water. However, discounting the following figures of Vickers and Mancuso to 31%, to 42%, or to 50% of their stated total uranium content yields soluble uranium values far in excess of those exhibited in the cores: Vickers reported 13 - 90 ppm total uranium in unaltered Michigamme slates, and Mancuso (1977) reported a maximum of 435 ppm total uranium in Baraga County radioactive phosphatic occurrences in what is here considered Bijiki Iron-Formation Member. The low values in the cores, with an average of 2.5 ppm relatively soluble uranium, do not augur well for down-dip supergene enrichments derived solely from these drilled strata.

The geologic data report for DL-7 (Trow, 1978, p. 2 - 4) illustrates the possible development of roll fronts in pyritic-carbonaceous strata with an initial wave of oxidation which changes black rocks to green by oxidizing the sulfur of pyrite without oxidizing the iron, followed by a second wave of oxidation which changes green rocks to red by oxidizing the iron. Through such oxidation tetravalent

uranium could be oxidized to mobile uranyl species, to be precipitated through reduction down dip. To yield a uraniferous roll front with a cross section of 100 square feet in a permeable bed 10 feet thick, deriving all uranium from the 2.5 ppm average in the bed, solutions would have to migrate 5,000 feet down dip to form an "ore body" with 1250 ppm uranium, if not blocked and reduced with resulting lower tenor at higher levels by a vertical east-west sulfide-rich Keweenaw diabase dike. In the latter instance, such leaner concentrations might be detected at the surface by alpha-radon or helium detectors on the up-dip (with respect to Baraga Group strata) side of Precambrian Y diabase dikes located by their negative magnetic signatures. Sufficient down-dip migration to insure sufficient tenor for roll fronts yields unattractively deep targets, if all such uranium is derived solely from the slates themselves.

Suitably permeable strata were conspicuously absent from the Marquette County cores. Experience at DL-7 indicates that green-red oxidized strata are very permeable and are characterized during drilling by a complete loss of circulation which fails to respond to usual mudding and grouting remedies. Such strata require casing and reduction to smaller tools for continued drilling. If someone encounters such a zone at great depth, then one might seek a roll front down dip from such a hole, as the longer (and deeper) the migration of uranyl solutions in such lean strata, the greater the opportunity for finding sufficient concentrations of reduced uranium species. The only other conspicuously permeable bed in the Marquette County holes occurred at DL-1 (83-86 feet) where a black sooty carbonaceous cherty porcellanite developed 30% porosity presumably through dissolving of carbonates, above a footwall of black impermeable slate in which radioactivity increased to two times background. These observations suggest that some uranyl solutions moving down dip in the porous zone were reduced and fixed as tetravalent uranium by the underlying carbonaceous and pyritic slate. Fault-induced permeability at DL-6, in Iron County, was not accompanied by obvious uranium enrichment. The general paucity of permeable beds in the mildly metamorphosed Michigamme Formation and the commonly low uranium content of such strata drilled are not overwhelmingly favorable for the formation of rich dike-

intersection or roll-front supergene uranium ore bodies. Perhaps the most important function that Baraga Group carbonaceous strata may have accomplished is to have served as the electrically conductive carbon source for the electrochemical evolution of methane to reduce and precipitate uranium in overlying oxidized rocks, as indicated in the following paragraphs, whether those oxidized rocks are oxidized iron-formation, the Jacobsville Sandstone, or Pleistocene drift (time permitting).

A NEW MODEL FOR SASKATCHEWAN'S UNCONFORMITY-RELATED ORE BODIES IS RELEVANT TO MICHIGAN

General Principles

Hoeve and Sibbald (1978) suggest that ore bodies of reduced uranium species, at and above the unconformity at the base of the mainly oxidized Athabasca Formation, were precipitated by rising fugitive reducing agents such as methane. Carbon dioxide and methane occur in the ores, and some underlying graphite appears to have been decomposed. Hoeve and Sibbald ascribe the evolution of these gases to thermally activated reactions involving the carbon-hydrogen-oxygen system within the carbonaceous strata below the unconformity. Rather than calling upon thermal events related to deep-burial diagenesis or to metamorphism to provide the energy for these near-equilibrium reactions, it is here suggested that the alternative may be that electrochemical cells energized the methane-producing reactions. This proposal is somewhat similar to that of Tilsley (1978, and to Robertson, Tilsley, and Hogg, 1978) who suggested electroplating directly adjacent to conductors rather than evolution of fugitive reducing gases migrating upward from conductors. The presence of considerable ore tonnages at higher levels than the graphitic conductors in Saskatchewan implies the correctness of the Hoeve-Sibbald appeal to rising gases which have developed ore and bleached zones in otherwise unaltered hematitic sandstones.

Sato and Mooney (1960) demonstrate that a negative electrical self-potential geophysical anomaly exists above a carbonaceous conductor exposed to shallow oxidizing solutions and to deep reducing solutions. Figure 5 illustrates an application of such an electrical cell to Saskatchewan unconformity-type ores:

Figure 5

Schematic cross section of methane generation and resulting pitchblende ore above graphite conductor with a negative self-potential geophysical anomaly (at the time of ore deposition) in the Athabasca Basin.

The advantage of this model is that it does not require either deep burial or metamorphism to provide the energy to drive the methane-producing reaction to the right. A natural electric current does the job.

Thermodynamically, methane should reduce soluble uranyl species to pitchblende. Rumors that laboratory experiments show kinetically that methane will not reduce uranyl species in oxygenated waters are not in this case convincing because 1) such experiments have resulted in acidic waters from the oxidation of methane. However, in its simplest statement, such a reaction,

consists of two rate-determining steps,

both of which require an excess of hydroxide ions. These would be expected in oxygenated ground waters through hematitic porous media. 2) Such experiments have not included the presence of finely divided hematite, which is present in unaltered Athabasca Formation and which may be relevant:

3) Such experiments have not involved negative electrical fields consistent with low-voltage high-capacitance negative self-potential geophysical anomalies. Such experiments apparently have not duplicated the geological conditions in Saskatchewan, and hence should not be cited as evidence against the postulated effectiveness of methane as a reductant in Saskatchewan. To condense the presentation, each of the above reactions is a combination of two half-cell reactions, and for the sake of simplicity, the uranyl soluble species UO_2^{++} is used, even though phosphate and carbonate complex ions are more likely in the pH range expected.

It should be noted that presently, concealed methane-producing graphite conductors are being located by geophysical methods other than self-potential surveys, for example by various ground or airborne EM methods. Self-potential anomalies would be expected to persist only as long as high Eh oxygenated waters percolated through the Athabasca Formation, thereby driving the electrochemical reactions. Likewise, methane production would be expected to persist only as long as such solutions migrated and provided a contrast to basement rock connate water.

Essentials for this model include the following: 1) An oxidized permeable medium transporting an abundant flow of relatively oxygenated uranyl solutions of relatively high Eh, above and in contact with 2) more reduced rocks with lower Eh connate waters penetrated by or including 3) a graphitic conductor with sufficient adjacent permeability (ground preparation) to permit migration of ions to close the electric circuit related to the current (flow of electrons) in the conductor itself. The following paragraphs illustrate some examples in which Precambrian X carbonaceous strata in Michigan may be responsible for uranium concentrations in geometrically overlying oxidized rocks.

Michigan Oxidized Iron-Formations/Soft Iron Ores and Graphitic Slates of Precambrian X Age

Two-thirds of the supergene uranium occurrences in Michigan's metasedimentary rocks cited by Johnson (1976, p. 108 - 127) occur where oxidized iron-formation or soft iron ore is in contact with graphitic slate. A classic example is well illustrated (James, Dutton, Pettijohn, and Wier, 1968, p. 114 - 118) from the Sherwood mine, near Iron River, where in 1951 Robert C. Reed and John M. Ohlson discovered uraninite with equivalent U_3O_8 as high as 0.513% in small pockets in overturned oxidized cherty iron-formation where it geometrically lies above a graphitic-pyritic slate. Where the beds are not overturned and the graphitic slate lies geometrically and stratigraphically above the oxidized iron-formation, no uranium occurs. This geometry fits the model here presented, and suggests that the graphite generated methane which rose into the oxidizing solutions to precipitate sulfides and uraninite. The great depth of oxidation of iron-formations to a depth of 5000 - 6000 feet in the Marquette district (Boyum, 1975) suggests that in post-Precambrian X time appropriate oxidizing solutions penetrated to very deep levels in the Lake Superior region. Some of the most favorable sites for supergene uranium possibilities in Michigan lie in oxidized iron-formations or soft ores above graphitic beds.

Michigan's Precambrian Z Jacobsville Sandstone over Precambrian X Graphitic Slates

Jorma Kalliokoski (1977) has well stated the favorability of such a combination, in considerable detail.

Pleistocene Drift over Precambrian X Graphitic Slates

Enough time may not have elapsed since the end of the Pleistocene for the formation of ores in glacial drift. However, the presence of excellent sources of uranium in Precambrian W granitic and metarhyolitic rocks, the permeability and

state of oxidation of some drift, and the presence of reduced carbonaceous strata in underlying Precambrian X sequences suggest the geometric favorability for the eventual formation of pitchblende in the Pleistocene sediments. Such potential ores may be growing at present, associated with self-potential anomalies and the evolution of methane.

BIBLIOGRAPHY

- Boyum, B. H., 1975, The Marquette mineral district of Michigan: Proc. 21st Annual Inst. Lake Superior Geology, Marquette, Michigan, p. 189-261.
- Burns, G. K., 1975, Middle Precambrian black slate of the Baraga Basin, Baraga County, Michigan: Unpub. master's thesis, Bowling Green State University, 129 p.
- Busk, H. G., 1929, Earth flexures: Cambridge University Press.
- Cannon, W. F., and Klasner, J. S., 1976, Phosphorite and other apatite-bearing sedimentary rocks in the Precambrian of northern Michigan: U. S. Geol. Survey Circ. 746, 6 p.
- Cannon, W. F., 1977, Map showing Precambrian geology in parts of the Baraga, Dead River, and Clark Creek Basins, Marquette and Baraga Counties, Michigan: U. S. Geol. Survey Prelim. Open-file Map 77-467.
- Cannon, W. F., 1978, A Middle and Late Precambrian fault system in northern Wisconsin and northern Michigan: Abst. and Proc. 24th Inst. Lake Superior Geology, Milwaukee, Wisconsin, p. 8.
- Hietanen, A., 1967, On facies series in various types of metamorphism: Jour. Geology, v. 75, p. 187-212.
- Hoeve, J., and Sibbald, T. I. I., 1978, On the genesis of Rabbit Lake and other unconformity-type uranium deposits in northern Saskatchewan, Canada: Econ. Geology, v. 73, p. 1450-1473.
- James, H. L., 1955, Zones of regional metamorphism in the Precambrian of northern Michigan: Geol. Soc. Amer. Bull., v. 66, p. 1455-1488.
- James, H. L., Dutton, C. E., Pettijohn, F. J., and Wier, K. L., 1968, Geology and ore deposits of the Iron River - Crystal Falls district, Iron County, Michigan: U. S. Geol. Survey Prof. Pap. 570, 134 p.
- Johnson, C., 1976, Part II, Mode of occurrence of uranium and thorium in the Precambrian rocks of the Upper Peninsula of Michigan: in Kalliokoski, J., Uranium and thorium occurrences in Precambrian rocks, Upper Peninsula of Michigan and northern Wisconsin, with thoughts on other possible settings: U. S. E. R. D. A. Open-file Report GJBX-48 (76), Grand Junction, Colorado, p. 13-159.

BIBLIOGRAPHY

- Kalliokoski, J., 1977, The unconformity-type Proterozoic pitchblende ore body model and its application to northern Michigan: in Metamorphic host rock session, 1977 NURE Geology Uranium Symposium, Dec. 7 - 8, Bendix Field Engineering Corporation, Grand Junction, Colorado, p. 28-35.
- Lamey, C. A., 1937, Republic Granite or basement complex: Jour. Geology, v. 45, p. 487-510.
- Langmuir, D., 1978, Uranium solution-mineral equilibria at low temperatures with applications to sedimentary ore deposits: Geochem. et Cosmochim. Acta, v. 42, p. 547-569.
- Mancuso, J. J., Loughheed, M. S., and Shaw, R., 1975, Carbonate-apatite in Precambrian cherty iron-formation, Baraga County, Michigan: Econ. Geology, v. 70, p. 583-586.
- Mancuso, J. J., Loughheed, M. S., Seavoy, R., and Shaw, R., 1975, The significance of the cherty iron formation, Baraga Basin, Michigan: Proc. 21st Annual Inst. Lake Superior Geology, Marquette, Michigan, p. 25.
- Mancuso, J. J., 1977, personal communication.
- Puffett, W. P., 1974, Geology of the Negaunee Quadrangle, Marquette County, Michigan: U. S. Geol. Survey Prof. Paper 788, 53 p.
- Reed, R. C., 1977, Unsolicited proposal for drilling for geologic information in Middle Precambrian basins in the western portion of northern Michigan: Geol. Survey Div., Michigan Dept. Nat. Resources, Box 30028, Lansing, Michigan 48909.
- Robertson, D. S., Tilsley, J. E., and Hogg, M. G., 1978, The time-bound character of uranium deposits: Econ. Geology, V. 73, p. 1409-1419.
- Sato, M., and Mooney, N. M., 1960, The electrochemical mechanism of sulfide self-potentials: Geophysics, v. 25, p. 226-249.
- Tilsley, J. E., 1978, Role of electrochemical cells in formation of paleo-surface-related vein-type uraniferous deposits: Am. Assoc. Petrol. Geologists Bull., v. 62, p. 567.
- Trow, J., 1978, Engineering report, diamond drilling for geologic information in the Middle Precambrian basins in the western portion of northern Michigan: Bendix Field Engineering Corporation, Tech. Library, Box 1569, Grand Junction, Colorado 81501, GJBX50 (79)
DL-1, 11 p. + microfiche Bendix and Birdwell geophysical logs,
DL-3, 11 p. + microfiche Bendix and Birdwell geophysical logs,
DL-4, 16 p. + microfiche Bendix and Birdwell geophysical logs,
DL-5, 10 p. + microfiche Bendix and Birdwell geophysical logs,
DL-6, 8 p. + microfiche Bendix and Birdwell geophysical logs, and
DL-7, 7 p. + microfiche Bendix and Birdwell geophysical logs.

BIBLIOGRAPHY

- Trow, J., 1978, Preliminary geologic data (including d.d.h. logs by Jack W. Avery and David W. Snider: Geol. Survey Div., Michigan Dept. Nat. Resources, Box 30028 Lansing, Michigan 48909,
DL-1, 5 p. + 26 p. d.d.h. logs by J. W. Avery,
DL-3, 5 p. + 20 p. d.d.h. logs by J. W. Avery,
DL-4, 6 p. + 53 p. d.d.h. logs by J. W. Avery and D. W. Snider,
DL-5, 6 p. + 18 p. d.d.h. logs by J. W. Avery,
DL-6, 4 p. + 11 p. d.d.h. logs by J. W. Avery,
DL-7, 4 p. + 10 p. d.d.h. logs by J. W. Avery.
- Tyler, S. A., and Twenhofel, W. H., 1952, Sedimentation and stratigraphy of the Huronian of Upper Michigan: Am. Jour. Sci. v. 250, p. 1-27, 118-151.
- Van Schmus, W. R., 1978, Geochronologic analysis of core samples from drill holes in the Middle Precambrian basins in Marquette County, Michigan: Aug. 20, 1978, report to Geol. Survey Div., Michigan Dept. Nat. Resources, 9 p.
- Vickers, R. C., 1956, Origin and occurrence of uranium in northern Michigan: U. S. Geol. Survey Open-file Report, 76 p.
- Villar, J. W., 1965, Metamorphic petrology of the Animikie Series in the Republic Trough area, Marquette County, Michigan: Unpub. Ph.D. thesis, Michigan State University, 179 p.

APPENDIX
OF
ANALYTICAL CHEMICAL DATA

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DOC: P2 JOB NO: 011.15 FRACT: NPLOTS: 28 ARI 2: T

AREA DESC: MICHIGAN - DAVE SNIDER

USER'S INITS: DCN

CARD INPUT PARAMETERS:

CAO-%	27	LINEAR	18.0	0.0001
FE2O3-%	51	LINEAR	1.0 20.0	0.0001
MGO-%	59	LINEAR		0.0001
MNO-%	63	LINEAR		0.0001
P2O5-%	75	LINEAR	2.0	0.0001

PROFILE PLOT--CAO, Fe_2O_3 , MGO, MNO, P_2O_5

AREA: MICH

AREA: MYCH										
CAN-8		FE203-8		MG0-8		MNO-8		P205-8		
LINEAR SCALE		LINEAR SCALE		LINEAR SCALE		LINEAR SCALE		LINEAR SCALE		
CLIENT	0.160	18.0	1.00	20.0	0.200	6.20	0.00950	0.850	0.	2.00
SAMPLE NAME	+	+	+	+	+	+	+	+	+	+
1-104-109	*		*****		*****		*		**	
1-134-139	*		*****		*****		*		**	
1-164-169	*		*****		*****		*		**	
1-194-199	*		*****		*****		**		**	
1-224-229	*		*****		*****		**		**	
1-284-289	*		*****		*****		**		**	
1-314-319	*		*****		*****		**		**	
1-344-349	*		*****		*****		**		**	
1-374-379	*		*****		*****		**		**	
1-404-409	*		*****		*****		**		**	
1-434-439	*		*****		*****		**		**	
1-464-469	*		*****		*****		**		**	
1-494-499	*		*****		*****		**		**	
1-524-529	*		*****		*****		**		**	
1-554-559	*		*****		*****		**		**	
1-584-589	*		*****		*****		**		**	
1-614-619	*		*****		*****		**		**	
1-644-649	**		*****		*****		**		**	
1-674-679	*		*****		*****		**		**	
1-704-709	**		*****		*****		**		**	
1-734-739	*		*****		*****		**		**	
1-764-769	*		*****		*****		**		**	
1-794-799	**		*****		*****		**		**	
1-824-829	*		*****		*****		**		**	
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1-884-889	**		*****		*****		**		**	
1-914-919	*		*****		*****		**		**	
1-944-949	***		*****		*****		**		**	
1-974-979	*		*****		*****		**		**	
1004-1009	****		*****		*****		**		*	
1034-1039	*		*****		*****		**		**	
1064-1069	**		*****		*****		**		**	
1094-1099	**		*****		*****		**		**	
1124-1129	****		*****		*****		**		**	
1154-1159	*		*****		*****		*		**	
1184-1189	***		*****		*****		**		**	
1214-1219	**		*****		*****		*		**	
1244-1249	*		*****		*****		*		**	
1274-1279	**		*****		*****		**		**	
1304-1309	*		*****		*****		*		**	
1334-1339	*		*****		*****		*		**	
1364-1369	**		*****		*****		**		**	
1394-1399	**		*****		*****		**		**	
1424-1429	**		*****		*****		**		**	
1454-1459	**		*****		*****		**		**	
1484-1489	**		*****		*****		**		**	
1514-1519	**		*****		*****		**		**	
1544-1549	**		*****		*****		**		**	
1574-1579	**		*****		*****		**		*	
1604-1609	***		*****		*****		**		**	
1634-1639	**		*****		*****		**		**	
1654-1669	**		*****		*****		*		**	
1694-1699	**		*****		*****		**		**	
1724-1729	**		*****		*****		**		*	

1754-1759	**	*****	*****	*	**
1764-1769	****	*****	*****	**	**
1814-1819	**	*****	*****	*	*
1844-1849	**	*****	*****	*	**
1874-1879	****	*****	*****	**	**
1904-1909	*****	*****	*****	*****	**
1934-1939	***	*****	*****	**	**
1964-1969	***	*****	*****	**	**
1994-1999	**	*****	*****	**	**
2024-2029	**	*****	*****	**	**
2054-2059	**	*****	*****	*	**
2084-2089	****	*****	*****	**	*
2114-2119	**	*****	*****	*	**
2144-2148	****	*****	*****	**	**
3-234-239	*	*****	*****	*	**
3-264-269	*	*****	*****	**	*
3-294-299	**	*****	*****	*	**
3-324-329	**	*****	*****	*	**
3-354-359	*	*****	*****	*	**
3-384-389	**	*****	*****	*	**
3-414-419	*****	*****	*****	***	*
3-444-449	***	*****	*****	**	**
3-474-479	**	*****	*****	*	*
3-504-509	**	*****	*****	*	**
3-534-539	**	*****	*****	**	**
3-564-569	***	*****	*****	**	**
3-594-599	*****	*****	*****	**	*
3-624-629	**	*****	*****	*	**
3-654-659	**	*****	*****	*	**
3-684-689	**	*****	*****	*	**
3-714-719	*	*****	*****	*	**
3-744-749	*	*****	*****	*	**
774-779	**	*****	*****	*	**
3-804-809	*****	*****	*****	***	**
3-834-839	****	*****	*****	**	*
3-864-869	**	*****	*****	**	**
3-894-899	*	*****	*****	*	*
3-924-929	**	*****	*****	**	**
3-954-959	**	*****	*****	*	**
3-984-989	**	*****	*****	**	**
1014-1019	*	*****	*****	*	**
1044-1049	*	*****	*****	*	**
1074-1079	*****	*****	*****	**	**
1104-1109	*	*****	*****	*	**
1134-1139	****	*****	*****	**	**
1154-1169	**	*****	*****	*	**
1194-1199	*****	*****	*****	*****	**
1224-1229	**	*****	*****	**	*
1254-1259	*	*****	*****	**	**
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1314-1319	*	*****	*****	**	*
1344-1349	*	*****	*****	**	**
1374-1379	**	*****	*****	**	**
1404-1409	**	*****	*****	**	*
1434-1439	**	*****	*****	**	**
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1494-1499	**	*****	*****	**	*
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1584-1589	**	*****	*****	**	**
1614-1619	*	*****	*****	**	**

5-364-369	*	*****	*****	*	*
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5-484-489	*	*****	*****	*	*
5-514-519	**	*****	*****	*	*
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1114-1119	*****	*****	*****	****	*
1144-1149	*****	*****	*****	****	*
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EX-124-130	***	*****	*****	**	*
EX-155-160	****	*****	*****	**	*
EX-185-190	****	*****	*****	**	*
EX-215-220	**	*****	*****	**	*
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EX-275-280	**	*****	*****	**	*
EX-305-310	**	*****	*****	**	*
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EX-395-400	**	*****	*****	**	*
EX-425-430	**	*****	*****	*	*
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EX-485-490	*	*****	*****	*	*
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EX-935-940	**	*****	*****	**	*
965-970	*	*****	*****	*	*
995-1000	*	*****	*****	**	*
1025-1030	*	*****	*****	*	**

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EX.

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4-1099-1104	*	*****	*****	**	**
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4-1159-1164	**	*****	*****	**	**
4-1189-1194	*	*****	*****	*	**
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4-1249-1254	**	*****	*****	**	**
4-1279-1284	**	*****	*****	**	*
4-1309-1314	***	*****	*****	**	**
4-1339-1344	**	*****	*****	**	**
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4-1399-1404	*	*****	*****	*	**
481429-1434	*	*****	*****	**	**
481459-1464	*	*****	*****	*	**
481489-1494	**	*****	*****	**	**
481519-1524	*****	*****	*****	*****	*
481549-1554	*	*****	*****	*	*
481579-1584	*****	*****	*****	*****	**
481609-1614	**	*****	*****	**	**
481639-1644	*****	*****	*****	****	**
481669-1674	****	*****	*****	**	**
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481729-1734	*	*****	*****	*	**
481759-1764	*	*****	*****	**	**
481789-1794	*	*****	*****	**	**

Ex. 4

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4819091914	*	*****	*****	**	**
4819391944	**	*****	*****	**	**
4819691974	**	*****	*****	**	**
4819992004	*	*****	*****	**	**
4820292034	*****	*****	*****	*****	**
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4820892094	*****	*****	*****	***	**
4821192124	***	*****	*****	***	**
4821492154	*	*****	*****	**	**
4821792184	*****	*****	*****	***	**
4822092214	*	*****	*****	**	**
4822392244	**	*****	*****	**	**
4822692274	**	*****	*****	**	**
4822992304	*****	*****	*****	***	***
4823292334	*****	*****	*****	***	***
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4824792484	***	*****	*****	***	**
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4831693174	*****	****	*****	***	**
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6-308-313	*	*****	*****	***	**
6-338-343	*	*****	*****	***	**
6-368-373	*****	*****	*****	*****	***
6-398-403	*	*****	*****	***	**
6-428-433	*****	*****	*****	*****	*****
6-458-463	**	*****	*****	*****	*****
6-488-493	*	*****	*****	***	**
6-518-523	*	*****	*****	***	**
6-548-553	*	*****	*****	***	**
6-578-583	*	*****	*****	***	**
6-608-613	*	*****	*****	***	**
6-638-643	*****	*****	*****	*****	*****
6-668-678	*	*****	*****	***	**
6-698-703	*	*****	*****	***	**

6-728-733	*	*****	*****	*****	**
6-758-763	*	*****	*****	*****	**
6-788-793	*	*****	*****	*****	**
6-818-823	***	*****	*****	*****	*****
6-848-853	***	*****	*****	*****	*****
6-878-883	**	*****	*****	*****	*****
6-908-913	*	*****	*****	*****	*****
6-938-943	*	*****	*****	*****	**
6-968-973	*****	*****	*****	*****	*****
6-998-1003	***	*****	*****	*****	*****
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7-395-400	*	*****	*****	*	**
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7-515-520	***	*****	*****	**	**
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7-575-580	*****	**	**	*	***
7-605-610	*****	*****	*****	*****	**
7-635-640	*****	*****	*****	*****	**
7-665-670	*****	*****	*****	**	***
7-691-696	***	**	**	*	**
55-713-714	*****	*****	*****	*****	***
5510591065	*****	*****	*****	*****	**
5510651069	*****	*****	*****	*****	*
5510691080	*****	*****	*****	*****	*
5510801090	*****	*****	*****	*****	*
5510901100	*****	*****	*****	*****	*
5511001110	*****	*****	*****	*****	*
5511101120	*****	*****	*****	*****	*
5511201130	*****	*****	*****	*****	**
7-510-511	***	***	***	***	**
7-560-561	**	***	***	*	**
4-3011	*****	*****	*****	*****	*****

6

7

7

SPECIAL SAMPLES

CARD INPUT PARAMETERS:

K ₂ O-%	79	LINEAR	0.0001
SiO ₂ -%	91	LINEAR 30.0	
Na ₂ O-%	99	LINEAR	0.0001
TiO ₂ -%	115	LINEAR	0.0001
AL ₂ O ₃ -%	143	LINEAR	0.0001

PROFILE PLOT—K₂O, SiO₂, Na₂O, TiO₂, Al₂O₃

AREA: MICH

	K20-%		SI02-%		NA20-%		TI02-%		Al 203-%	
	LINEAR SCALE		LINEAR SCALE		LINEAR SCALE		LINEAR SCALE		LINEAR SCALE	
CLIENT	0.00670	5.20	30.0	67.0	0.	4.60	0.0540	3.80	1.20	22.0
SAMPLE NAME	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1-104-109	*****		*****		**		***		*****	
1-134-139	*****		*****		**		****		*****	
1-164-169	*****		*****		*		****		*****	
1-194-199	*****		*****		****		****		*****	
1-224-229	*****		*****		*****		****		*****	
1-284-289	*****		*****		*****		****		*****	
1-314-319	*****		*****		*****		****		*****	
1-344-349	*****		*****		*****		***		*****	
1-374-379	*****		*****		*****		****		*****	
1-404-409	*****		*****		*****		****		*****	
1-434-439	*****		*****		*****		****		*****	
1-464-469	*****		*****		*****		****		*****	
1-494-499	*****		*****		*****		****		*****	
1-524-529	*****		*****		*****		****		*****	
1-554-559	*****		*****		*****		****		*****	
1-584-589	*****		*****		*****		****		*****	
1-614-619	*****		*****		*****		****		*****	
1-644-649	*****		*****		*****		****		*****	
1-674-679	*****		*****		*****		****		*****	
1-704-709	*****		*****		*****		****		*****	
1-734-739	*****		*****		*****		****		*****	
1-764-769	*****		*****		*****		****		*****	
1-794-799	*****		*****		*****		****		*****	
1-824-829	*****		*****		*****		****		*****	
1-854-859	*****		*****		*****		****		*****	
1-884-889	*****		*****		*****		****		*****	
1-914-919	*****		*****		*****		****		*****	
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1-974-979	*****		*****		*****		****		*****	
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1124-1129	*****		*****		*****		****		*****	
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1694-1699	*****		*****		*****		***		*****	
1724-1729	*****		*****		*****		****		*****	

1754-1759	*****	*****	*****	*****
1784-1789	*****	*****	*****	*****
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1844-1849	*****	*****	*****	*****
1874-1879	*****	*****	*****	*****
1904-1909	*****	*****	*****	*****
1934-1939	*****	*****	*****	*****
1964-1969	*****	*****	*****	*****
1994-1999	*****	*****	*****	*****
2024-2029	*****	*****	*****	*****
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2114-2119	*****	*****	*****	*****
2144-2149	*****	*****	*****	*****
2-234-239	*****	*****	*****	*****
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2-294-299	*****	*****	*****	*****
2-324-329	*****	*****	*****	*****
2-354-359	*****	*****	*****	*****
2-384-389	*****	*****	*****	*****
2-414-419	*****	*****	*****	*****
2-444-449	*****	*****	*****	*****
2-474-479	*****	*****	*****	*****
2-504-509	*****	*****	*****	*****
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1554-1559	*****	*****	*****	*****
1584-1589	*****	*****	*****	*****
1614-1619	*****	*****	*****	*****

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5-484-489	*****	*****	*****	*****	*****
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5-544-549	*****	*****	*****	*****	*****
5-574-579	*****	*****	*****	*****	*****
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1114-1119	*****	*****	*****	*****	*****
1144-1149	*****	*****	*****	*****	*****
FX-35-40	*****	*****	*****	*****	*****
FX-65-70	*****	*****	*****	*****	*****
FX-95-100	*****	*****	*****	*****	*****
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EX-185-190	*****	*****	*****	*****	*****
EX-215-220	*****	*****	*****	*****	*****
EX-245-250	*****	*****	*****	*****	*****
EX-275-280	*****	*****	*****	*****	*****
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EX-365-370	*****	*****	*****	*****	*****
EX-395-400	*****	*****	*****	*****	*****
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EX-455-460	*****	*****	*****	*****	*****
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EX-725-730	*****	*****	*****	*****	*****
EX-755-760	*****	*****	*****	*****	*****
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EX-905-910	*****	*****	*****	*****	*****
EX-935-940	*****	*****	*****	*****	*****
965-970	*****	*****	*****	*****	*****
995-1000	*****	*****	*****	*****	*****
1025-1030	*****	*****	*****	*****	*****

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EX.

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4-199-204	*****	*****	*	*****	*****
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4-709-714	*****	*****	*****	*****	*****
4-739-744	*****	*****	*****	*****	*****
4-769-774	*****	*****	*****	*****	*****
4-799-804	*****	*****	*****	*****	*****
4-829-834	*****	*****	*****	*****	*****
4-859-864	*****	*****	*****	*****	*****
4-889-894	*****	*****	*****	*****	*****
4-919-924	*****	*****	*****	*****	*****
4-949-954	*****	*****	*****	*****	*****
4-979-984	*****	*****	*****	*****	*****
4-10091014	*****	*****	*****	*****	*****
4-10391044	*****	*****	*****	*****	*****
4-10691074	*****	*****	*****	*****	*****
4-10991104	*****	*****	*****	*****	*****
4-11291134	*****	*****	*****	*****	*****
4-11591164	*****	*****	*****	*****	*****
4-11891194	*****	*****	*****	*****	*****
4-12191224	*****	*****	*****	*****	*****
4-12491254	*****	*****	*****	*****	*****
4-12791284	*****	*****	*****	*****	*****
4-13091314	*****	*****	*****	*****	*****
4-13391344	*****	*****	*****	*****	*****
4-13691374	*****	*****	*****	*****	*****
4-13991404	*****	*****	*****	*****	*****
4R14291434	*****	*****	*****	*****	*****
4R14591464	*****	*****	*****	*****	*****
4R14891494	*****	*****	*****	*****	*****
4R15191524	*	-	*****	*****	*****
4R15491554	*****	*****	*****	*****	*****
4R15791584	*****	*****	*****	*****	*****
4R16091614	*****	*****	*****	*****	*****
4R16391644	*****	*****	*****	*****	*****
4R16691674	*****	*****	*****	*****	*****
4R16991704	*****	*****	*****	*****	*****
4R17291734	*****	*****	*****	*****	*****
4R17591764	*****	*****	*****	*****	*****
4R17891794	*****	*****	*****	*****	*****

EX
4

10191924	*****	*****	*****	*****
4014401854	*****	*****	*****	*****
4019791844	*****	*****	*****	*****
4019001914	*****	*****	*****	*****
4019391944	*****	*****	*****	*****
4019691974	*****	*****	*****	*****
4019992004	*****	*****	*****	*****
4020292034	*****	*****	*****	*****
4020592064	*****	*****	*****	*****
4020892094	*****	*****	*****	*****
4021192124	*****	*****	*****	*****
4021492154	*****	*****	*****	*****
4021792184	*****	*****	*****	*****
4022092214	*****	*****	*****	*****
4022392244	*****	*****	*****	*****
4022692274	*****	*****	*****	*****
4022992304	*****	*****	*****	*****
4023292334	*****	*****	*****	*****
4023592364	*****	*****	*****	*****
4023892394	*****	*****	*****	*****
4024192424	*****	*****	*****	*****
4024492454	*****	*****	*****	*****
4024792484	*****	*****	*****	*****
4025092514	*****	*****	*****	*****
4025392544	*****	*****	*****	*****
4025692574	*****	*****	*****	*****
4025992604	*****	*****	*****	*****
4026292634	*****	*****	*****	*****
4026592664	*****	*****	*****	*****
4026892694	*****	*****	*****	*****
4027192724	*****	*****	*****	*****
4027492754	*****	*****	*****	*****
4027792784	*****	*****	*****	*****
4028092814	*****	*****	*****	*****
4028392844	*****	*****	*****	*****
4028692874	*****	*****	*****	*****
4028992904	*****	*****	*****	*****
4029292934	*****	*****	*****	*****
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4029892994	*****	*****	*****	*****
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4030793084	*****	*****	*****	*****
4031093114	*****	*****	*****	*****
4031393144	*****	*****	*****	*****
4031693174	*****	*****	*****	*****
6-27A-283	*****	*****	*****	*****
6-30A-313	*****	*****	*****	*****
6-33A-343	*****	*****	*****	*****
6-36A-373	*****	*****	*****	*****
6-39A-403	*****	*****	*****	*****
6-42A-433	*****	*****	*****	*****
6-45A-463	*****	*****	*****	*****
6-48A-493	*****	*****	*****	*****
6-51A-523	*****	*****	*****	*****
6-54A-553	*****	*****	*****	*****
6-57A-583	*****	*****	*****	*****
6-60A-613	*****	*****	*****	*****
6-63A-643	*****	*****	*****	*****
6-66A-673	*****	*****	*****	*****
6-69A-703	*****	*****	*****	*****

2018-01-01

CARD INPUT PARAMETERS:

CO-PPM	39	LINEAR	
CU-PPM	43	LINEAR	
PB-PPM	55	LINEAR	
MO-PPM	67	LINEAR	
NI-PPM	71	LINEAR	300.

PROFILE PLOT---Co, Cu, Pb, Mo, Ni

1754-1759	*****	**	*****	*****	*****
1784-1789	****	**	*****	**	*****
1814-1819	***	**	*****	**	*****
1844-1849	***	***	*****	*****	*****
1874-1879	*****	**	*****	*****	*****
1904-1909	**	**	*****	****	****
1934-1939	***	***	*****	*****	*****
1964-1969	****	**	****	*****	*****
1994-1999	****	**	*****	*****	*****
2024-2029	***	***	*****	*****	*****
2054-2059	***	***	*****	*****	*****
2084-2089	***	***	****	*****	*****
2114-2119	***	****	*****	*****	*****
2144-2148	***	***	*****	*****	*****
3-234-239	****	**	*****	*	*****
3-264-269	***	**	****	*****	*****
3-294-299	****	**	***	**	*****
3-324-329	****	***	***	*****	*****
3-354-359	****	**	****	*****	*****
3-384-389	****	*	***	*****	*****
3-414-419	****	****	*****	*****	*****
3-444-449	****	****	*	*****	*****
3-474-479	****	**	***	*****	*****
3-504-509	****	**	***	*****	*****
3-534-539	****	**	**	*****	*****
3-564-569	****	***	*	*****	*****
3-594-599	****	*****	****	*****	*****
3-624-629	****	**	*****	*****	*****
3-654-659	*****	***	*****	*****	*****
3-684-689	*****	***	****	*****	*****
3-714-719	*****	****	****	*****	*****
3-744-749	*****	**	*****	*****	*****
774-779	***	**	*	*****	*****
3-804-809	****	**	*	*****	*****
3-834-839	***	**	**	*****	*****
3-864-869	*****	***	*	*****	*****
3-894-899	***	**	*	*****	*****
3-924-929	****	**	*****	*****	*****
3-954-959	****	**	***	*****	*****
3-984-989	*****	**	*****	*****	*****
1014-1019	***	**	*****	*****	*****
1044-1049	***	**	***	*****	*****
1074-1079	****	**	**	*****	*****
1104-1109	****	**	***	*****	*****
1134-1139	****	**	**	*****	*****
1164-1169	****	**	*****	***	*****
1194-1199	****	**	***	*****	*****
1224-1229	*****	**	*****	*****	*****
1254-1259	*****	**	*	*****	*****
1284-1289	***	*	*	***	*****
1314-1319	****	**	*****	**	*****
1344-1349	*****	**	**	**	*****
1374-1379	****	**	*	*****	*****
1404-1409	*****	**	*	***	*****
1434-1439	****	**	*	*	*****
1464-1469	***	**	*	*	*****
1494-1499	****	**	*	*	*****
1524-1529	****	**	*	*	*****
1554-1559	***	**	*	*	*****
1584-1589	*****	**	*	*	*****
1614-1619	****	**	*	*	*****

5-364-364	****	**	*	*****
5-394-399	****	*	*	*****
5-424-429	****	*	*	*****
5-454-459	***	*	*	*****
5-484-489	****	**	*	*****
5-514-519	****	**	*	*****
5-544-549	*****	*****	*	*****
5-574-579	*****	*****	*	*****
5-604-609	***	**	*	*****
5-634-639	****	**	*	*****
5-664-669	**	*	*	*****
5-694-699	***	*	*	*****
5-724-729	***	*	*	*****
5-754-759	*****	*	*	*****
5-784-789	****	*	*	*****
5-814-819	****	*	*	*****
5-844-849	*****	*	*	*****
5-874-879	****	*	*	*****
5-904-909	***	*	*	*****
5-934-939	**	*	*	*****
5-964-969	**	*	*	*****
5-994-999	*	*	*	*****
1024-1029	*	*	*	*****
1054-1059	**	**	*****	*****
1084-1089	*****	**	*	*****
1114-1119	*****	**	*	*****
1144-1148	*****	**	*	*****
EX-35-40	****	*****	*****	*****
EX-65-70	****	**	*****	*****
EX-95-100	***	***	*****	*****
EX-124-130	****	*****	*****	*****
EX-155-160	**	**	*	*****
EX-185-190	***	*****	*****	*****
EX-215-220	***	**	*****	*****
EX-245-250	****	**	**	*****
EX-275-280	***	**	*****	*****
EX-305-310	***	**	*****	*****
EX-335-340	****	*****	*****	*****
EX-365-370	***	***	*****	*****
EX-395-400	**	**	*****	*****
EX-425-430	***	***	*****	*****
EX-455-460	****	***	*****	*****
EX-485-490	***	***	*****	*****
EX-515-520	***	**	*	*****
EX-545-550	***	***	*	*****
EX-575-580	***	***	*	*****
EX-605-610	****	***	*****	*****
EX-635-640	***	***	**	*****
EX-665-670	****	***	**	*****
EX-695-700	****	***	*****	*****
EX-725-730	****	**	*	*****
EX-755-760	***	**	*	*****
EX-785-790	****	***	*****	*****
EX-815-820	****	**	*	*****
EX-845-850	****	**	*	*****
EX-875-880	*****	**	*	*****
EX-905-910	****	**	*	*****
EX-935-940	****	***	*	*****
965-970	****	**	**	*****
995-1000	****	***	*****	*****
1025-1030	****	***	***	*****

5
EX.

1055-1060	*****	**	*	*	*****
1085-1090	***	**	*	**	*****
1115-1120	*****	**	*	**	*****
1123-1128	*****	**	**	*	*****
4-109-114	***	*	*	*	*****
4-139-144	*****	**	*	*	*****
4-169-174	*****	***	*	*	*****
4-199-204	*****	**	*	*	*****
4-229-234	*****	*****	*	****	*****
4-259-264	*****	**	*	*	*****
4-289-294	*****	**	*	*	*****
4-319-324	*****	**	*	***	*****
4-349-354	*****	**	*	****	*****
4-379-384	*****	**	*	*	*****
4-409-414	***	**	*	*	*****
4-439-444	*****	**	*	*	*****
4-469-474	*****	*	*	*	*****
4-499-504	*****	**	*	*	*****
4-529-534	***	**	*	***	*****
4-559-564	*****	*	*	*	*****
4-589-594	***	*	*	*	*****
4-619-624	*****	**	*	*	*****
4-649-654	*****	**	*	*	*****
4-679-684	*****	**	*	**	*****
4-709-714	***	*	*	**	*****
4-739-744	*****	*	*	*	*****
4-769-774	*****	**	*	**	*****
4-799-804	*****	**	*	*	*****
4-829-834	*****	**	*	***	*****
4-859-864	*****	**	*	*	*****
4-889-894	*****	*	*	**	*****
4-919-924	*****	*	*	*	*****
4-949-954	*****	**	*	*	*****
4-979-984	***	**	*	*	*****
4-1009-1014	*****	**	*	*	*****
4-1039-1044	*****	*	*	*	*****
4-1069-1074	***	*	*	*	*****
4-1099-1104	*****	**	*	*	*****
4-1129-1134	*****	**	**	*	*****
4-1159-1164	***	**	*	*	*****
4-1189-1194	***	*	*	*	*****
4-1219-1224	*****	*	*	*	*****
4-1249-1254	*****	*	*	*	*****
4-1279-1284	*****	*	*	*	*****
4-1309-1314	***	*	*	*	*****
4-1339-1344	*****	**	*	*	*****
4-1369-1374	*****	*	*	*	*****
4-1399-1404	*****	*****	*****	*****	*****
4814291434	***	***	**	*****	*****
4814591464	*****	*****	***	*****	*****
4814891494	*****	**	***	*****	*****
4815191524	*	*	***	***	*****
4815491554	*****	*****	*****	*****	*****
4815791584	***	*	*	**	*****
4815091614	*****	**	*****	*	*****
4815391644	*****	*	*	**	*****
4815691674	***	*	*	*	*****
4815991704	***	*	*	***	*****
4817291734	*****	**	*	***	*****
4817591764	*****	*	*	*	*****
4817891794	*****	*	*	**	*****

EX.
4

4418191824	****	*	*	****	****
4418491854	****	*	*	****	****
4418791884	****	*	*	****	****
4419091914	****	*	*	****	****
4419391944	****	**	*	****	****
4419691974	****	*	*	****	****
4420092004	*****	**	*	****	****
4420292034	*****	*	*	****	****
4420592064	*****	**	*	****	****
4420892094	*****	*	*	****	****
4421192124	*****	**	*	****	****
4421492154	*****	*	*	****	****
4421792184	*****	**	*	****	****
4422092214	*****	**	*	****	****
4422392244	*****	**	*	****	****
4422692274	*****	*	*	****	****
4422992304	*****	*****	*	****	****
4423292334	*****	*****	*	****	****
4423592364	*****	*	*	****	****
4423892394	*****	**	*	****	****
4424192424	*****	*	*	****	****
4424492454	*****	*	*	****	****
4424792484	*****	*	*	****	****
4425092514	*****	**	*	****	****
4425392544	*****	**	*	****	****
4425692574	*****	**	*	****	****
4425992604	*****	**	*	****	****
4426292634	*****	**	*	****	****
4426592664	*****	**	*	****	****
4426892694	*****	**	*	****	****
4427192724	*****	**	**	****	****
4427492754	*****	*	*	****	****
4427792784	*****	**	*	****	****
4428092814	*****	*****	*****	****	*****
4428392844	*****	****	****	****	*****
4428692874	*****	****	****	****	*****
4428992904	*****	****	*	*****	*****
4429292934	*****	*****	*	****	*****
4429592964	*****	*	*	****	****
4429892994	****	**	*	****	****
4430193024	*****	*	*	****	****
4430493054	*****	*	*	****	****
4430793084	****	*	*	****	****
4431093114	*****	*	*	****	****
4431393144	***	*	*	****	****
4431693174	****	*	*	****	****
6-278-283	*****	**	*	****	****
6-308-313	*****	*	*	****	****
6-338-343	*****	*	*	****	****
6-368-373	*****	*****	*	*****	****
6-398-403	*****	*	*	****	****
6-428-433	*****	****	*	****	****
6-458-463	*****	**	*	****	****
6-488-493	*****	*	*	****	****
6-518-523	*****	*	*	****	****
6-548-553	*****	*	*	****	****
6-578-583	*****	*	*	****	****
6-608-613	*****	*	*	****	****
6-638-643	*****	**	*	****	****
6-668-678	*****	*	*	****	****
6-698-703	*****	**	*	****	****

6-728-733	*****	**	*	*	*****
6-758-763	*****	**	*	*	*****
6-788-793	*****	***	*	*	*****
6-818-823	*****	***	*	*	*****
6-848-853	*****	*****	*	***	*****
6-878-883	*****	**	*	*	*****
6-908-913	*****	**	*	*	*****
6-938-943	*****	**	*	*	*****
6-968-973	*****	***	*	**	*****
6-998-1003	*****	****	*	*****	*****
6-1028-1033	*****	**	*	*	*****
6-1058-1063	*****	***	*	**	*****
6-1088-1093	*****	**	*	**	*****
7-275-280	*****	*	*	**	*****
7-305-310	*****	*	*	*	*****
7-335-340	*****	**	*****	*	*****
7-365-370	*****	*	**	**	*****
7-395-400	*****	**	***	*****	*****
7-425-430	*****	**	*****	*****	*****
7-455-460	*****	***	*****	*****	*****
7-485-490	*****	**	*****	*****	*****
7-515-520	*****	***	*****	*****	*****
7-545-550	*****	**	*****	*****	*****
7-575-580	***	*	***	*	*****
7-605-610	****	*	*	***	**
7-635-640	****	*	*	**	**
7-665-670	****	*	***	***	**
7-695-700	***	*	***	*	**
SS-713-714	*****	*	*	*	**
SS10591065	*****	****	*	*	*****
SS10651069	*****	*****	*	*	*****
SS10691080	*****	*****	*	*	*****
SS10801090	*****	**	*	*	*****
SS10901100	*****	**	*	*	*****
SS11001110	*****	**	*	*	*****
SS11101120	*****	***	*	*	*****
SS11201130	*****	**	*	*	*****
7-510-511	****	**	*****	*	*****
7-560-561	*****	***	*****	**	*****
6-3011	*****	*	*****	*****	*****

6

7

7
SPECIAL SAMPLES

CARD INPUT PARAMETERS:

BA-PPM 83 LINEAR

AG-PPM 95 LINEAR

SR-PPM 103 LINEAR

TH-PPM 119 LINEAR

ZR-PPM 123 LINEAR

PROFILE PLOT--BA, AG, TH, ZR

AREA: MILH

CLIENT	BA-PPM LINEAR SCALE			AG-PPM LINEAR SCALE			SK-PPM LINEAR SCALE			IC-PPM LINEAR SCALE			Zn-PPM LINEAR SCALE		
	3.60	3100.	0.	4.90	1.00	650.	0.	50.0	0.	420.					
SAMPLE NAME	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
1-104-109	**		*		*		****		*****						
1-134-139	***		*		*		***		*****						
1-164-169	**		*		*		***		*****						
1-194-199	*****		*		**		***		*****						
1-224-229	*****		*		**		***		*****						
1-284-289	***		*		**		***		*****						
1-314-319	***		*		**		***		*****						
1-344-349	**		*		**		**		*****						
1-374-379	**		*		**		***		*****						
1-404-409	**		*		**		***		*****						
1-434-439	*****		*		**		*****		*****						
1-464-469	***		*		**		***		*****						
1-494-499	***		*		**		***		*****						
1-524-529	**		*		**		***		*****						
1-554-559	***		*		**		***		*****						
1-584-589	***		*		**		***		*****						
1-614-619	***		*		**		***		*****						
1-644-649	**		*		**		***		*****						
1-674-679	***		*		**		***		*****						
1-704-709	***		*		**		***		*****						
1-734-739	**		*		**		***		*****						
1-764-769	*****		*		**		***		*****						
1-794-799	*****		*		**		***		*****						
1-824-829	*****		*		**		***		*****						
1-854-859	*****		*		**		***		*****						
1-884-889	***		*		**		***		*****						
1-914-919	**		*		**		***		*****						
1-944-949	*****		*		*****		***		*****						
1-974-979	*****		*		**		***		*****						
1004-1009	*****		*		*****		***		*****						
1034-1039	**		*		*		***		*****						
1064-1069	*****		*		*****		***		*****						
1094-1099	***		*		**		***		*****						
1124-1129	*****		*		*****		***		*****						
1154-1159	*****		*		**		***		*****						
1184-1189	**		*		*****		*****		*****						
1214-1219	***		*		*****		***		*****						
1244-1249	*****		**		***		***		*****						
1274-1279	*****		*		*****		*****		*****						
1304-1309	*****		*		**		***		*****						
1334-1339	*****		*		**		***		*****						
1364-1369	*****		***		***		***		*****						
1394-1399	*****		**		***		***		*****						
1424-1429	**		*		***		***		*****						
1454-1459	**		*		***		***		*****						
1484-1489	***		**		***		***		*****						
1514-1519	***		*		***		***		*****						
1544-1549	***		**		***		***		*****						
1574-1579	**		**		***		***		*****						
1604-1609	***		*		*****		***		*****						
1634-1639	***		**		***		***		*****						
1664-1669	**		*		***		***		*****						
1694-1699	**		*		***		***		*****						
1724-1729	*		***		***		***		*****						

ATTN: BY RIGHT

1754-1759	***	***	*****	*****	*****
1764-1789	***	**	*****	*****	*****
1814-1819	****	**	***	*****	*****
1844-1849	**	***	*****	*****	*****
1874-1879	*****	***	*****	*****	*****
1904-1909	***	*	*****	***	*****
1934-1939	*****	*****	*****	*****	*****
1964-1969	*****	*****	*****	*****	*****
1994-1999	*****	*****	***	*****	*****
2024-2029	*****	*****	***	*****	*****
2054-2059	*****	*****	*****	*****	*****
2084-2089	*****	*****	*****	*****	*****
2114-2119	*****	*****	*****	*****	*****
2144-2149	*****	*****	*****	*****	*****
3-234-239	*****	***	**	*****	*****
3-264-269	*****	***	***	*****	*****
3-294-299	*****	*****	***	*****	*****
3-324-329	*****	*****	***	*****	*****
3-354-359	***	*****	***	*****	*****
3-384-389	*****	*****	***	*****	*****
3-414-419	*****	*****	*****	*****	*****
3-444-449	**	*****	*****	*****	*****
3-474-479	*****	*****	***	*****	*****
3-504-509	*****	*****	***	*****	*****
3-534-539	*****	*****	***	*****	*****
3-564-569	*****	*****	***	*****	*****
3-594-599	*****	*****	*****	*****	*****
3-624-629	*****	*****	***	*****	*****
3-654-659	**	*****	***	*****	*****
3-684-689	*****	*****	***	*****	*****
3-714-719	***	*****	***	*****	*****
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774-779	*****	*****	***	*****	*****
3-804-809	*****	*****	***	*****	*****
3-834-839	*****	*****	*****	*****	*****
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3-894-899	*****	*****	***	*****	*****
3-924-929	*****	*****	***	*****	*****
3-954-959	*****	*****	***	*****	*****
3-984-989	*****	*****	***	*****	*****
1014-1019	*****	*****	***	*****	*****
1044-1049	*****	*****	***	*****	*****
1074-1079	***	*****	*****	*****	*****
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1194-1199	*****	*****	***	*****	*****
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1584-1589	*****	*	***	*****	*****
1614-1619	*****	*	***	*****	*****

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4-1219-1224	****	*	***	***	*****
4-1249-1254	***	*	****	**	*****
4-1279-1284	****	*	**	**	*****
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4-1339-1344	****	*	*****	**	*****
4-1369-1374	****	*	*****	**	*****
4-1399-1404	***	*****	*	*****	*****
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481489-1494	***	****	**	*****	*****
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481639-1644	*****	*	**	*****	*****
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481789-1794	*****	*	**	*****	*****

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4819391944	****	*	*	*****	*****
4819691974	****	*	*	*****	*****
4819992004	*****	*	*	*****	*****
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4820592064	*****	*	*	*****	*****
4820892094	*****	*	*	*****	*****
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4821492154	*****	*	*	*****	*****
4821792184	*****	*	*****	*****	*****
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4831393144	*****	*	*****	*****	*****
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6-338-343	*****	*	*	*****	*****
6-368-373	*****	*	*	*****	*****
6-398-403	*****	*	*	*****	*****
6-428-433	*	*	*	*****	*****
6-458-463	*****	*	*	*****	*****
6-488-493	*****	*	*	*****	*****
6-518-523	*****	*	*	*****	*****
6-548-553	*****	*	*	*****	*****
6-578-583	*****	*	*	*****	*****
6-608-613	*****	*	*	*****	*****
6-638-643	*****	*	*	*****	*****
6-668-678	*****	*	*	*****	*****
6-698-703	*****	*	*	*****	*****

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6-758-763	*****	*	**	***	*****
6-788-793	*****	*	**	***	*****
6-818-823	****	*	**	***	*****
6-848-853	***	*	**	***	*****
6-878-883	****	*	**	***	*****
6-908-913	*****	*	**	***	*****
6-938-943	*****	*	**	***	*****
6-968-973	**	*	**	***	*****
6-998-1003	*	*	**	***	*****
6-1028-1033	*****	*	**	***	*****
6-1058-1063	***	****	**	***	*****
6-1088-1093	*****	***	**	***	*****
7-275-280	*****	**	**	***	*****
7-305-310	*****	**	**	***	*****
7-335-340	*****	*	**	***	*****
7-365-370	*****	***	*	***	*****
7-395-400	*****	****	**	***	*****
7-425-430	***	****	**	***	*****
7-455-460	*****	*****	**	***	*****
7-485-490	*****	*****	**	***	*****
7-515-520	*****	*****	**	***	*****
7-545-550	*****	*****	**	***	*****
7-575-580	**	***	***	**	***
7-605-610	*	**	***	**	***
7-635-640	**	**	***	**	***
7-665-670	*****	*	*****	*****	*****
7-691-695	*****	*	*****	**	*****
S5-713-714	****	*	***	*	***
S510591065	**	****	*	**	****
S510651069	**	*****	**	*	**
S510691080	****	*****	**	*	**
S510801091	*****	*	***	*	***
S510901100	*****	*	***	*	***
S511001110	*****	*	***	*	***
S51101120	*****	*	***	*	***
S511201130	*****	*	***	*	***
7-510-511	*****	*	**	**	*****
7-560-561	*****	*****	**	***	*****
4-3011	*	**	****	***	*

6
7

7

CARD INPUT PARAMETERS:

ORG.C-2	139	LINEAR	0.0001
AS-PPM	19	LINEAR	150.
BE-PPM	23	LINEAR	
CD-PPM	31	LINEAR	
CR-PPM	35	LINEAR	30.0 250.

PROFILE PLOT---ORGANIC CARBON, AS, BE, CD, CR

AREA: MICH

CLIENT	ORG-C-3 LINEAR SCALE		AS-PPM LINEAR SCALE		RE-PPM LINEAR SCALE		CD-PPM LINEAR SCALE		CH-PPM LINEAR SCALE	
	3.9E-06	0.00001	0.490	150.	0.	3.50	0.	47.0	30.0	250.
SAMPLE NAME										
1-104-104	*****		****		*****				*****	
1-134-139	*****		*****		*****				*****	
1-164-169	*****		*****		*****				*****	
1-194-199	*****		****		*****				*****	
1-224-229	*****		***		*****				*****	
1-284-289	*****		**		*****				*****	
1-314-319	*****		**		*****				*****	
1-344-349	*****		*****		*****				*****	
1-374-379	*****		****		*****				*****	
1-404-409	*****		****		*****				*****	
1-434-439	*****		***		*****				*****	
1-464-469	*****		****		*****				*****	
1-494-499	*****		**		*****				*****	
1-524-529	*****		*****		*****				*****	
1-554-559	*****		***		*****				*****	
1-584-589	*****		****		*****				*****	
1-614-619	*****		****		*****				*****	
1-644-649	*****		****		*****				*****	
1-674-679	*****		**		*****				*****	
1-704-709	*****		**		*****				*****	
1-734-739	*****		**		*****				*****	
1-764-769	*****		**		*****				*****	
1-794-799	*****		*		*****				*****	
1-824-829	*****		*		*****				*****	
1-854-859	*****		**		*****				*****	
1-884-889	*****		**		*****				*****	
1-914-919	*****		**		*****				*****	
1-944-949	*****		**		*****				*****	
1-974-979	*****		***		*****				*****	
1004-1009	*****		**		*****				*****	
1034-1039	*****		**		*****				*****	
1064-1069	*****		****		*****				*****	
1094-1099	*****		**		*****				*****	
1124-1129	*****		**		*****				*****	
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1184-1189	*****		****		*****				*****	
1214-1219	*****		**		*****				*****	
1244-1249	*****		***		*****				*****	
1274-1279	*****		*		*****				*****	
1304-1309	*****		**		*****				*****	
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1574-1579	*****		*****		*****				*****	
1604-1609	*****		*****		*****				*****	
1634-1639	*****		*****		*****				*****	
1664-1669	*****		****		*****				*****	
1694-1699	*****		*****		*****				*****	
1724-1729	*****		*****		*****				*****	

1754-1759	*****	*****	*****	**	*****
1784-1789	*****	*****	*****	*	*****
1814-1819	*****	*****	*****	*	*****
1844-1849	*****	*****	*****	**	*****
1874-1879	*****	*****	*****	**	*****
1904-1909	*****	*****	*****	*	*****
1934-1939	*****	*****	*****	**	*****
1964-1969	*****	*****	*****	**	*****
1994-1999	*****	*****	*****	*****	*****
2024-2029	*****	*****	*****	**	*****
2054-2059	*****	*****	*****	**	*****
2084-2089	*****	*****	*****	**	*****
2114-2119	*****	*****	*****	*****	*****
2144-2148	*****	*****	*****	**	*****
3-234-239	****	****	*****	**	*****
3-264-269	*****	*****	*****	*****	*****
3-294-299	****	****	*****	*	*****
3-324-329	*****	*****	*****	*	*****
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3-624-629	*****	*****	*****	**	*****
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3-684-689	*****	****	*****	**	*****
3-714-719	*****	****	*****	**	*****
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774-779	****	****	*****	*	*****
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1014-1019	*****	*****	*****	**	*****
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1194-1199	*****	****	*****	**	*****
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1344-1349	*****	**	*****	*	*****
1374-1379	****	*****	*****	**	*****
1404-1409	****	****	*****	**	*****
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1464-1469	*****	**	*****	*	*****
1494-1499	*****	**	*****	*	*****
1524-1529	****	****	*****	****	*****
1554-1559	*****	****	*****	*	*****
1584-1589	****	*****	*****	*	*****
1614-1619	*****	****	*****	*	*****

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5-394-399	***	**	*****	0	*****
5-424-429	*	**	*****	00	*****
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5-484-489	***	**	*****	0	*****
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5-574-579	*	*	*****	0	*****
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5-634-639	**	**	*****	0	*****
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5-724-729	***	**	*****	0	*****
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5-784-789	***	*	*****	00	*****
5-814-819	**	*	*****	0	*****
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5-934-939	**	*	*****	0	*****
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5-994-999	*	*	*****	0	*****
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EX-95-100	*****	**	*****	0	*****
EX-124-130	*****	**	*****	000	*****
EX-155-160	*****	*****	*****	0	*****
EX-185-190	*****	**	*****	0	*****
EX-215-220	*****	***	*****	000	*****
EX-245-250	*****	**	*****	0	*****
EX-275-280	*****	**	*****	0	*****
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1025-1030	****	*****	*****	0	*****

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4-169-174	***	**	*****	***	*****
4-199-204	***	***	*****	*	*****
4-229-234	***	***	*****	*****	*****
4-259-264	**	**	*****	**	*****
4-289-294	***	***	*****	***	*****
4-319-324	***	***	*****	*****	*****
4-349-354	***	**	*****	***	*****
4-379-384	***	***	*****	*****	*****
4-409-414	*****	**	*****	*****	*****
4-439-444	***	***	*****	*****	*****
4-469-474	***	***	*****	*****	*****
4-499-504	***	*	*****	*****	*****
4-529-534	*****	*	*****	*****	*****
4-559-564	**	***	*****	*****	*****
4-589-594	*	**	*****	*****	*****
4-619-624	*	**	*****	*	*****
4-649-654	*	*	*****	*****	*****
4-679-684	*	**	*****	*****	*****
4-709-714	*	*	*****	*****	*****
4-739-744	*	**	*****	*****	*****
4-769-774	*	***	*****	*	*****
4-799-804	***	*	*****	*****	*****
4-829-834	**	*	*****	*****	*****
4-859-864	***	**	*****	*****	*****
4-889-894	**	**	*****	*****	*****
4-919-924	**	***	*****	*****	*****
4-949-954	**	***	*****	*****	*****
4-979-984	***	*	*****	*****	*****
4-1009-1014	**	**	*****	*****	*****
4-1039-1044	***	**	*****	*****	*****
4-1069-1074	***	**	*****	*****	*****
4-1099-1104	***	**	*****	*****	*****
4-1129-1134	**	*	*****	*****	*****
4-1159-1164	**	*	*****	*****	*****
4-1189-1194	***	*	*****	*	*****
4-1219-1224	***	***	*****	*****	*****
4-1249-1254	**	***	*****	*****	*****
4-1279-1284	**	***	*****	*****	*****
4-1309-1314	**	***	*****	*****	*****
4-1339-1344	***	*****	*****	*****	*****
4-1369-1374	***	*****	*****	*****	*****
4-1399-1404	*****	***	*****	*****	*****
4A14291434	*****	**	*****	*	*****
4A14591464	*****	***	*****	*****	*****
4A14891494	*****	**	*****	*****	*****
4A15191524	*****	*	*	*****	*****
4A15491554	*****	*	*****	*****	*****
4A15791584	*****	***	*****	*****	*****
4A16091614	***	***	*****	*****	*****
4A16391644	***	***	*****	*****	*****
4A16691674	***	*	*****	*****	*****
4A16991704	**	**	*****	*****	*****
4A17291734	***	**	*****	*****	*****
4A17591764	*	*	*****	*****	*****
4A17891794	**	*	*****	*****	*****

EX.

4

4R18191824	**	*	*****	*	*****
4R18491854	**	*	*****	*	*****
4R18791884	**	*	*****	*	*****
4R19091914	**	*	*****	*	*****
4R19391944	**	**	*****	*	*****
4R19691974	**	*	*****	*	*****
4R20092004	**	*	*****	**	*****
4R20292034	**	*	*****	**	*****
4R20592064	***	*	*****	**	*****
4R20892094	****	*	*****	**	*****
4R21192124	**	*	*****	*	*****
4R21492154	**	*	*****	**	*****
4R21792184	***	*	*****	**	*****
4R22092214	**	*	*****	**	*****
4R22392244	**	*	*****	**	*****
4R22692274	*	*	*****	**	*****
4R22992304	*	*	*****	**	*****
4R23292334	*	*	*****	**	*****
4R23592364	*	**	*****	**	*****
4R23892394	***	**	*****	**	*****
4R24192424	**	**	*****	*	*****
4R24492454	*****	*	*****	**	*****
4R24792484	**	**	*****	**	*****
4R25092514	***	**	*****	**	*****
4R25392544	**	**	*****	**	*****
4R25692574	****	**	*****	**	*****
4R25992604	****	**	*****	**	*****
4R26292634	****	**	*****	**	*****
4R26592664	**	**	*****	**	*****
4R26892694	**	***	*****	**	*****
4R27192724	****	***	*****	**	*****
4R27492754	**	***	*****	**	*****
4R27792784	****	***	*****	**	*****
4R28092814	*****	***	*****	****	*****
4R28392844	*****	**	*****	*****	*****
4R28692874	*****	****	*****	*****	*****
4R28992904	*****	**	*****	**	*****
4R29292934	*****	**	*****	*	*****
4R29592964	***	**	*****	**	*****
4R29892994	*****	*	*****	**	*****
4R30193024	*	**	*****	**	*****
4R30493054	**	*	*****	**	*****
4R30793084	**	*	*****	**	*****
4R31093114	**	*	*****	*	*****
4R31393144	**	*	*****	*	*****
4R31693174	**	*	*****	*	*****
6-27R-283	**	***	*****	*	*****
6-30R-313	**	*	*****	**	*****
6-33R-343	***	*	*****	**	*****
6-36R-373	*****	*****	*****	**	*****
6-39R-403	**	*	*****	*	*****
6-42R-433	*****	*****	*****	**	*****
6-45R-463	*****	*	*****	**	*****
6-48R-493	**	*	*****	****	*****
6-51R-523	**	*	*****	****	*****
6-54R-553	**	*	*****	**	*****
6-57R-583	**	*	*****	**	*****
6-60R-613	**	*	*****	**	*****
6-63R-643	*****	****	*****	**	*****
6-66R-678	**	*	*****	**	*****
6-69R-703	**	****	*****	****	*****

4-724-733	**	***	*****	***	*****
4-758-763	**	***	*****	***	*****
4-788-793	***	***	*****	***	*****
4-818-823	***	*	***	***	*****
4-848-853	*****	***	***	***	*****
4-878-883	***	***	*****	***	*****
6-908-913	***	**	*****	**	*****
6-938-943	***	***	*****	***	*****
6-968-973	****	*	**	*****	***
5-998-1003	**	*	***	*****	*****
5-10281033	**	*	*****	**	*****
5-10581063	*****	***	*****	***	*****
6-10881093	*****	**	*****	***	*****
7-275-280	*	**	*****	***	*****
7-305-310	*	*	*****	***	*****
7-335-340	****	*	*****	***	*****
7-365-370	**	**	*****	***	*****
7-395-400	****	*****	*****	***	*****
7-425-430	*****	*****	*****	***	*****
7-455-460	*****	*****	*****	***	*****
7-485-490	*****	*****	*****	*****	*****
7-515-520	*****	*****	*****	*****	*****
7-545-550	*****	*****	*****	*****	*****
7-575-580	**	***	*****	*****	***
7-605-610	*****	*	*****	*****	**
7-635-640	****	**	*****	*****	**
7-665-670	*	*	*****	***	*
7-691-696	*	*	***	***	**
55-713-714	*****	**	*****	***	***
5510591065	**	*	*****	**	**** SPECIAL SAMPLES
5510651069	*	*	***	**	*****
5510691080	*	*	***	*****	*****
5510801090	*	*	**	***	*****
5510901100	**	**	**	***	*****
5511001110	*	**	***	***	*****
5511101120	**	***	**	*****	*****
5511201130	**	*	**	*****	*****
7-510-511	****	***	*****	*****	**
7-560-561	*****	*****	*****	***	*****
4-3011	*****	**	*****	***	***

6
7

7

REMARKS BY AGENT

C

CARD INPUT PARAMETERS:

URANIUM RUNS: HF AND PERCHLORIC SOLVENT EXTRACTION

V-PPM	127	LINEAR	500.
ZN-PPM	131	LINEAR	
U-PPM	135	LINEAR	10.

4-859-864 = 4.4 U

S 4 - 3011 = 260 U = 1/2 LB/TON

PROFILE PLOT --- V, ZN, U

AREA: MICH

V-PPM
LINEAR SCALEZN-PPM
LINEAR SCALEU-PPM
LINEAR SCALE

CLIENT	1.30	500.	1.50	1400.	0.0900	10.0	
SAMPLE NAME	-----	-----	-----	-----	-----	-----	HOLE 1
1-104-109	*****		***		***		
1-134-139	*****		***		*****		
1-164-169	*****		***		*****		
1-194-199	*****		***		*****		
1-224-229	*****		**		**		
1-284-289	*****		**		**		
1-314-319	*****		***		***		
1-344-349	*****		***		***		
1-374-379	*****		***		***		
1-404-409	*****		***		***		
1-434-439	*****		***		***		
1-464-469	*****		**		**		
1-494-499	*****		***		***		
1-524-529	*****		***		**		
1-554-559	*****		**		**		
1-584-589	*****		***		*****		
1-614-619	*****		***		***		
1-644-649	*****		***		*****		
1-674-679	*****		***		*****		
1-704-709	*****		***		***		
1-734-739	*****		**		**		
1-764-769	*****		**		**		
1-794-799	*****		**		**		
1-824-829	*****		**		**		
1-854-859	*****		**		**		
1-884-889	*****		**		**		
1-914-919	*****		***		**		
1-944-949	****		**		*		
1-974-979	*****		**		**		
1004-1009	*****		**		**		
1034-1039	*****		***		***		
1064-1069	*****		**		*		
1094-1099	*****		***		**		
1124-1129	****		**		**		
1154-1159	*****		***		**		
1184-1189	*****		*****		**		
1214-1219	***		**		*		
1244-1249	*****		**		*		
1274-1279	*****		**		*		
1304-1309	*****		**		**		
1334-1339	****		**		*		
1364-1369	*****		**		**		
1394-1399	*****		**		**		
1424-1429	*****		***		**		
1454-1459	*****		**		*		
1484-1489	*****		***		**		
1514-1519	*****		**		**		
1544-1549	*****		**		**		
1574-1579	*****		***		**		
1604-1609	*****		**		*		
1634-1639	*****		*****		**		
1664-1669	*****		***		**		
1694-1699	*****		*****		***		
1724-1729	*****		*****		*****		

174-175	*****	*****	*****
1784-178	*****	*****	*****
1814-181	*****	*****	*****
1844-184	*****	*****	*****
1874-187	*****	*****	*****
1904-190	*****	*****	*****
1934-193	*****	*****	*****
1964-196	*****	*****	*****
1994-199	*****	*****	*****
2024-202	*****	*****	*****
2054-205	*****	*****	*****
2084-208	*****	*****	*****
2114-211	*****	*****	*****
2144-214	*****	*****	*****
3-234-23	*****	*****	*****
3-264-26	*****	*****	*****
3-294-29	*****	*****	*****
3-324-32	*****	*****	*****
3-354-35	*****	*****	*****
3-384-38	*****	*****	*****
3-414-41	*****	*****	*****
3-444-44	*****	*****	*****
3-474-47	*****	*****	*****
3-504-50	*****	*****	*****
3-534-53	*****	*****	*****
3-564-56	*****	*****	*****
3-594-59	*****	*****	*****
3-624-62	*****	*****	*****
3-654-65	*****	*****	*****
3-684-68	*****	*****	*****
3-714-71	*****	*****	*****
3-744-74	*****	*****	*****
774-77	*****	*****	*****
3-804-80	*****	*****	*****
3-834-83	*****	*****	*****
3-864-86	*****	*****	*****
3-894-89	*****	*****	*****
3-924-92	*****	*****	*****
3-954-95	*****	*****	*****
3-984-98	*****	*****	*****
1014-101	*****	*****	*****
1044-104	*****	*****	*****
1074-107	*****	*****	*****
1104-110	*****	*****	*****
1134-113	*****	*****	*****
1164-116	*****	*****	*****
1194-119	*****	*****	*****
1224-122	*****	*****	*****
1254-125	*****	*****	*****
1284-128	*****	*****	*****
1314-131	*****	*****	*****
1344-134	*****	*****	*****
1374-137	*****	*****	*****
1404-140	*****	*****	*****
1434-143	*****	*****	*****
1464-146	*****	*****	*****
1494-149	*****	*****	*****
1524-152	*****	*****	*****
1554-155	*****	*****	*****
1584-158	*****	*****	*****
1614-161	*****	*****	*****

HOLE 1

HOLE 3

HOLE 3

HOLE 5

HOLE 5
HOLE EX.

5-364-364	*****	***	**
5-394-394	*****	**	*
5-424-424	*****	***	**
5-454-454	*****	**	*
5-484-484	*****	**	*
5-514-514	*****	***	**
5-544-544	*****	**	*
5-574-574	*****	**	*
5-604-604	*****	**	*
5-634-634	*****	**	*
5-664-664	*****	**	*
5-694-694	*****	*	*
5-724-724	***	*	*
5-754-754	*****	**	**
5-784-784	*****	**	**
5-814-814	***	**	*
5-844-844	***	**	*
5-874-874	****	**	*
5-904-904	**	*	*
5-934-934	**	*	*
5-964-964	**	*	*
5-994-994	*	*	*
1024-1024	*	*	*****
1054-1054	*	*****	*****
1084-1084	*****	**	*
1114-1114	*****	**	*
1144-1144	*****	**	*
EX-35-40	*****	*****	*****
EX-65-70	*****	*****	*****
EX-95-100	*****	*****	*****
EX-124-130	*****	*****	*****
EX-155-160	*****	*****	*****
EX-185-190	*****	*****	*****
EX-215-220	*****	*****	*****
EX-245-250	*****	*****	*****
EX-275-280	*****	*****	*****
EX-305-310	*****	*****	*****
EX-335-340	*****	*****	*****
EX-365-370	*****	*****	*****
EX-395-400	*****	*****	*****
EX-425-430	*****	*****	*****
EX-455-460	*****	*****	*****
EX-485-490	*****	*****	*****
EX-515-520	*****	*****	*****
EX-545-550	*****	*****	*****
EX-575-580	*****	*****	*****
EX-605-610	*****	*****	*****
EX-635-640	*****	*****	*****
EX-665-670	*****	*****	*****
EX-695-700	*****	*****	*****
EX-725-730	*****	*****	*****
EX-755-760	*****	*****	*****
EX-785-790	*****	*****	*****
EX-815-820	*****	*****	*****
EX-845-850	*****	*****	*****
EX-875-880	*****	*****	*****
EX-905-910	*****	*****	*****
EX-935-940	*****	*****	*****
965-970	*****	*****	*****
995-1000	*****	*****	*****
1025-1030	*****	*****	*****

1055-1060	*****	*****	**
1085-1090	*****	*****	*****
1115-1120	*****	*****	*****
1123-1126	*****	*****	*****
4-104-114	*****	**	***
4-139-144	*****	**	**
4-169-174	*****	**	**
4-199-204	*****	**	**
4-229-234	*****	**	**
4-259-264	*****	**	**
4-289-294	*****	*****	***
4-319-324	*****	**	**
4-349-354	*****	**	***
4-379-384	*****	**	**
4-409-414	*****	**	***
4-439-444	*****	***	**
4-469-474	*****	***	**
4-499-504	*****	**	***
4-529-534	*****	**	***
4-559-564	*****	***	**
4-589-594	*****	**	**
4-619-624	*****	***	**
4-649-654	*****	**	**
4-679-684	*****	***	**
4-709-714	*****	**	**
4-739-744	*****	**	*****
4-769-774	*****	**	**
4-799-804	*****	**	***
4-829-834	*****	***	**
4-859-864	*****	**	***
4-889-894	*****	**	*
4-919-924	*****	**	**
4-949-954	*****	***	**
4-979-984	*****	**	***
4-1009-1014	*****	**	**
4-1039-1044	*****	***	***
4-1069-1074	*****	**	***
4-1099-1104	*****	***	***
4-1129-1134	*****	***	**
4-1159-1164	*****	***	**
4-1189-1194	*****	***	**
4-1219-1224	*****	***	***
4-1249-1254	*****	**	**
4-1279-1284	*****	**	**
4-1309-1314	*****	**	**
4-1339-1344	*****	**	**
4-1369-1374	*****	**	**
4-1399-1404	*****	*****	*****
4B1429-1434	*****	*****	*****
4B1459-1464	*****	*****	*****
4B1489-1494	*****	*****	*****
4B1519-1524	*	*	*****
4B1549-1554	*****	*****	*****
4B1579-1584	***	**	*
4B1609-1614	*****	***	***
4B1639-1644	*****	***	**
4B1669-1674	***	**	**
4B1699-1704	***	**	**
4B1729-1734	*****	***	**
4B1759-1764	*****	***	**
4B1789-1794	*****	**	**

HOLE Ex
HOLE 4

4818191824	*****	**	**
4818491854	*****	**	**
4818741884	*****	**	**
4819091914	*****	**	**
4819391944	*****	**	**
4819691974	*****	**	**
4819992004	*****	**	**
4820292034	*****	**	**
4820592064	*****	**	**
4820892094	*****	**	**
4821192124	*****	**	**
4821492154	*****	**	**
4821792184	*****	**	**
4822092214	*****	**	**
4822392244	*****	**	**
4822692274	*****	**	**
4822992304	*****	**	**
4823292334	*****	**	**
4823592364	*****	**	**
4823892394	*****	**	**
4824192424	*****	**	**
4824492454	*****	**	**
4824792484	*****	**	**
4825092514	*****	**	**
4825392544	*****	**	**
4825692574	*****	**	**
4825992604	*****	**	**
4826292634	*****	**	**
4826592664	*****	**	**
4826892694	*****	**	**
4827192724	*****	**	**
4827492754	*****	**	**
4827792784	*****	**	**
4828092814	*****	**	**
4828392844	*****	**	**
4828692874	*****	**	**
4828992904	*****	**	**
4829292934	*****	**	**
4829592964	*****	**	**
4829892994	*****	**	**
4830193024	**	*	*
4830493054	**	*	*
4830793084	**	*	*
4831093114	**	*	*
4831393144	**	*	*
4831693174	**	*	*
6-278-283	*****	**	**
6-308-313	*****	**	**
6-338-343	*****	**	*
6-368-373	*****	**	*
6-398-403	*****	**	*
6-428-433	**	*	**
6-458-463	*****	**	**
6-488-493	*****	**	*
6-518-523	*****	**	**
6-548-553	*****	**	**
6-578-583	*****	**	*
6-608-613	*****	**	*
6-638-643	*****	**	*
6-668-678	*****	**	**
6-698-703	*****	**	**

HOLE 4
HOLE 6

6-728-733	*****	**	***	
6-758-763	*****	**	**	
6-788-793	*****	***	*	
6-818-823	*****	***	**	
6-848-853	*****	***	**	
6-878-883	*****	**	**	
6-908-913	*****	***	***	
6-938-943	*****	**	***	
6-968-973	**	*	*	
6-998-1003	***	***	**	
6-1028-1033	*****	***	***	
6-1058-1063	*****	***	***	
6-1088-1093	*****	**	***	HOLE 6
7-275-280	*****	**	**	HOLE 7
7-305-310	*****	***	**	
7-335-340	*****	***	**	
7-365-370	*****	*****	***	
7-395-400	*****	*****	***	
7-425-430	*****	*****	***	
7-455-460	*****	*****	*****	
7-485-490	*****	*****	*****	
7-515-520	*****	*****	***	
7-545-550	*****	***	**	
7-575-580	***	*	***	
7-605-610	**	*	*	
7-635-640	**	*	*	
7-665-670	**	**	***	
7-695-700	**	**	***	
SS-713-714	***	*	**	HOLE 7
SS10591063	***	***	**	SPECIAL SAMPLES
SS10651069	***	**	*	
SS10691080	*****	***	*	
SS10801090	*****	**	*	
SS10901100	*****	**	*	
SS11001110	*****	**	*	
SS11101120	*****	***	***	
SS11201130	*****	**	*	
7-510-511	***	*****	*****	
7-560-561	*****	***	***	
4-3011	*****	*	*****	

AREA: MICH

TH-PPM

P205-%
V-PPM

AS-PPM
ZN-PPM

CU-PPM
U-PPM

PB-PPM

NI-PPM

DOC: P2 JOB NO: 011.15 FRACT: NPLOTS: 9 ARL2: T

AREA DESC: MICHIGAN - DAVE SNIDER

USER'S INITS: DCN

CARD INPUT PARAMETERS:

P205-% 75 LINEAR

0.0001

AS-PPM 19 LINEAR

CU-PPM 43 LINEAR

PB-PPM 55 LINEAR

NI-PPM 71 LINEAR

TRACE ELEMENT INDICATOR GROUP PROFILE PLOT

TH-PPM 119 LINEAR

PROVIDES A RAPID VIEW OF THE RELATIVE AMOUNTS OF 8 TRACE ELEMENTS
PLUS P₂₀₅ IN THE DAMPLED ZONES OF THE DRILL CORE.

V-PPM 127 LINEAR

ZN-PPM 131 LINEAR

U-PPM 135 LINEAR

സുപ്രീം കോടതി

1844-1849	*****
1874-1879	*****
1904-1909	*****
1934-1939	*****
1964-1969	*****
1994-1999	*****
2024-2029	*****
2054-2059	*****
2084-2089	*****
2114-2119	*****
2144-2148	*****
3-234-239	*****
3-264-269	*****
3-294-299	*****
3-324-329	*****
3-354-359	*****
3-384-389	*****
3-414-419	*****
3-444-449	*****
3-474-479	*****
3-504-509	*****
3-534-539	*****
3-564-569	*****
3-594-599	*****
3-624-629	*****
3-654-659	*****
3-684-689	*****
3-714-719	*****
3-744-749	*****
774-779	*****
3-804-809	*****
3-834-839	*****
3-864-869	*****
3-894-899	*****
3-924-929	*****
3-954-959	*****
3-984-989	*****
1014-1019	*****
1044-1049	*****
1074-1079	*****
1104-1109	*****
1134-1139	*****
1164-1169	*****
1194-1199	*****
1224-1229	*****
1254-1259	*****
1284-1289	*****
1314-1319	*****
1344-1349	*****
1374-1379	*****
1404-1409	*****
1434-1439	*****
1464-1469	*****
1494-1499	*****
1524-1529	*****
1554-1559	*****
1584-1589	*****
1614-1619	*****
5-364-369	*****
5-394-399	*****
5-424-429	*****

HOLE No. 1
HOLE No. 3

HOLE No. 3
HOLE No. 5

5-454-459	*****
5-484-489	*****
5-514-519	*****
5-544-549	*****
5-574-579	*****
5-604-609	*****
5-634-639	*****
5-664-669	*****
5-694-699	*****
5-724-729	*****
5-754-759	*****
5-784-789	*****
5-814-819	*****
5-844-849	*****
5-874-879	*****
5-904-909	*****
5-934-939	*****
5-964-969	*****
5-994-999	*****
1024-1029	*****
1054-1059	*****
1084-1089	*****
1114-1119	*****
1144-1148	*****
EX-35-40	*****
EX-65-70	*****
EX-95-100	*****
EX-124-130	*****
EX-155-160	*****
EX-185-190	*****
EX-215-220	*****
EX-245-250	*****
EX-275-280	*****
EX-305-310	*****
EX-335-340	*****
EX-365-370	*****
EX-395-400	*****
EX-425-430	*****
EX-455-460	*****
EX-485-490	*****
EX-515-520	*****
EX-545-550	*****
EX-575-580	*****
EX-605-610	*****
EX-635-640	*****
EX-665-670	*****
EX-695-700	*****
EX-725-730	*****
EX-755-760	*****
EX-785-790	*****
EX-815-820	*****
EX-845-850	*****
EX-875-880	*****
EX-905-910	*****
EX-935-940	*****
965-970	*****
995-1000	*****
1025-1030	*****
1055-1060	*****
1085-1090	*****
1115-1120	*****

HOLE No. 5
HOLE EX.

1123-1128	*****	HOLE EX. HOLE No. 4
4-109-114	*****	
4-139-144	*****	
4-169-174	*****	
4-199-204	*****	
4-229-234	*****	
4-259-264	*****	
4-289-294	*****	
4-319-324	*****	
4-349-354	*****	
4-379-384	*****	
4-409-414	*****	
4-439-444	*****	
4-469-474	*****	
4-499-504	*****	
4-529-534	*****	
4-559-564	*****	
4-589-594	*****	
4-619-624	*****	
4-649-654	*****	
4-679-684	*****	
4-709-714	*****	
4-739-744	*****	
4-769-774	*****	
4-799-804	*****	
4-829-834	*****	
4-859-864	*****	
4-889-894	*****	
4-919-924	*****	
4-949-954	*****	
4-979-984	*****	
4-10091014	*****	
4-10391044	*****	
4-10691074	*****	
4-10991104	*****	
4-11291134	*****	
4-11591164	*****	
4-11891194	*****	
4-12191224	*****	
4-12491254	*****	
4-12791284	*****	
4-13091314	*****	
4-13391344	*****	
4-13691374	*****	
4-13991404	*****	
4B14291434	*****	
4B14591464	*****	
4P14891494	*****	
4B15191524	*****	
4B15491554	*****	
4B15791584	*****	
4B16091614	*****	
4B16391644	*****	
4B16691674	*****	
4B16991704	*****	
4B17291734	*****	
4B17591764	*****	
4B17891794	*****	
4B18191824	*****	
4B18491854	*****	
4B18791884	*****	

4819091914	*****
4819391944	*****
4819691974	*****
4819992004	*****
4820292034	*****
4820592064	*****
4820892094	*****
4821192124	*****
4821492154	*****
4821792184	*****
4822092214	*****
4822392244	*****
4822692274	*****
4822992304	*****
4823292334	*****
4823592364	*****
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4824492454	*****
4824792484	*****
4825092514	*****
4825392544	*****
4825692574	*****
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4826592664	*****
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4827192724	*****
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4827792784	*****
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4828392844	*****
4828692874	*****
4828992904	*****
4829292934	*****
4829592964	*****
4829892994	*****
4830193024	*****
4830493054	*****
4830793084	*****
4831093114	*****
4831393144	*****
4831693174	*****
6-278-283	*****
6-308-313	*****
6-338-343	*****
6-368-373	*****
6-398-403	*****
6-428-433	*****
6-458-463	*****
6-488-493	*****
6-518-523	*****
6-548-553	*****
6-578-583	*****
6-608-613	*****
6-638-643	*****
6-668-678	*****
6-698-703	*****
6-728-733	*****
6-758-763	*****
6-788-793	*****

HOLE No. 4

HOLE No. 6

6-818-823 *****
 6-843-853 *****
 6-878-883 *****
 6-908-913 *****
 6-933-943 *****
 6-968-973 *****

6-993-1003 *****
 6-10281033 *****
 6-10581063 *****
 6-10881093 *****
 7-275-280 *****
 7-305-310 *****

HOLE No. 6

HOLE No. 7

7-335-340 *****
 7-365-370 *****
 7-395-400 *****
 7-425-430 *****
 7-455-460 *****
 7-485-490 *****

7-515-520 *****
 7-545-550 *****
 7-575-580 *****
 7-605-610 *****
 7-635-640 *****
 7-665-670 *****

7-691-696 *****
 S5-713-714 *****
 S510591065 *****
 S510651069 *****
 S510691080 *****
 S510801090 *****

HOLE No. 7

SPECIAL SAMPLES

S510901100 *****
 S511001110 *****
 S511101120 *****
 S511201130 *****
 7-510-511 *****
 7-560-561 *****

4-3011 *****

SCALE: 100= 78 UNITS

DOC: 87 JOB: 011.15

APFA: MICHIGAN - DAVE SVIDER

Teague - 6/1/82

INIT: DCN

NAME	NCHAN1	NCHAN2	FACTOR	NSIGS	NAME	NCHAN1	NCHAN2	FACTOR	NSIGS	NAME	NCHAN1	NCHAN2	FACTOR	NSIGS
CAS-X	27		0.0001		FF203-X	51		0.0001		MGO-X	59		0.0001	
MND-X	63		0.0001		P205-X	75		0.0001		K20-X	79		0.0001	
SIG2-X	91				NA20-X	99		0.0001		TI02-X	115		0.0001	
AL203-X	143		0.0001		SUMOX	147		0.0001		ORG.C-X	139			

AREA: MICH													
CLIENT SAMPLE NAME	CAO-%	FF203-%	MG0-%	MNO-%	P205-%	<20-%	SI02-%	NA20-%	TI02-%	AL203-%	SUMOX	ORG.C-%	
1-104-109	0.209	9.74	3.26	0.0292	0.147	3.35	58.2	0.327	0.592	18.6	94.4	2.50	
1-134-139	0.174	11.4	3.35	0.0299	0.105	4.43	56.1	0.171	0.733	15.0	95.6	2.82	
1-164-169	0.191	10.4	3.44	0.0313	0.105	2.32	58.3	0.0931	0.770	18.7	94.3	2.64	
1-194-199	0.431	8.66	3.33	0.0346	0.114	4.34	57.9	0.028	0.828	19.0	95.5	2.60	
1-224-229	0.401	8.55	3.33	0.0360	0.112	4.07	60.4	1.55	0.835	18.9	98.1	1.60	
1-284-289	0.364	9.59	3.40	0.0355	0.0928	3.69	58.8	1.55	0.840	19.6	97.5	1.62	
1-314-319	0.521	9.22	3.43	0.0392	0.195	3.69	57.8	1.76	0.826	19.2	96.7	1.20	
1-344-349	0.594	15.3	3.09	0.0357	0.0868	3.51	54.5	1.27	0.621	16.9	95.9	2.88	
1-374-379	0.484	10.2	3.54	0.0394	0.0641	3.99	57.2	1.81	0.842	19.8	98.0	1.58	
1-404-409	0.571	9.77	3.24	0.0368	0.0797	3.76	57.2	1.43	0.742	18.2	95.0	1.96	
1-434-439	0.588	9.28	3.43	0.0380	0.116	4.22	57.8	1.52	0.746	19.6	97.4	1.90	
1-464-469	0.507	9.23	3.37	0.0365	0.126	3.02	55.6	1.77	0.802	19.2	94.6	1.34	
1-494-499	0.507	9.14	3.37	0.0372	0.111	3.83	58.8	1.64	0.778	18.9	97.1	1.90	
1-524-529	0.417	9.89	3.34	0.0364	0.108	3.28	59.9	1.56	0.816	18.7	95.1	1.68	
1-554-559	0.276	9.48	3.50	0.0362	0.0972	3.85	60.4	1.97	0.867	19.6	100.	1.20	
1-584-589	0.486	9.53	3.28	0.0344	0.0915	3.61	58.3	1.74	0.770	19.0	96.7	2.24	
1-614-619	0.549	8.99	3.27	0.0371	0.123	3.92	57.8	1.91	0.850	19.0	96.5	1.38	
1-644-649	0.652	9.98	3.26	0.0363	0.137	3.61	56.7	1.56	0.722	18.4	95.1	2.80	
1-674-679	0.537	9.01	3.44	0.0383	0.128	3.74	58.8	1.78	0.831	18.8	97.1	1.44	
1-704-709	0.913	4.13	3.26	0.0410	0.142	3.45	61.0	1.81	0.776	17.6	98.0	1.64	
1-734-739	0.501	9.29	3.39	0.0353	0.141	3.97	58.3	1.81	0.854	19.4	97.7	1.44	
1-764-769	0.537	9.22	3.51	0.0391	0.0750	3.71	61.0	1.89	0.852	19.0	99.9	1.30	
1-794-799	0.651	9.09	3.48	0.0387	0.152	3.11	59.4	2.07	0.889	19.6	98.5	1.30	
1-824-829	0.348	9.45	3.63	0.0378	0.112	4.06	61.0	2.04	0.956	20.0	102.	0.960	
1-854-859	0.438	9.33	3.56	0.0393	0.0811	3.89	61.5	2.00	0.892	19.6	101.	1.10	
1-884-889	0.957	9.38	3.53	0.0484	0.0634	3.81	59.9	1.80	0.897	19.0	99.4	1.10	
1-914-919	0.531	9.65	3.46	0.0400	0.0701	3.92	59.9	1.71	0.864	19.0	99.2	1.64	
1-944-949	2.13	5.20	1.80	0.0460	0.0858	1.26	74.9	3.33	0.506	12.4	102.	0.600	
1-974-979	0.255	8.70	3.21	0.0307	0.0682	3.28	65.8	2.35	0.855	19.2	104.	0.680	
1004-1009	3.13	6.66	2.55	0.0529	0.0334	2.44	70.0	1.63	0.575	13.8	101.	0.900	
1034-1039	0.335	10.2	3.63	0.0347	0.131	4.00	61.0	1.55	0.816	19.2	101.	1.76	
1064-1069	1.35	8.26	2.74	0.0392	0.0798	2.45	68.4	2.76	0.689	16.3	103.	1.68	
1094-1099	0.877	10.1	3.28	0.0456	0.175	3.80	61.5	1.49	0.824	18.1	100.	1.10	
1124-1129	2.56	5.23	1.97	0.0463	0.0730	1.36	73.8	3.49	0.567	12.2	101.	0.900	
1154-1159	0.243	9.90	3.58	0.0288	0.103	3.71	62.0	2.22	0.889	19.8	102.	0.800	
1184-1189	1.53	9.87	3.37	0.0617	0.108	4.36	57.2	1.45	0.708	18.7	97.4	2.32	
1214-1219	1.24	3.93	1.42	0.0295	0.120	0.935	77.5	4.25	0.373	11.4	101.	0.640	
1244-1249	0.322	9.21	3.10	0.0259	0.0397	2.82	65.2	2.62	0.765	16.9	101.	0.760	
1274-1279	0.740	8.19	2.84	0.0330	0.0987	2.05	65.2	3.48	0.637	15.7	98.9	0.600	
1304-1309	0.335	9.71	3.41	0.0258	0.106	3.32	61.0	2.22	0.817	18.7	99.7	0.840	
1334-1339	0.451	5.34	1.87	0.0146	0.115	1.50	77.0	3.88	0.363	13.4	104.	0.680	
1364-1369	0.635	9.34	3.29	0.0343	0.118	3.96	57.2	2.75	0.765	18.5	96.6	1.28	
1394-1399	0.621	9.11	3.40	0.0360	0.0939	3.97	61.0	2.28	0.833	18.9	100.	1.08	
1424-1429	0.820	9.62	3.34	0.0388	0.164	3.81	59.9	2.07	0.751	18.5	99.0	1.80	
1454-1459	0.844	9.76	3.28	0.0392	0.109	3.73	59.9	2.10	0.759	18.1	98.6	2.00	
1484-1489	0.700	9.52	3.36	0.0342	0.137	3.12	59.4	2.14	0.742	18.5	97.6	1.06	
1514-1519	0.704	9.61	3.32	0.0342	0.128	3.69	61.0	1.94	0.806	18.4	99.6	1.04	
1544-1549	0.785	9.89	3.39	0.0389	0.137	3.31	57.2	2.06	0.703	18.5	96.0	1.28	
1574-1579	0.796	9.96	3.30	0.0389	0.0441	3.83	56.7	1.98	0.727	18.3	95.7	2.08	
1604-1609	1.59	4.23	3.50	0.0592	0.0935	3.58	59.9	2.13	0.680	17.9	98.7	1.68	
1634-1639	0.851	9.29	3.14	0.0364	0.152	3.51	58.8	2.01	0.672	17.4	95.9	2.36	
1664-1669	0.615	8.60	3.18	0.0275	0.0814	3.91	60.4	1.95	0.697	18.6	98.0	1.76	
1694-1699	1.11	9.89	3.17	0.0370	0.149	3.36	61.0	1.79	0.656	16.2	97.3	1.84	
1724-1729	1.09	12.1	3.28	0.0322	0.0315	3.89	54.5	1.47	0.651	16.8	93.9	1.84	
1754-1759	0.841	9.84	3.22	0.0259	0.0609	3.45	57.7	1.69	0.614	16.4	93.9	3.40	

AREA: MICH												
CLINT SAMPLE NAME	CAO-%	FE2O3-%	MGO-%	MNO-%	P2O5-%	K2O-%	SiO2-%	Na2O-%	TiO2-%	AL2O3-%	SUMOX	ORG.C-%
1784-1789	2.55	6.53	3.09	0.0516	0.116	4.35	57.2	1.57	0.509	17.5	93.4	2.20
1914-1919	1.12	4.69	2.68	0.0245	0.0277	3.04	63.1	1.37	0.504	18.9	95.4	2.50
1844-1849	1.34	6.36	2.43	0.0269	0.107	2.73	65.2	2.74	0.450	14.6	90.0	3.76
1874-1879	2.57	6.40	3.03	0.0544	0.195	2.76	60.4	2.22	0.550	15.1	93.3	3.40
1904-1909	7.38	5.83	3.68	0.291	0.112	1.26	60.4	1.61	0.252	7.38	88.4	3.26
1934-1939	1.80	5.12	2.68	0.0354	0.113	3.45	63.1	2.40	0.542	16.1	95.4	3.16
1964-1969	1.95	5.94	3.02	0.0437	0.0757	1.85	62.6	2.39	0.617	16.9	95.4	3.20
1994-1999	1.33	6.05	2.65	0.0453	0.127	3.51	64.2	2.45	0.688	17.0	98.0	3.26
2024-2029	1.32	4.83	2.55	0.0333	0.123	3.59	65.2	2.03	0.516	16.0	96.2	2.96
2054-2059	1.17	5.11	2.58	0.0264	0.119	3.95	60.4	1.52	0.562	19.2	94.7	2.20
2084-2089	2.97	5.35	3.03	0.0487	0.0332	3.37	63.6	1.59	0.493	14.7	95.2	2.04
2114-2119	0.985	4.84	2.46	0.0217	0.0971	3.58	66.8	1.84	0.568	15.9	97.1	2.46
2144-2149	2.55	5.67	2.95	0.0585	0.167	3.31	62.6	1.74	0.611	14.8	94.4	2.76
3-234-239	0.302	6.32	3.15	0.0281	0.155	4.13	66.3	1.11	0.687	17.4	99.6	1.30
3-264-269	0.411	6.22	2.96	0.0306	0.116	3.42	66.3	2.00	0.668	16.7	98.8	1.72
3-294-299	1.01	6.22	2.83	0.0304	0.106	3.41	63.6	1.95	0.619	16.7	96.4	1.30
3-324-329	0.642	6.72	2.79	0.0292	0.116	3.24	65.2	1.94	0.612	16.5	98.0	1.86
3-354-359	0.439	7.75	2.86	0.0274	0.0919	2.19	61.5	1.69	0.571	16.2	93.3	1.40
3-384-389	0.721	6.52	2.97	0.0302	0.0841	2.42	61.5	1.90	0.651	17.8	94.6	1.70
3-414-419	7.64	6.27	2.53	0.0543	0.0273	3.33	54.5	1.49	0.504	15.1	91.4	1.05
3-444-449	1.79	8.45	2.88	0.0406	0.113	3.29	63.1	2.01	0.637	16.4	98.7	0.840
3-474-479	0.849	6.07	2.84	0.0293	0.0387	3.25	64.7	2.18	0.655	16.2	96.8	1.40
3-504-509	0.657	6.04	2.86	0.0288	0.109	3.26	67.9	2.28	0.661	16.3	100.	1.40
3-534-539	1.41	6.45	2.95	0.0371	0.106	3.44	63.1	2.00	0.690	16.8	97.0	1.64
3-564-569	1.93	5.81	3.52	0.0586	0.126	3.18	59.1	2.17	0.608	15.8	72.8	1.44
3-594-599	7.68	6.25	2.25	0.0589	N.D.	2.56	57.2	1.71	0.530	13.3	91.8	1.60
3-624-629	0.641	5.79	2.71	0.0251	0.126	3.09	65.8	2.20	0.590	15.6	96.6	1.84
3-654-659	0.951	9.05	2.66	0.0266	0.0963	3.08	61.5	2.04	0.538	15.3	95.2	1.76
3-684-689	0.616	6.37	2.90	0.0272	0.117	3.47	66.3	2.20	0.576	17.0	99.5	1.60
3-714-719	0.542	7.27	2.79	0.0254	0.147	3.17	66.8	2.07	0.580	15.8	99.2	1.56
3-744-749	0.524	6.67	2.98	0.0273	0.111	3.17	65.8	2.11	0.626	16.3	98.4	1.32
3-774-779	0.821	6.09	2.83	0.0285	0.0580	3.55	64.7	2.04	0.665	16.7	97.5	1.24
3-804-809	3.39	5.47	4.00	0.0812	0.0947	2.15	63.6	1.65	0.503	12.7	93.6	1.76
3-834-839	2.45	5.94	2.43	0.0429	0.0497	3.06	63.1	2.02	0.520	14.7	94.3	1.56
3-864-869	1.47	7.24	2.77	0.0365	0.100	3.21	63.6	1.89	0.508	15.8	96.7	1.20
3-894-899	0.596	6.29	2.79	0.0275	0.0314	3.30	65.2	2.09	0.608	16.3	97.2	0.940
3-924-929	0.910	6.78	2.81	0.0309	0.106	3.25	62.6	2.04	0.566	16.3	95.4	1.00
3-954-959	0.753	6.28	2.71	0.0264	0.0963	3.02	65.8	2.12	0.549	15.6	96.9	1.70
3-984-989	0.917	6.81	2.72	0.0356	0.120	2.15	62.0	1.43	0.528	15.6	92.8	1.32
1014-1019	0.276	6.23	2.62	0.0247	0.0591	3.24	67.4	2.11	0.555	15.8	98.3	1.72
1044-1049	0.518	6.28	2.53	0.0236	0.0968	3.13	64.7	2.12	0.569	15.5	95.5	2.24
1074-1079	4.23	7.78	2.90	0.0639	0.163	3.81	54.5	1.47	0.551	17.0	92.5	1.50
1104-1109	0.514	7.51	2.61	0.0246	0.0825	3.37	64.7	2.04	0.584	15.9	97.4	2.32
1134-1139	2.46	6.82	2.72	0.0458	0.142	3.16	63.6	1.58	0.567	14.8	95.9	0.900
1164-1169	0.715	8.45	2.91	0.0349	0.115	2.88	64.7	2.01	0.665	17.0	99.5	1.30
1194-1199	9.27	6.94	5.52	0.202	0.0734	2.95	46.0	1.26	0.491	13.3	86.1	2.90
1224-1229	1.48	9.36	2.77	0.0395	0.0491	2.97	63.6	2.25	0.613	16.6	99.7	2.10
1254-1259	0.283	9.31	3.18	0.0313	0.0733	3.30	61.5	2.32	0.657	18.2	98.8	1.76
1284-1289	0.556	7.10	2.96	0.0323	0.0837	3.05	64.7	2.35	0.629	17.2	98.7	1.48
1314-1319	0.223	7.92	3.07	0.0314	0.0193	2.69	64.7	2.42	0.694	16.7	98.5	1.36
1344-1349	0.304	11.9	3.37	0.0344	0.0715	3.25	58.3	2.51	0.742	20.0	100.	1.76
1374-1379	1.17	8.66	2.77	0.0382	0.0625	3.19	62.0	2.81	0.539	17.8	99.1	1.30
1404-1409	0.813	10.4	2.89	0.0327	0.0347	3.26	63.6	2.52	0.529	17.8	102.	1.28
1434-1439	0.785	8.83	2.99	0.0308	0.0574	3.86	61.0	2.42	0.628	18.3	98.9	1.44
1464-1469	0.526	8.45	3.00	0.0309	0.0753	2.42	65.2	2.23	0.547	17.2	99.7	1.84

AREA: MICH												
CLIENT	CAO-%	FE203-%	MGO-%	MNO-%	P205-%	KT0-%	SI02-%	HA20-%	TIO2-%	AL203-%	SUMOX	ORG.C-%
1494-1499	0.793	4.77	2.40	0.0308	0.0160	3.53	63.1	2.37	0.545	17.4	99.5	2.16
1526-1529	1.15	7.91	2.85	0.0337	0.103	3.46	63.6	2.38	0.583	17.4	99.5	1.60
1554-1559	0.809	7.67	3.03	0.0373	0.0488	3.36	65.8	2.32	0.612	16.6	100.	1.60
1584-1589	0.754	4.29	2.95	0.0405	0.120	3.43	67.7	2.30	0.620	17.6	100.	1.20
1614-1619	0.523	4.26	2.96	0.0336	0.129	3.65	63.6	2.44	0.566	16.1	100.	2.36
5-364-369	0.284	4.58	2.62	0.0204	0.0200	4.14	66.3	1.42	0.733	18.6	103.	0.500
5-394-399	1.22	4.26	2.58	0.0326	0.0398	4.67	63.6	2.00	0.714	20.0	103.	0.680
5-424-429	0.190	4.95	2.51	0.0146	0.0321	4.36	63.1	2.18	0.602	19.6	102.	0.200
5-454-459	0.229	4.16	2.65	0.0174	0.0254	5.01	61.0	0.817	0.725	19.8	98.4	0.880
5-484-489	0.246	4.88	2.48	0.0177	N.D.	3.74	66.3	2.24	0.659	17.4	99.9	0.940
5-514-519	0.661	7.74	2.52	0.0251	0.0194	4.13	65.8	1.65	0.769	16.3	99.6	0.860
5-544-549	9.25	17.1	4.77	0.195	0.325	0.923	46.5	2.60	3.20	14.5	99.4	0.240
5-574-579	0.66	14.9	4.55	0.193	0.259	1.01	50.3	2.83	3.29	15.0	103.	0.180
5-604-609	2.60	4.13	2.58	0.0556	0.113	1.91	71.1	1.22	0.774	11.0	99.5	0.680
5-634-639	0.309	7.31	2.76	0.0196	0.0542	5.01	65.8	0.987	0.846	16.3	99.4	0.320
5-664-669	2.97	1.73	0.583	0.0156	0.426	1.23	86.1	0.280	0.174	3.84	97.4	0.160
5-694-699	4.68	5.82	5.61	0.103	N.D.	0.993	66.3	0.219	0.277	5.93	91.9	0.0800
5-724-729	3.30	5.60	2.37	0.101	N.D.	2.07	77.5	0.243	0.236	6.01	97.4	0.700
5-754-759	1.51	18.4	5.05	0.153	0.0476	2.32	48.1	0.523	0.536	13.2	90.8	0.600
5-784-789	0.864	17.7	2.53	0.0501	N.D.	2.04	62.6	0.356	1.10	10.2	97.5	0.680
5-814-819	2.39	14.0	2.62	0.102	N.D.	1.85	65.2	0.287	0.393	7.89	96.7	0.520
5-844-849	1.34	24.7	3.37	0.645	0.185	1.96	47.6	0.393	0.427	7.68	88.3	2.44
5-874-879	1.20	15.4	2.52	0.0761	0.0377	5.16	58.8	0.254	0.617	13.2	97.3	1.44
5-904-909	1.11	7.95	1.42	0.0208	N.D.	4.47	72.2	0.323	0.155	8.78	96.4	0.840
5-934-939	0.893	6.15	1.14	0.0127	N.D.	5.01	77.5	0.566	0.113	8.90	100.	0.600
5-964-969	0.518	4.13	0.855	0.0141	0.0314	4.65	75.4	0.316	0.140	9.38	95.5	0.300
5-994-999	2.35	2.89	1.64	0.0538	N.D.	3.35	66.8 73.0	1.17	0.0557	9.16	85.9	0.200
1024-1029	0.472	3.975	0.238	0.0101	N.D.	2.36	76.5	3.70	0.0799	14.2	98.5	0.0600
1054-1059	3.54	2.98	0.616	0.0676	N.D.	4.04	71.7	0.378	0.0807	12.5	96.1	0.0600
1084-1089	7.79	14.0	6.17	0.206	0.109	0.737	49.2	1.71	0.820	14.3	95.1	0.360
1114-1119	10.1	9.57	4.02	0.152	0.0261	1.11	52.9	2.52	0.809	12.9	94.1	0.160
1144-1149	10.9	11.8	4.43	0.175	N.D.	0.982	47.1	1.73	0.835	14.0	91.9	0.360
EX-35-40	1.30	6.69	2.71	0.0404	0.0553	3.05	62.6	1.59	0.471	14.5	93.0	3.36
EX-65-70	1.41	6.75	2.50	0.0371	0.0920	2.82	62.0	1.79	0.500	13.9	91.8	3.70
EX-95-100	2.36	5.83	2.50	0.0597	0.0818	2.33	66.3	2.07	0.524	13.2	95.3	3.08
EX-124-130	1.54	6.87	2.81	0.0423	0.0588	2.98	63.1	2.10	0.545	15.5	95.6	3.24
EX-155-160	3.17	4.36	2.16	0.0520	0.0771	2.82	70.0	1.53	0.518	13.3	97.9	2.20
EX-185-190	3.13	5.64	3.00	0.0557	0.115	3.85	57.8	2.10	0.851	16.1	94.7	2.66
EX-215-220	1.30	5.54	3.11	0.0384	0.0951	3.81	64.2	2.21	0.656	16.4	99.4	3.12
EX-245-250	0.785	6.15	3.28	0.0368	0.207	3.69	64.2	2.27	0.760	18.5	99.9	2.28
EX-275-280	0.731	4.98	2.95	0.0323	0.123	3.06	65.8	2.60	0.680	16.9	97.9	3.56
EX-305-310	1.16	5.41	3.27	0.0400	0.145	3.71	62.6	1.83	0.723	17.8	96.7	3.16
EX-335-340	1.60	6.23	3.38	0.0373	0.570	4.02	59.4	1.81	0.817	19.2	97.1	3.64
EX-365-370	0.662	5.26	2.90	0.0324	0.144	2.89	67.4	2.14	0.712	15.7	97.8	4.00
EX-395-400	0.710	5.29	2.73	0.0322	0.112	2.53	67.9	1.98	0.639	13.9	95.8	3.36
EX-425-430	0.644	5.11	2.64	0.0301	0.101	2.62	64.2	1.91	0.562	13.2	91.0	3.64
EX-455-460	0.515	5.61	2.69	0.0321	0.0779	2.63	62.6	1.89	0.610	13.2	90.1	2.88
EX-485-490	0.386	5.09	2.70	0.0298	0.0794	2.51	69.0	1.48	0.606	13.0	94.9	3.04
EX-515-520	1.53	6.06	2.98	0.0447	0.0764	3.02	63.1	1.27	0.572	14.5	93.2	1.44
EX-545-550	0.793	5.22	2.97	0.0316	0.126	4.31	65.4	1.19	0.691	14.4	99.5	1.44
EX-575-580	1.68	6.33	3.35	0.0483	0.122	3.33	65.8	1.73	0.641	17.0	100.	1.36
EX-605-610	4.26	5.99	3.03	0.0684	0.209	2.90	61.5	1.38	0.543	14.5	94.3	3.68
EX-635-640	0.544	5.78	3.00	0.0340	0.118	3.36	66.8	1.59	0.676	16.1	98.0	2.56
EX-665-670	0.762	6.33	3.08	0.0384	0.149	3.46	65.8	1.94	0.644	17.0	99.3	1.66
EX-695-700	0.892	6.60	3.27	0.0421	0.114	3.15	70.5	1.92	0.640	16.4	103.	2.50

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AREA: MICH												
CLIENT												
SAMPLE NAME	CAO-2	FE203-2	MGO-2	MNO-2	P205-2	AL2O3-2	STO2-2	NA2O-2	TIO2-2	AL2O3-2	SUMOX	ORG.C-2
EX-725-730	3.79	6.10	3.09	0.0854	0.123	3.38	68.4	1.66	0.524	16.6	104.	0.800
EX-755-760	0.652	5.71	3.20	0.0394	0.135	4.09	66.8	1.44	0.702	18.7	101.	0.880
EX-785-790	0.645	6.66	3.36	0.0409	0.0524	3.33	65.8	1.68	0.742	17.1	99.4	3.00
EX-815-820	1.03	6.96	3.19	0.0426	0.152	2.94	69.5	2.42	0.693	16.9	104.	1.88
EX-845-850	0.562	6.84	3.35	0.0370	0.184	3.44	66.3	2.35	0.712	18.1	102.	1.50
EX-875-880	0.320	7.35	3.21	0.0332	0.0891	3.31	66.3	2.56	0.729	18.3	102.	1.72
EX-905-910	0.959	6.43	2.86	0.0389	0.145	3.00	69.0	1.90	0.635	15.5	101.	1.60
EX-935-940	0.959	7.45	2.84	0.0347	0.146	2.77	67.2	2.15	0.551	15.6	82.7	1.50
965-970	0.549	6.76	2.93	0.0300	0.112	3.23	65.8	2.14	0.638	16.5	98.7	1.64
995-1000	0.575	7.27	2.86	0.0337	0.121	3.17	63.1	2.09	0.612	15.7	95.6	1.50
1025-1030	0.502	7.14	2.92	0.0300	0.0948	3.12	67.4	2.17	0.727	16.2	100.	1.36
1055-1060	7.67	9.49	6.10	0.109	0.0770	1.12	52.4	0.790	1.23	11.6	90.6	0.680
1085-1090	0.316	5.71	3.01	0.0313	0.0893	4.86	63.6	1.71	0.724	19.2	99.3	1.64
1115-1120	0.256	10.2	3.00	0.0324	0.0500	3.29	64.2	1.85	0.620	16.4	99.9	0.800
1123-1128	0.321	10.0	2.86	0.0294	0.104	3.28	60.4	1.92	0.709	16.1	95.8	1.24
4-109-114	0.285	9.44	3.82	0.0421	0.0403	3.34	60.5	N.D.	0.604	17.4	95.6	0.300
4-139-144	0.225	9.59	3.89	0.0412	0.0534	3.93	57.0	0.0192	0.749	18.3	93.8	0.420
4-169-174	0.209	8.52	3.50	0.0516	0.0551	3.55	59.1	0.00465	0.593	16.9	92.5	1.31
4-199-204	0.285	9.74	3.93	0.0571	0.159	3.78	57.0	0.0259	0.568	17.8	93.3	0.976
4-229-234	1.06	9.27	3.62	0.0401	0.0291	4.38	58.4	N.D.	0.524	16.6	93.9	0.920
4-259-264	0.413	9.19	3.75	0.0573	0.101	3.93	57.0	0.569	0.621	17.7	93.3	0.440
4-289-294	0.379	9.27	3.73	0.0439	0.117	3.52	56.2	1.24	0.599	18.0	93.1	0.650
4-319-324	2.67	7.11	3.77	0.134	0.105	3.97	59.1	0.749	0.522	14.1	92.2	0.800
4-349-354	0.413	9.95	3.69	0.0552	0.110	3.96	57.0	0.857	0.663	18.4	95.1	0.760
4-379-384	0.582	9.33	3.77	0.0471	0.108	3.88	53.3	1.31	0.684	19.0	92.1	0.810
4-409-414	0.286	9.71	3.72	0.0589	0.0868	2.89	55.1	1.56	0.649	17.3	91.4	1.85
4-439-444	0.277	9.03	3.73	0.0557	0.0989	3.07	55.4	1.58	0.691	17.7	91.6	1.02
4-469-474	8.42	6.00	2.57	0.200	0.0793	2.58	51.9	1.84	0.560	14.3	88.5	0.680
4-499-504	0.235	9.46	3.19	0.0335	0.0947	2.99	56.8	1.25	0.584	16.4	91.0	0.790
4-529-534	0.542	7.39	3.23	0.0437	0.0552	2.43	58.6	2.20	0.517	15.7	91.2	1.62
4-559-564	0.617	9.34	3.58	0.0466	0.0469	2.81	55.4	2.25	0.693	18.5	93.3	0.260
4-589-594	1.15	6.68	2.74	0.0430	0.103	1.68	61.5	3.63	0.566	15.6	93.7	0.230
4-619-624	0.957	7.97	3.29	0.0478	0.101	3.09	55.4	2.30	0.694	18.6	92.4	0.190
4-649-654	1.38	7.30	2.90	0.0517	0.0596	1.41	60.4	3.27	0.523	14.5	91.8	0.100
4-679-684	0.626	8.48	3.43	0.0421	0.0791	2.62	56.8	2.37	0.649	17.6	92.7	0.190
4-709-714	0.772	6.75	3.12	0.0505	0.100	1.58	64.7	3.44	0.607	15.1	96.3	0.0800
4-739-744	1.20	6.62	3.17	0.0576	0.150	1.34	65.7	2.96	0.712	13.4	95.3	0.150
4-769-774	0.497	9.38	4.07	0.0484	0.194	3.36	53.3	1.55	0.675	14.0	92.1	0.190
4-799-804	0.543	8.66	3.41	0.0444	0.0256	2.38	60.0	1.70	0.520	14.6	91.4	0.650
4-829-834	3.60	7.69	3.07	0.0962	0.218	2.91	54.3	1.85	0.621	16.6	91.0	0.530
4-859-864	0.379	10.0	3.34	0.0394	0.143	3.23	55.3	1.41	0.619	17.4	91.9	0.910
4-889-894	5.48	6.69	2.57	0.137	0.119	1.96	57.4	2.57	0.658	14.2	91.8	0.450
4-919-924	1.88	8.56	3.19	0.0725	0.0836	2.33	57.8	2.32	0.643	18.3	93.2	0.560
4-949-954	0.242	10.3	3.84	0.0471	0.0374	3.35	53.9	1.55	0.736	19.0	93.1	0.470
4-979-984	0.627	7.87	3.25	0.0421	0.114	2.87	58.1	1.72	0.584	16.7	91.8	1.13
4-10091014	0.430	9.52	3.27	0.0416	0.0905	3.13	58.1	1.21	0.673	17.0	93.5	0.640
4-10391044	0.950	8.48	3.17	0.0475	0.0430	3.15	57.4	1.76	0.681	17.0	92.6	1.11
4-10691074	0.397	7.53	2.86	0.0353	0.0401	3.08	65.8	0.622	0.532	15.8	97.7	0.910
4-10991104	0.167	8.61	3.66	0.0307	0.0579	3.47	59.9	0.907	0.653	17.1	94.0	1.17
4-11291134	0.466	8.34	2.69	0.0589	N.D.	2.52	64.9	1.63	0.602	14.7	96.0	0.640
4-11591164	1.22	8.47	2.70	0.0698	0.175	2.54	64.0	1.50	0.620	14.8	96.0	0.430
4-11891194	0.167	8.98	3.27	0.0294	0.0519	3.28	58.9	1.05	0.660	17.2	93.5	0.830
4-12191224	0.414	9.67	3.41	0.0460	0.113	2.66	57.8	1.63	0.649	16.4	93.0	0.680
4-12491254	1.23	7.79	2.99	0.0512	0.118	2.04	61.3	2.61	0.609	15.4	94.2	0.270
4-12791284	0.941	8.19	3.38	0.0482	0.0215	2.70	58.5	1.97	0.602	16.0	93.3	0.370

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AREA: MICH												
CLIENT SAMPLE NAME	CAO-%	FE2O3-%	MGO-%	MNO-%	P2O5-%	K2O-%	SI02-%	NA2O-%	TIO2-%	AL2O3-%	SUM0%	ORG.C-%
4-13091314	2.08	7.37	7.06	0.0550	0.0699	2.56	58.1	2.07	0.596	16.1	92.1	0.620
4-13391344	1.22	8.86	7.52	0.0550	0.135	2.62	57.1	2.25	0.632	17.4	93.8	0.690
4-13691374	2.13	8.62	7.20	0.0703	0.115	2.96	57.1	2.18	0.705	17.7	94.2	0.690
4-13991404	0.175	11.3	7.76	0.0266	0.100	3.19	54.2	1.65	0.611	15.4	90.3	3.00
4314291434	0.225	7.19	7.32	0.0307	0.142	3.54	56.4	1.71	0.565	17.3	90.5	3.06
4314591464	0.337	9.33	7.23	0.0301	0.110	3.28	56.7	1.69	0.621	16.1	91.2	3.49
4314891494	0.805	8.28	7.25	0.0589	0.148	3.50	55.3	1.51	0.712	16.3	90.4	2.46
4315191524	5.73	5.98	7.40	0.277	N.D.	0.0426	58.5 58.5	3.46	0.344	9.77	39.5	2.46
4315491554	0.396	6.59	7.40	0.0295	0.0383	4.18	56.4	1.03	0.654	17.4	89.6	2.35
4315791584	7.15	5.74	4.06	0.122	0.141	2.41	50.4	1.81	0.493	12.7	85.1	2.50
4316091614	0.952	7.28	7.20	0.0432	0.177	4.21	52.2	1.34	0.787	18.5	88.7	1.06
4316391644	3.53	6.76	4.21	0.129	0.0609	3.29	50.4	1.59	0.630	16.1	86.7	1.08
4316691674	2.80	6.43	3.54	0.105	0.154	2.47	62.2	2.24	0.453	12.6	93.0	0.780
4316991704	1.22	7.84	7.88	0.0540	0.0624	1.87	64.3	1.83	0.441	13.2	94.7	0.410
4317291734	0.310	8.79	7.38	0.0293	0.139	4.31	56.8	1.23	0.670	19.0	94.3	0.650
4317591764	0.465	7.37	7.15	0.0407	0.131	2.53	59.7	2.51	0.596	15.7	92.2	0.190
4317891794	0.456	8.41	7.81	0.0375	0.119	4.04	56.1	0.946	0.746	17.8	92.4	0.480
4318191824	0.925	7.21	7.35	0.0576	0.159	2.23	60.4	2.73	0.510	15.3	92.9	0.300
4318491854	2.00	7.15	7.72	0.105	0.105	3.28	57.9	1.93	0.613	15.8	92.6	0.330
4318791884	0.498	9.38	4.52	0.0505	0.115	3.44	56.5	1.03	0.630	18.2	94.4	0.260
4319091914	0.396	9.33	7.52	0.0391	0.0987	3.68	57.5	1.40	0.682	18.2	93.9	0.500
4319391944	0.625	9.79	7.80	0.0671	0.0789	3.70	55.1	1.35	0.730	18.8	94.1	0.410
4319691974	0.627	8.16	7.12	0.0507	0.127	2.29	60.0	2.63	0.609	15.9	93.5	0.260
4319992004	0.399	9.39	7.67	0.0521	0.113	3.41	57.9	1.84	0.577	18.4	95.8	0.300
4320292034	7.52	6.15	2.75	0.208	0.115	2.36	56.1	2.49	0.564	14.2	92.5	0.420
4320592064	0.271	7.06	7.32	0.0306	0.121	5.20	57.9	1.43	0.693	21.5	97.5	0.740
4320892094	0.76	7.20	4.79	0.156	0.0940	2.83	52.9	1.69	0.619	16.2	91.3	1.25
4321192124	2.08	9.15	4.15	0.140	0.137	3.62	52.9	1.77	0.669	19.0	93.7	0.410
4321492154	0.327	9.49	7.70	0.0509	0.146	3.51	58.6	1.44	0.701	18.4	96.3	0.410
4321792184	3.90	7.51	7.11	0.135	0.0815	3.84	55.1	1.35	0.665	17.7	93.4	0.700
4322092214	0.356	10.7	7.53	0.0638	0.105	3.67	54.7	2.05	0.857	20.6	96.8	0.410
4322392244	0.767	8.08	7.19	0.0630	0.114	2.66	62.2	3.22	0.716	18.0	99.1	0.450
4322692274	0.952	8.48	7.32	0.0586	0.0946	1.94	62.4	3.43	0.717	15.9	97.3	0.180
4322992304	8.43	15.3	7.52	0.198	0.318	1.17	47.1	2.91	3.74	15.1	98.2	0.240
4323292334	8.10	15.0	4.27	0.194	0.326	1.15	46.1	3.00	3.00	15.0	96.2	0.180
4323592364	1.20	10.5	7.83	0.0544	0.101	3.30	56.7	2.21	0.934	19.8	98.7	0.150
4323892394	0.595	8.94	7.53	0.0567	0.109	3.16	59.6	2.45	0.785	18.5	97.7	0.560
4324192424	7.61	5.92	2.42	0.186	0.119	1.76	56.4	3.72	0.578	15.0	93.7	0.420
4324492454	0.787	7.44	7.07	0.0492	0.0649	3.36	60.3	2.12	0.593	17.9	95.7	2.71
4324792484	2.31	8.07	7.07	0.0902	0.0823	2.06	59.6	3.30	0.615	16.6	95.8	0.300
4325092514	0.955	9.01	7.39	0.0648	0.0848	2.24	58.5	3.07	0.598	17.4	95.3	0.760
4325392544	1.57	9.04	7.28	0.0804	0.140	2.67	58.5	2.81	0.742	18.4	97.2	0.260
4325692574	0.319	8.98	7.42	0.0422	0.0851	3.47	56.4	2.08	0.676	19.4	94.9	1.62
4325992604	0.247	8.54	7.28	0.0395	0.0792	3.76	55.3	1.92	0.701	20.0	93.9	1.22
4326292634	0.416	10.2	7.65	0.0535	0.114	3.05	57.4	2.20	0.751	19.2	97.1	1.22
4326592664	1.14	8.46	7.24	0.0407	0.117	2.53	57.5	2.69	0.645	17.7	94.6	0.440
4326892694	0.392	9.18	7.47	0.0447	0.142	3.10	57.4	1.83	0.715	17.9	94.2	0.700
4327192724	1.07	8.22	7.39	0.0689	0.106	3.34	56.0	1.15	0.594	16.5	90.4	1.84
4327492754	4.12	6.35	2.84	0.126	0.0984	3.04	56.0	2.15	0.563	16.1	91.4	0.550
4327792784	0.689	8.25	7.17	0.0461	0.120	3.29	58.1	1.63	0.651	17.4	93.4	1.18
4328092814	1.51	9.53	7.18	0.0849	0.0367	2.42	55.3	1.78	0.514	15.0	89.3	2.87
4328392844	2.78	12.5	7.17	0.139	0.174	1.26	57.4	0.581	0.438	9.49	88.0	2.87
4328692874	2.17	12.0	2.87	0.102	0.144	2.30	53.2	0.847	0.478	11.8	85.9	3.40
4328992904	0.839	6.51	2.55	0.0250	0.0532	3.11	57.4	1.21	0.506	13.4	85.6	6.02
4329292934	1.17	8.20	2.94	0.0258	0.0392	3.34	57.8	1.23	0.551	14.8	90.1	3.92

AREA: MICH													
CLIENT SAMPLE NAME	CAO-2	FE203-2	MGO-3	MNO-3	P205-3	<20-3	SI02-3	NA2O-3	TIO2-3	AL2O3-4	SUMOX	ORG.C-3	
4829592964	1.32	7.54	2.64	0.0152	0.0349	3.40	63.4	0.366	0.750	12.2	92.1	0.750	
4829892994	6.84	5.18	3.68	0.0097	0.143	1.72	58.9	N.D.	0.232	5.51	82.3	3.72	
4830193024	6.24	9.97	3.90	0.148	0.0945	2.48	49.5	0.185	0.432	9.43	82.6	0.230	
4830493054	1.46	11.4	3.03	0.0087	0.0147	3.14	59.9	0.536	0.541	12.4	92.7	0.300	
4830793084	2.27	5.69	2.34	0.0041	0.0855	3.12	64.6	0.653	0.183	8.18	87.2	0.380	
4831093114	4.57	12.6	3.40	0.236	0.144	0.706	60.3	0.102	0.307	7.28	89.6	0.470	
4831393144	2.40	2.32	1.01	0.0288	0.0486	2.47	66.7	4.59	0.278	15.7	83.5	0.300	
4831693174	4.88	4.14	3.12	0.0989	0.127	2.92	66.7	2.64	0.381	14.7	99.7	0.560	4
5-278-283	1.08	9.22	3.47	0.0836	0.121	4.25	54.2	0.348	0.513	19.0	92.7	0.410	6
5-308-313	0.287	10.2	3.79	0.0749	0.134	3.90	54.6	0.274	0.429	18.8	92.5	0.430	
5-338-343	0.419	11.0	3.77	0.120	0.0991	3.23	54.6	0.227	0.462	16.7	90.7	0.670	
5-368-373	4.73	12.8	4.35	0.442	0.182	1.30	48.1	0.126	0.419	10.3	82.8	3.39	
5-398-403	0.272	9.33	3.48	0.138	0.119	3.87	57.3	0.259	0.537	17.5	92.8	0.560	
5-428-433	5.14	35.6	3.06	0.265	0.581	0.0475	43.4	N.D.	0.0597	2.20	90.3	3.15	
5-458-463	0.648	21.6	4.35	0.275	0.419	0.203	45.2	0.255	0.441	14.5	87.9	2.86	
5-488-493	0.237	10.2	3.63	0.143	0.121	3.76	56.2	0.401	0.426	17.6	92.6	0.450	
5-518-523	0.269	10.1	3.68	0.130	0.132	4.00	55.2	0.329	0.439	18.3	92.6	0.450	
5-548-553	0.322	10.8	3.63	0.148	0.138	4.19	56.2	0.394	0.595	19.4	96.0	0.460	
5-578-583	0.308	11.0	3.45	0.131	0.120	3.95	58.9	0.327	0.477	18.5	97.5	0.370	
5-608-613	0.236	11.2	3.76	0.141	0.130	3.61	59.6	0.282	0.602	17.5	97.0	0.480	
5-638-643	6.36	21.4	4.40	0.561	0.472	0.109	39.7	0.0883	0.333	8.90	82.4	2.73	
5-668-678	0.244	10.9	3.79	0.135	0.126	3.93	57.4	0.315	0.623	18.1	95.5	0.560	
5-698-703	0.249	10.1	3.77	0.111	0.118	3.69	58.0	0.295	0.462	17.4	94.2	0.450	
5-728-733	0.244	10.4	3.78	0.141	0.113	3.72	60.3	0.257	0.555	17.5	97.0	0.560	
5-758-763	0.227	14.3	4.28	0.188	0.122	2.32	56.6	0.298	0.415	15.5	94.2	0.450	
5-788-793	0.248	14.7	4.06	0.145	0.137	2.44	58.9	0.229	0.539	15.8	97.2	0.820	
5-818-823	1.59	19.1	3.90	0.236	0.454	0.0653	55.9	0.0945	0.352	10.7	92.4	0.850	
5-848-853	1.57	35.0	3.69	0.224	0.514	N.D.	43.9	0.0666	0.317	11.4	96.7	3.56	
5-878-883	0.928	17.9	3.41	0.145	0.254	0.829	59.0	0.0267	0.408	10.8	93.6	1.21	
5-908-913	0.500	17.0	4.16	0.172	0.310	1.27	50.8	0.161	0.469	14.0	88.8	1.37	
5-938-943	0.294	12.0	3.35	0.0990	0.159	1.84	64.0	0.0765	0.414	11.6	93.9	0.800	
5-968-972	9.00	16.7	4.48	0.216	0.688	0.0375	42.5	0.0343	0.0759	1.98	75.7	1.81	6
6-998-1003	2.86	20.3	3.37	0.140	0.317	0.0422	55.9	N.D.	0.255	4.91	88.1	0.630	7
6-10281033	0.745	16.6	3.89	0.159	0.324	1.87	53.7	0.163	0.451	14.4	92.2	0.300	
6-10581063	0.636	14.7	3.28	0.0964	0.358	1.30	60.5	0.0815	0.331	9.60	90.9	4.44	
6-10881093	0.424	7.82	2.98	0.0590	0.259	2.75	69.1	0.121	0.435	12.0	96.0	1.90	
7-275-280	0.687	8.04	3.43	0.0275	0.137	3.35	61.8	0.244	0.644	16.9	95.2	0.170	
7-305-310	0.244	8.50	3.70	0.0292	0.0742	2.67	65.1	0.202	0.654	15.7	96.9	0.110	
7-335-340	0.432	8.65	3.69	0.0318	0.0694	3.64	58.8	0.208	0.780	18.1	94.6	1.18	
7-365-370	0.218	8.05	3.33	0.0179	0.0850	3.61	59.1	0.221	0.679	17.4	92.8	0.370	
7-395-400	0.182	8.85	2.99	0.00986	0.0927	3.39	58.2	0.349	0.556	15.5	90.2	1.69	
7-425-430	0.191	8.26	2.95	0.00957	0.0787	3.25	58.5	0.312	0.576	15.2	89.3	3.52	
7-455-460	1.92	7.12	2.88	0.0453	0.108	3.99	57.5	0.209	0.551	14.6	88.0	3.70	
7-485-490	1.39	5.43	2.60	0.0290	0.0875	3.28	61.5	0.177	0.572	15.5	91.0	3.32	
7-515-520	1.97	5.71	2.14	0.0557	0.147	3.66	62.0	0.149	0.614	14.3	90.7	2.82	
7-545-550	3.66	6.53	2.01	0.0558	0.139	3.41	59.1	0.111	0.554	13.0	86.6	3.06	
7-575-580	17.1	2.28	0.445	0.0229	0.285	0.472	56.2	0.0459	0.0780	1.58	78.5	0.260	
7-605-610	21.8	4.75	4.03	0.296	0.137	0.409	42.8	0.0111	0.0541	1.20	75.5	3.43	
7-635-640	24.6	3.04	2.37	0.202	0.0566	0.856	46.7	0.0158	0.0880	2.47	81.3	1.73	
7-665-670	6.73	2.75	1.59	0.0620	0.288	4.74	60.6	2.64	0.496	13.0	92.9	0.0710	
7-691-696	2.37	1.84	0.855	0.0264	0.0514	4.35	70.5	3.72	0.200	14.3	98.2	0.180	7
SS-713-714	22.8	7.02	6.16	0.285	0.254	0.422	56.2	0.142	0.230	4.95	98.5	4.05	
SS10591065	3.38	16.0	2.94	0.150	0.0506	1.76	23.2	0.995	0.319	8.53	57.4	0.440	
SS10651069	5.59	17.7	2.81	0.189	N.D.	0.113	60.6	0.459	0.252	4.88	92.6	0.200	
SS10691080	13.7	16.9	4.07	0.263	N.D.	0.212	39.2	0.992	0.566	9.21	85.0	0.170	SPECIAL SAMPLES

AREA: MICH												
CLIENT SAMPLE NAME	CAO-%	FE2O3-%	MGO-%	MNO-%	P2O5-%	K2O-%	SiO2-%	Na2O-%	TiO2-%	AL2O3-%	SUMOX	ORG.C-%
S510001090	7.81	10.4	4.47	0.194	N.D.	0.845	52.2	2.14	0.774	13.0	91.8	0.0400
S510501100	7.65	9.50	3.75	0.175	N.D.	2.04	52.5	2.80	0.930	15.1	94.6	0.280
S511001110	7.70	15.0	4.92	0.256	0.0270	0.900	42.5	1.97	0.905	16.0	90.2	0.220
S511101120	4.38	12.4	4.37	0.197	0.0229	0.859	49.6	2.16	0.898	14.6	91.5	0.280
S511201130	12.0	12.4	4.50	0.225	0.0513	0.436	49.0	2.02	0.922	13.4	95.0	0.260
7-510-511	3.18	4.40	1.63	0.0482	0.143	2.51	65.1	0.0632	0.559	10.1	87.6	1.29
7-568-561	1.01	5.39	1.63	0.0217	0.178	3.96	67.0	0.224	0.644	14.6	94.7	3.70
4-3011	30.0	7.38	5.65	0.820	2.79	0.654	10.5	0.0357	0.0887	1.75	59.6	8.01

**TABULAR LIST
TRACE ELEMENTS FOR DL-1**

<u>Sample No.</u>	<u>Pb ppm</u>	<u>Colorimetric As ppm</u>	<u>Zr ppm</u>	<u>Mo ppm</u>	<u>Th ppm</u>	<u>Ag ppm</u>	<u>Sr ppm</u>	<u>V ppm</u>	<u>Be ppm</u>	<u>Ba ppm</u>	<u>Ni ppm</u>	<u>Cu ppm</u>	<u>Zn ppm</u>	<u>Cr ppm</u>	<u>Co ppm</u>	<u>Cd ppm</u>	<u>Organic Carbon %</u>	<u>Fluori- metric U ppm</u>
104- 109	50	25	169	N.D.	6	N.D.	24.5	217.0	1.9	193	112	117.0	181	174.0	34	N.D.	2.50	1.6
134- 139	50	50	151	N.D.	N.D.	N.D.	22.4	251.0	1.8	379	136	145.0	303	204.0	32	N.D.	2.82	2.8
164- 169	35	53	146	N.D.	N.D.	N.D.	26.5	211.0	1.9	193	130	113.0	274	190.0	29	N.D.	2.64	2.4
194- 199	20	32	149	N.D.	8	N.D.	42.9	214.0	1.9	549	115	98.0	256	179.0	31	N.D.	2.60	2.0
224- 229	10	18	147	N.D.	N.D.	N.D.	61.2	176.0	1.8	1040	98	63.0	152	191.0	26	N.D.	1.60	0.8
284- 289	10	13	151	N.D.	7	N.D.	63.3	188.0	1.8	482	99	66.6	168	190.0	31	N.D.	1.62	1.2
314- 319	5	15	150	N.D.	N.D.	N.D.	75.5	169.0	1.7	527	100	57.2	179	196.0	30	N.D.	1.20	1.6
344- 349	85	67	124	N.D.	N.D.	N.D.	73.5	161.0	1.6	143	123	109.0	220	173.0	43	N.D.	2.88	1.4
374- 379	10	20	147	N.D.	N.D.	N.D.	75.5	179.0	1.7	199	99	65.6	186	189.0	40	N.D.	1.58	1.6
404- 409	10	20	141	N.D.	N.D.	N.D.	84.7	180.0	1.7	203	103	89.7	186	181.0	30	N.D.	1.96	1.6
434- 439	N.D.	15	159	N.D.	9	N.D.	84.7	202.0	1.9	811	105	64.8	205	196.0	26	N.D.	1.90	1.6
464- 469	10	21	152	N.D.	9	N.D.	84.7	186.0	1.8	239	101	69.1	173	185.0	28	N.D.	1.34	1.2
494- 499	10	17	147	N.D.	9	N.D.	84.7	182.0	1.8	313	101	66.1	183	181.0	29	N.D.	1.90	1.4
524- 529	40	290	148	N.D.	7	N.D.	68.4	173.0	1.8	181	115	66.4	179	175.0	41	N.D.	1.68	0.8
554- 559	5	15	152	N.D.	10	N.D.	68.4	163.0	1.8	468	95	52.0	167	186.0	34	N.D.	1.20	1.0
584- 589	15	20	149	N.D.	9	N.D.	64.3	196.0	1.8	248	118	111.0	237	181.0	31	N.D.	2.24	2.0
614- 619	20	22	166	N.D.	9	N.D.	70.4	171.0	1.8	284	104	64.7	184	190.0	30	N.D.	1.38	1.4
644- 649	20	26	145	22	9	N.D.	92.9	211.0	2.0	170	124	87.8	275	171.0	35	N.D.	2.80	2.4
674- 679	5	9	146	N.D.	9	N.D.	88.8	167.0	1.8	412	98	66.0	178	174.0	29	N.D.	1.44	2.6
704- 709	15	15	140	N.D.	9	N.D.	109.0	162.0	1.6	304	110	72.3	204	192.0	35	N.D.	1.64	1.2

**TABULAR LIST
TRACE ELEMENTS FOR DL-1**

<u>Sample No.</u>	<u>Pb ppm</u>	<u>Colorimetric As ppm</u>	<u>Zr ppm</u>	<u>Mo ppm</u>	<u>Th ppm</u>	<u>Ag ppm</u>	<u>Sr ppm</u>	<u>V ppm</u>	<u>Be ppm</u>	<u>Ba ppm</u>	<u>Ni ppm</u>	<u>Cu ppm</u>	<u>Zn ppm</u>	<u>Cr ppm</u>	<u>Co ppm</u>	<u>Cd ppm</u>	<u>Organic Carbon %</u>	<u>Fluori- metric U ppm</u>
734- 739	N.D.	9	157	N.D.	10	N.D.	88.8	170.0	1.8	294	99	57.1	167	203.0	30	N.D.	1.44	1.0
764- 769	N.D.	7	147	N.D.	11	N.D.	88.8	174.0	1.8	869	101	52.1	157	207.0	33	N.D.	1.30	0.8
794- 799	5	4	198	N.D.	11	N.D.	101.0	153.0	1.8	914	88	37.1	127	260.0	24	N.D.	1.30	0.8
824- 829	N.D.	2	163	N.D.	13	N.D.	76.5	177.0	1.9	1110	97	44.3	145	207.0	23	N.D.	0.96	0.8
854- 859	N.D.	5	160	N.D.	11	N.D.	84.7	169.0	1.8	718	97	50.1	160	203.0	33	N.D.	1.10	0.8
884- 889	N.D.	5	146	N.D.	10	N.D.	117.0	171.0	1.8	619	114	67.0	172	192.0	29	N.D.	1.10	0.8
914- 919	10	8	163	N.D.	11	N.D.	76.5	184.0	1.8	273	107	62.6	230	193.0	31	N.D.	1.64	0.8
944- 949	N.D.	11	132	N.D.	N.D.	N.D.	260.0	76.9	0.7	558	54	21.9	73	141.0	15	N.D.	0.60	0.2
974- 979	N.D.	13	171	N.D.	10	N.D.	82.7	161.0	1.8	1240	80	48.0	110	200.0	24	N.D.	0.68	1.0
1004-1009	N.D.	7	117	N.D.	8	N.D.	166.0	111.0	1.1	755	68	34.2	108	157.0	20	N.D.	0.90	0.4
1034-1039	N.D.	19	168	N.D.	9	N.D.	56.1	182.0	1.9	172	121	89.4	231	181.0	36	N.D.	1.76	1.8
1064-1069	N.D.	26	158	N.D.	7	N.D.	174.0	122.0	1.2	1250	81	39.1	114	174.0	37	N.D.	1.68	0.2
1094-1099	15	6	151	N.D.	8	N.D.	90.8	174.0	2.0	236	105	79.4	214	182.0	27	N.D.	1.10	0.6
1124-1129	N.D.	8	198	N.D.	7	N.D.	277.0	80.3	0.7	565	48	26.1	66	188.0	19	N.D.	0.90	0.4
1154-1159	N.D.	11	155	N.D.	9	N.D.	72.4	166.0	1.9	1370	98	45.6	142	180.0	31	N.D.	0.80	0.4
1184-1189	115	26	219	N.D.	14	N.D.	219.0	167.0	2.1	156	95	127.0	325	150.0	29	N.D.	2.32	0.6
1214-1219	N.D.	6	179	N.D.	7	N.D.	208.0	58.5	0.4	464	35	18.4	57	178.0	15	6	0.64	N.D.
1244-1249	10	14	158	N.D.	11	N.D.	99.3	140.0	1.5	1000	93	62.8	131	208.0	42	19	0.76	0.2
1274-1279	N.D.	2	177	N.D.	11	N.D.	170.0	111.0	1.0	905	79	26.7	86	211.0	29	4	0.60	0.2
1304-1309	N.D.	6	158	N.D.	14	N.D.	91.0	159.0	1.9	1250	101	47.3	115	226.0	28	3	0.84	0.4

**TABULAR LIST
TRACE ELEMENTS FOR DL-1**

<u>Sample No.</u>	<u>Pb</u> <u>ppm</u>	<u>Colorimetric</u> <u>As</u> <u>ppm</u>	<u>Zr</u> <u>ppm</u>	<u>Mo</u> <u>ppm</u>	<u>Th</u> <u>ppm</u>	<u>Ag</u> <u>ppm</u>	<u>Sr</u> <u>ppm</u>	<u>V</u> <u>ppm</u>	<u>Be</u> <u>ppm</u>	<u>Ba</u> <u>ppm</u>	<u>Ni</u> <u>ppm</u>	<u>Cu</u> <u>ppm</u>	<u>Zn</u> <u>ppm</u>	<u>Cr</u> <u>ppm</u>	<u>Co</u> <u>ppm</u>	<u>Cd</u> <u>ppm</u>	<u>Organic</u> <u>Carbon</u> <u>%</u>	<u>Fluori-</u> <u>metric</u> <u>U</u> <u>ppm</u>
1334-1339	N.D.	11	131	N.D.	7	N.D.	145.0	69.3	0.7	870	50	20.6	76	147.0	16	5	0.68	0.2
1364-1369	20	23	162	N.D.	12	N.D.	141.0	155.0	1.6	1390	103	50.6	116	224.0	35	3	1.28	0.4
1394-1399	10	16	148	N.D.	11	N.D.	120.0	175.0	1.7	680	95	60.6	158	199.0	30	11	1.08	0.6
1424-1429	10	31	155	14	11	N.D.	135.0	188.0	1.7	208	102	84.4	202	200.0	42	N.D.	1.80	0.6
1454-1459	10	41	157	14	11	N.D.	133.0	198.0	1.7	211	114	96.8	165	208.0	36	3	2.00	0.8
1484-1489	25	24	149	N.D.	11	N.D.	120.0	174.0	1.6	252	100	67.7	207	201.0	32	3	1.06	0.6
1514-1519	5	27	145	N.D.	11	N.D.	114.0	169.0	1.6	342	100	63.5	163	194.0	34	3	1.04	1.2
1544-1549	5	29	152	N.D.	11	N.D.	118.0	173.0	1.7	320	105	66.8	170	205.0	33	3	1.28	0.8
1574-1579	10	53	153	14	11	N.D.	106.0	209.0	1.9	196	116	91.5	183	192.0	45	3	2.08	1.0
1604-1609	5	41	137	N.D.	10	N.D.	191.0	169.0	1.6	295	85	58.1	168	180.0	29	3	1.68	0.2
1634-1639	10	41	151	27	11	N.D.	126.0	236.0	1.7	392	121	100.0	411	192.0	32	N.D.	2.36	1.2
1664-1669	15	26	192	15	13	N.D.	108.0	174.0	1.9	197	92	70.9	223	164.0	29	4	1.76	1.2
1694-1699	25	82	147	13	13	N.D.	145.0	186.0	1.6	115	115	99.0	360	176.0	32	N.D.	1.84	1.4
1724-1729	60	106	162	13	12	N.D.	133.0	190.0	1.7	55	124	184.0	426	151.0	34	N.D.	2.16	2.4
1754-1759	30	79	136	23	10	N.D.	127.0	223.0	1.8	281	120	154.0	331	156.0	36	N.D.	3.40	3.2
1784-1789	35	65	270	4	25	N.D.	262.0	209.0	2.3	277	94	131.0	313	87.9	25	N.D.	2.20	2.8
1814-1819	40	55	307	8	34	N.D.	121.0	173.0	2.7	433	80	101.0	291	62.6	22	N.D.	2.50	2.8
1844-1849	50	116	153	35	13	N.D.	169.0	210.0	1.7	386	91	170.0	407	88.8	20	4	3.76	3.6
1874-1879	60	89	173	31	13	N.D.	237.0	246.0	2.0	716	94	139.0	513	103.0	31	4	3.40	3.2
1904-1909	75	41	74	15	N.D.	N.D.	490.0	118.0	0.9	284	52	65.7	322	76.9	15	N.D.	3.26	0.6

**TABULAR LIST
TRACE ELEMENTS FOR DL-1**

<u>Sample No.</u>	<u>Pb</u> <u>ppm</u>	<u>Colorimetric</u> <u>As</u> <u>ppm</u>	<u>Zr</u> <u>ppm</u>	<u>Mo</u> <u>ppm</u>	<u>Th</u> <u>ppm</u>	<u>Ag</u> <u>ppm</u>	<u>Sr</u> <u>ppm</u>	<u>V</u> <u>ppm</u>	<u>Be</u> <u>ppm</u>	<u>Ba</u> <u>ppm</u>	<u>Ni</u> <u>ppm</u>	<u>Cu</u> <u>ppm</u>	<u>Zn</u> <u>ppm</u>	<u>Cr</u> <u>ppm</u>	<u>Co</u> <u>ppm</u>	<u>Cd</u> <u>ppm</u>	<u>Organic</u> <u>Carbon</u> <u>%</u>	<u>Fluori-</u> <u>metric</u> <u>U</u> <u>ppm</u>
1934-1939	55	41	222	33	16	N.D.	185.0	201.0	2.1	977	76	194.0	1280	83.9	21	4	3.16	2.8
1964-1969	25	31	177	19	13	N.D.	200.0	245.0	2.2	970	77	128.0	514	111.0	25	4	3.20	1.6
1994-1999	50	49	198	34	14	N.D.	156.0	269.0	2.3	708	90	198.0	1110	101.0	25	19	3.26	1.2
2024-2029	50	38	186	21	14	N.D.	150.0	235.0	2.3	965	74	174.0	590	86.2	22	5	2.96	1.6
2054-2059	50	46	245	21	20	N.D.	129.0	191.0	3.0	446	65	202.0	498	59.8	23	5	2.20	2.2
2084-2089	25	21	164	29	14	N.D.	271.0	166.0	2.0	853	54	178.0	485	69.4	18	5	2.04	0.6
2114-2119	50	24	179	22	16	N.D.	127.0	205.0	2.3	1070	70	263.0	1160	80.7	22	12	2.46	1.8
2144-2148	35	34	157	31	15	N.D.	225.0	221.0	2.2	879	78	229.0	768	85.1	23	4	2.76	1.8

TABULAR LIST
TRACE ELEMENTS FOR DL-3

<u>Sample No.</u>	<u>Pb</u> <u>ppm</u>	<u>Colorimetric</u> <u>As</u> <u>ppm</u>	<u>Zr</u> <u>ppm</u>	<u>Mo</u> <u>ppm</u>	<u>Th</u> <u>ppm</u>	<u>Ag</u> <u>ppm</u>	<u>Sr</u> <u>ppm</u>	<u>V</u> <u>ppm</u>	<u>Be</u> <u>ppm</u>	<u>Ba</u> <u>ppm</u>	<u>Ni</u> <u>ppm</u>	<u>Cu</u> <u>ppm</u>	<u>Zn</u> <u>ppm</u>	<u>Cr</u> <u>ppm</u>	<u>Co</u> <u>ppm</u>	<u>Cd</u> <u>ppm</u>	<u>Organic</u> <u>Carbon</u> <u>%</u>	<u>Fluori-</u> <u>metric</u> <u>U</u> <u>ppm</u>
234- 239	40	20	151	N.D.	12	N.D.	54.2	171.0	2.0	1110	62	98.4	534	150.0	26	4	1.30	1.0
264- 269	25	27	141	24	15	N.D.	91.7	200.0	2.0	1080	56	124.0	534	147.0	23	20	1.72	1.4
294- 299	15	17	143	9	13	N.D.	115.0	183.0	1.7	1090	69	88.5	485	139.0	25	N.D.	1.30	1.4
324- 329	15	29	139	36	15	N.D.	106.0	224.0	1.7	989	104	195.0	673	154.0	25	N.D.	1.88	2.6
354- 359	25	26	139	37	16	N.D.	75.0	174.0	1.7	243	75	99.1	413	142.0	26	4	1.40	2.8
384- 389	15	23	153	37	16	N.D.	108.0	198.0	2.0	1100	70	83.7	363	154.0	25	N.D.	1.70	3.0
414- 419	35	12	160	41	22	N.D.	437.0	123.0	1.6	828	70	360.0	221	113.0	25	5	1.06	1.4
444- 449	5	20	149	33	16	N.D.	148.0	145.0	1.7	151	101	312.0	176	150.0	28	N.D.	0.84	1.2
474- 479	20	13	149	36	18	N.D.	125.0	179.0	1.8	1130	64	87.3	537	147.0	28	N.D.	1.40	2.4
504- 509	20	14	142	37	17	N.D.	117.0	173.0	1.8	1100	56	83.4	329	150.0	24	5	1.40	1.8
534- 539	10	12	143	34	18	N.D.	125.0	189.0	2.0	1100	70	75.2	316	154.0	25	4	1.04	1.6
564- 569	5	21	133	33	15	N.D.	89.6	173.0	1.7	1010	64	59.2	241	144.0	25	N.D.	1.44	1.4
594- 599	25	26	120	40	14	N.D.	208.0	163.0	1.4	631	114	681.0	1350	123.0	26	18	1.60	1.4
624- 629	30	30	133	37	17	N.D.	108.0	175.0	1.7	874	76	97.6	424	141.0	30	4	1.84	3.2
654- 659	85	37	135	49	18	N.D.	100.0	173.0	1.6	104	125	234.0	804	147.0	34	N.D.	1.76	4.0
684- 689	25	19	144	37	17	N.D.	108.0	178.0	1.8	888	107	161.0	644	146.0	32	4	1.60	3.8
714- 719	25	19	140	37	17	N.D.	104.0	183.0	1.7	371	111	269.0	456	149.0	33	4	1.56	4.0
744- 749	40	25	139	50	19	N.D.	108.0	181.0	1.7	971	70	124.0	472	146.0	32	4	1.32	2.8
774- 779	10	13	152	36	17	N.D.	110.0	186.0	2.0	1160	69	80.2	465	149.0	18	N.D.	1.24	2.6
804- 809	5	14	109	54	18	N.D.	75.0	156.0	1.4	634	66	121.0	273	133.0	24	5	1.76	3.0

**TABULAR LIST
TRACE ELEMENTS FOR DL-3**

<u>Sample No.</u>	<u>Pb</u> <u>ppm</u>	<u>Colorimetric</u> <u>As</u> <u>ppm</u>	<u>Zr</u> <u>ppm</u>	<u>Mo</u> <u>ppm</u>	<u>Th</u> <u>ppm</u>	<u>Ag</u> <u>ppm</u>	<u>Sr</u> <u>ppm</u>	<u>V</u> <u>ppm</u>	<u>Be</u> <u>ppm</u>	<u>Ba</u> <u>ppm</u>	<u>Ni</u> <u>ppm</u>	<u>Cu</u> <u>ppm</u>	<u>Zn</u> <u>ppm</u>	<u>Cr</u> <u>ppm</u>	<u>Co</u> <u>ppm</u>	<u>Cd</u> <u>ppm</u>	<u>Organic</u> <u>Carbon</u> <u>%</u>	<u>Fluori-</u> <u>metric</u> <u>U</u> <u>ppm</u>
834- 839	10	37	113	44	15	N.D.	212.0	175.0	1.6	999	82	147.0	386	135.0	22	4	1.56	2.8
864- 869	5	23	125	34	16	N.D.	133.0	143.0	1.7	870	87	183.0	354	130.0	35	4	1.20	1.8
894- 899	5	21	129	37	14	N.D.	104.0	169.0	1.7	1030	65	81.6	354	144.0	22	4	0.94	3.0
924- 929	35	27	133	36	15	N.D.	115.0	156.0	1.7	912	69	102.0	299	138.0	24	4	1.00	2.6
954- 959	15	23	121	23	17	N.D.	117.0	188.0	1.6	890	74	114.0	529	139.0	26	4	1.70	3.4
984- 989	40	580	127	36	16	N.D.	108.0	174.0	1.6	711	89	83.4	337	141.0	40	4	1.32	2.2
1014-1019	20	21	128	64	23	N.D.	87.5	157.0	1.7	862	64	54.7	352	139.0	22	4	1.72	2.8
1044-1049	15	11	127	24	15	N.D.	106.0	179.0	1.6	870	76	81.5	379	138.0	20	4	2.24	2.2
1074-1079	10	14	140	52	19	N.D.	262.0	158.0	2.0	241	103	133.0	243	120.0	28	4	1.50	1.6
1104-1109	15	49	133	50	17	N.D.	100.0	207.0	1.8	310	140	107.0	672	146.0	29	3	2.32	1.8
1134-1139	10	25	125	57	20	N.D.	192.0	130.0	1.6	853	61	60.8	128	168.0	25	4	0.90	0.4
1164-1169	30	25	132	10	12	N.D.	100.0	135.0	1.6	284	81	82.4	261	145.0	25	N.D.	1.30	1.0
1194-1199	15	22	106	35	15	N.D.	64.6	114.0	1.6	475	75	65.1	280	115.0	27	4	2.90	0.2
1224-1229	45	44	117	21	13	N.D.	137.0	155.0	1.6	122	103	93.4	302	128.0	33	3	2.10	2.4
1254-1259	5	12	119	25	11	N.D.	85.4	170.0	1.7	197	110	132.0	364	132.0	31	3	1.76	1.8
1284-1289	N.D.	16	115	11	12	N.D.	93.7	145.0	1.6	798	55	49.9	198	142.0	20	N.D.	1.48	1.0
1314-1319	50	18	93	12	11	N.D.	91.7	119.0	1.4	694	51	53.1	164	130.0	28	N.D.	1.36	0.8
1344-1349	10	8	129	12	11	N.D.	89.6	136.0	1.7	114	122	136.0	101	128.0	36	N.D.	1.76	1.0
1374-1379	N.D.	36	118	22	12	N.D.	129.0	145.0	1.6	169	81	64.4	299	135.0	27	3	1.30	1.2
1404-1409	N.D.	22	132	10	10	N.D.	100.0	145.0	1.7	137	134	144.0	586	128.0	31	N.D.	1.28	0.8

TABULAR LIST
TRACE ELEMENTS FOR DL-3

<u>Sample No.</u>	<u>Pb</u> <u>ppm</u>	Colorimetric <u>As</u> <u>ppm</u>	<u>Zr</u> <u>ppm</u>	<u>Mo</u> <u>ppm</u>	<u>Th</u> <u>ppm</u>	<u>Ag</u> <u>ppm</u>	<u>Sr</u> <u>ppm</u>	<u>V</u> <u>ppm</u>	<u>Be</u> <u>ppm</u>	<u>Ba</u> <u>ppm</u>	<u>Ni</u> <u>ppm</u>	<u>Cu</u> <u>ppm</u>	<u>Zn</u> <u>ppm</u>	<u>Cr</u> <u>ppm</u>	<u>Co</u> <u>ppm</u>	<u>Cd</u> <u>ppm</u>	<u>Organic</u> <u>Carbon</u> <u>%</u>	<u>Fluori-</u> <u>metric</u> <u>U</u> <u>ppm</u>
1434-1439	N.D.	19	162	N.D.	12	N.D.	109.0	165.0	2.1	271	98	93.2	260	155.0	28	N.D.	1.84	0.8
1464-1469	5	14	143	N.D.	12	N.D.	87.0	166.0	1.6	422	90	92.9	278	144.0	23	N.D.	1.84	1.0
1494-1499	N.D.	19	141	N.D.	12	N.D.	121.0	192.0	1.8	274	141	154.0	496	143.0	30	N.D.	2.16	1.4
1524-1529	N.D.	16	136	N.D.	10	N.D.	131.0	149.0	1.8	389	76	86.6	258	131.0	24	6	1.40	1.0
1554-1559	N.D.	20	142	N.D.	7	N.D.	91.9	177.0	1.7	430	79	126.0	338	147.0	23	N.D.	1.60	1.4
1584-1589	N.D.	37	146	N.D.	12	N.D.	91.9	186.0	1.9	776	109	79.8	698	156.0	32	N.D.	1.20	1.0
1614-1619	N.D.	25	132	N.D.	10	N.D.	111.0	179.0	1.8	889	91	93.0	356	170.0	27	N.D.	2.36	1.4

TABULAR LIST
TRACE ELEMENTS FOR DL-4, 4B

<u>Sample No.</u>	<u>Pb</u> <u>ppm</u>	<u>Colorimetric</u> <u>As</u> <u>ppm</u>	<u>Zr</u> <u>ppm</u>	<u>Mo</u> <u>ppm</u>	<u>Th</u> <u>ppm</u>	<u>Ag</u> <u>ppm</u>	<u>Sr</u> <u>ppm</u>	<u>V</u> <u>ppm</u>	<u>Be</u> <u>ppm</u>	<u>Ba</u> <u>ppm</u>	<u>Ni</u> <u>ppm</u>	<u>Cu</u> <u>ppm</u>	<u>Zn</u> <u>ppm</u>	<u>Cr</u> <u>ppm</u>	<u>Co</u> <u>ppm</u>	<u>Cd</u> <u>ppm</u>	<u>Organic</u> <u>Carbon</u> <u>%</u>	<u>Fluori-</u> <u>metric</u> <u>U</u> <u>ppm</u>
109- 114	N.D.	12	123	N.D.	9	N.D.	32.5	132.0	1.4	490	73	50.4	63	177.0	30	N.D.	0.300	1.0
139- 144	N.D.	10	123	N.D.	12	N.D.	32.5	130.0	1.4	544	66	79.3	70	122.0	31	4	0.420	0.6
169- 174	N.D.	8	98	N.D.	12	N.D.	27.5	131.0	1.4	543	67	160.0	61	120.0	31	4	1.310	0.8
199- 204	N.D.	12	112	N.D.	10	N.D.	32.5	150.0	1.2	523	107	73.1	63	175.0	44	N.D.	0.965	0.4
229- 234	N.D.	17	104	15	9	N.D.	30.0	139.0	1.2	515	149	586.0	60	136.0	55	29	0.921	0.8
259- 264	N.D.	10	101	N.D.	10	N.D.	32.5	139.0	1.4	539	101	67.1	69	148.0	32	4	0.489	0.6
289- 294	N.D.	12	109	N.D.	9	N.D.	50.0	158.0	1.4	532	78	63.9	257	170.0	34	4	0.649	1.0
319- 324	N.D.	12	102	10	8	N.D.	35.0	89.2	0.8	352	64	56.6	74	121.0	29	30	0.801	0.8
349- 354	N.D.	5	119	17	16	N.D.	40.0	145.0	1.5	565	73	101.0	72	133.0	29	4	0.763	1.2
379- 384	N.D.	16	119	N.D.	9	N.D.	55.0	155.0	1.5	603	89	115.0	74	170.0	39	12	0.811	0.8
409- 414	N.D.	6	105	N.D.	6	N.D.	57.5	140.0	1.2	499	100	84.2	101	172.0	29	12	1.850	1.4
439- 444	N.D.	12	109	N.D.	7	N.D.	57.5	148.0	1.3	506	83	67.3	151	164.0	30	12	1.020	0.8
469- 474	N.D.	15	124	N.D.	8	N.D.	385.0	89.9	0.9	423	55	48.5	127	114.0	28	14	0.679	0.4
499- 504	N.D.	3	128	N.D.	8	N.D.	60.0	116.0	1.2	432	64	132.0	70	96.7	35	12	0.792	1.4
529- 534	N.D.	1	115	14	6	N.D.	75.0	127.0	0.9	378	47	56.1	58	127.0	20	13	1.620	1.6
559- 564	N.D.	19	117	N.D.	7	N.D.	100.0	131.0	1.2	521	71	50.7	107	148.0	36	25	0.263	0.6
589- 594	N.D.	5	102	N.D.	N.D.	N.D.	180.0	89.4	0.7	315	41	21.9	70	114.0	20	14	0.226	0.6
619- 624	N.D.	8	115	N.D.	7	N.D.	115.0	137.0	1.5	591	64	54.9	107	148.0	29	N.D.	0.191	0.6
649- 654	N.D.	1	122	N.D.	8	N.D.	160.0	80.5	0.6	262	45	25.3	81	112.0	27	13	0.096	0.4
679- 684	N.D.	7	118	4	10	N.D.	100.0	120.0	1.2	483	63	56.5	111	138.0	32	13	0.191	0.4

TABULAR LIST
TRACE ELEMENTS FOR DL-4, 4B

<u>Sample No.</u>	<u>Pb</u> <u>ppm</u>	<u>Colorimetric</u> <u>As</u> <u>ppm</u>	<u>Zr</u> <u>ppm</u>	<u>Mo</u> <u>ppm</u>	<u>Th</u> <u>ppm</u>	<u>Ag</u> <u>ppm</u>	<u>Sr</u> <u>ppm</u>	<u>V</u> <u>ppm</u>	<u>Be</u> <u>ppm</u>	<u>Ba</u> <u>ppm</u>	<u>Ni</u> <u>ppm</u>	<u>Cu</u> <u>ppm</u>	<u>Zn</u> <u>ppm</u>	<u>Cr</u> <u>ppm</u>	<u>Co</u> <u>ppm</u>	<u>Cd</u> <u>ppm</u>	<u>Organic</u> <u>Carbon</u> <u>%</u>	<u>Fluori-</u> <u>metric</u> <u>U</u> <u>ppm</u>
709- 714	N.D.	2	128	3	8	N.D.	115.0	90.1	0.8	289	40	25.9	69	127.0	22	14	0.076	0.4
739- 744	N.D.	5	417	N.D.	31	N.D.	100.0	109.0	0.6	271	38	16.9	58	205.0	25	14	0.153	2.4
769- 774	N.D.	14	126	4	10	N.D.	55.0	133.0	1.5	586	70	56.1	74	141.0	37	N.D.	0.191	0.4
799- 804	N.D.	2	100	4	11	N.D.	50.0	109.0	0.9	392	56	82.3	61	109.0	30	13	0.645	1.0
829- 834	N.D.	3	108	13	9	N.D.	175.0	109.0	1.1	468	65	55.6	115	117.0	30	13	0.531	0.4
859- 864	N.D.	9	103	4	11	N.D.	55.0	142.0	1.4	485	74	69.5	90	138.0	36	12	0.911	1.2
889- 894	N.D.	7	125	7	13	N.D.	300.0	99.2	0.9	340	52	28.3	73	126.0	27	14	0.450	0.2
919- 924	N.D.	15	125	N.D.	10	N.D.	147.0	101.0	1.0	392	63	41.9	101	132.0	33	21	0.560	0.4
949- 954	N.D.	13	112	N.D.	14	N.D.	55.0	145.0	1.5	566	80	59.1	106	159.0	34	20	0.472	0.4
979- 984	N.D.	1	103	N.D.	11	N.D.	75.0	140.0	1.0	439	73	76.0	80	152.0	23	21	1.130	1.0
1009-1014	N.D.	6	103	N.D.	13	N.D.	55.0	122.0	1.2	474	59	90.3	96	103.0	28	21	0.640	0.8
1039-1044	N.D.	8	110	N.D.	11	N.D.	75.0	153.0	1.3	516	70	47.7	112	134.0	28	21	1.110	1.2
1069-1074	N.D.	6	95	N.D.	10	N.D.	32.5	111.0	1.2	459	41	48.9	52	95.2	21	22	0.905	1.0
1099-1104	N.D.	9	90	N.D.	15	N.D.	45.0	140.0	1.4	509	65	122.0	111	109.0	36	21	1.170	1.4
1129-1134	10	2	122	N.D.	11	N.D.	85.0	92.9	1.0	387	41	87.2	154	86.0	28	21	0.641	0.6
1159-1164	N.D.	1	115	N.D.	12	N.D.	82.5	92.5	1.0	383	36	66.0	113	83.2	21	21	0.431	0.6
1189-1194	N.D.	N.D.	96	N.D.	9	N.D.	47.5	122.0	1.3	488	39	39.8	107	102.0	21	N.D.	0.825	0.8
1219-1224	N.D.	14	115	N.D.	N.D.	N.D.	67.5	110.0	1.0	440	72	50.4	133	114.0	33	12	0.675	1.2
1249-1254	N.D.	13	121	N.D.	N.D.	N.D.	105.0	96.3	.9	326	52	29.7	77	132.0	27	13	0.272	0.4
1279-1284	N.D.	19	110	N.D.	N.D.	N.D.	90.0	118.0	1.0	441	63	49.4	95	139.0	26	13	0.366	0.6

TABULAR LIST
TRACE ELEMENTS FOR DL-4, 4B

<u>Sample No.</u>	<u>Pb</u> <u>ppm</u>	<u>Cclorimetric</u> <u>As</u> <u>ppm</u>	<u>Zr</u> <u>ppm</u>	<u>Mo</u> <u>ppm</u>	<u>Th</u> <u>ppm</u>	<u>Ag</u> <u>ppm</u>	<u>Sr</u> <u>ppm</u>	<u>V</u> <u>ppm</u>	<u>Be</u> <u>ppm</u>	<u>Ba</u> <u>ppm</u>	<u>Ni</u> <u>ppm</u>	<u>Cu</u> <u>ppm</u>	<u>Zn</u> <u>ppm</u>	<u>Cr</u> <u>ppm</u>	<u>Co</u> <u>ppm</u>	<u>Cd</u> <u>ppm</u>	<u>Organic</u> <u>Carbon</u> <u>%</u>	<u>Fluori-</u> <u>metric</u> <u>U</u> <u>ppm</u>
1309-1314	N.D.	24	100	N.D.	N.D.	N.D.	170.0	108.0	1.1	419	59	49.4	75	132.0	23	13	0.619	0.4
1339-1344	N.D.	35	122	N.D.	N.D.	N.D.	127.0	126.0	1.2	427	70	56.1	99	151.0	35	13	0.694	0.4
1369-1374	N.D.	25	125	N.D.	N.D.	N.D.	205.0	121.0	1.3	495	59	48.5	91	145.0	26	13	0.263	0.6
1399-1404	25	12	99	27	12	N.D.	60.0	230.0	1.4	267	142	925.0	650	122.0	62	19	3.000	3.6
B-1429-1434	10	5	117	27	15	N.D.	72.5	231.0	1.5	537	73	160.0	364	144.0	22	N.D.	3.060	2.4
B-1459-1464	15	17	114	27	12	N.D.	65.0	207.0	1.4	213	95	508.0	1020	130.0	47	32	3.490	3.2
B-1489-1494	25	9	120	25	13	N.D.	70.0	189.0	1.5	316	110	261.0	643	130.0	42	20	2.460	2.2
B-1519-1524	20	9	134	10	9	N.D.	83.0	244.0	1.8	495	96	216.0	1460	174.0	59	13	2.460	2.6
B-1549-1554	75	2	105	17	8	N.D.	57.5	265.0	1.7	719	101	567.0	1370	124.0	24	45	2.350	4.0
B-1579-1584	N.D.	15	122	5	8	N.D.	160.0	67.9	0.8	440	47	24.9	53	120.0	20	22	2.500	0.2
B-1609-1614	45	22	122	N.D.	9	N.D.	70.0	185.0	1.7	840	57	87.6	143	146.0	29	22	1.080	1.0
B-1639-1644	5	12	102	7	10	N.D.	65.0	108.0	1.4	658	53	45.7	202	125.0	27	47	1.080	0.4
B-1669-1674	N.D.	3	125	N.D.	7	N.D.	80.0	64.1	0.5	298	35	12.1	66	118.0	16	22	0.783	0.4
B-1699-1704	N.D.	6	114	15	8	N.D.	60.0	68.3	0.8	325	49	39.3	62	121.0	23	21	0.410	0.6
B-1729-1734	N.D.	6	124	17	12	N.D.	55.0	128.0	1.7	727	68	58.9	130	158.0	31	34	0.649	0.8
B-1759-1764	N.D.	4	113	7	10	N.D.	90.0	90.6	1.0	469	50	25.3	128	124.0	28	22	0.185	0.4
B-1789-1794	N.D.	4	124	7	13	N.D.	47.5	136.0	1.4	581	59	49.9	66	146.0	29	21	0.479	0.8
B-1819-1824	N.D.	2	120	15	12	N.D.	95.0	89.4	0.9	393	48	33.4	77	126.0	24	N.D.	0.295	0.6
B-1849-1854	N.D.	4	120	12	12	N.D.	70.0	99.2	1.0	485	51	36.8	90	126.0	29	22	0.332	0.4
B-1879-1884	N.D.	3	122	17	14	N.D.	40.0	124.0	1.5	581	65	48.9	88	142.0	27	N.D.	0.258	0.6

TABULAR LIST
TRACE ELEMENTS FOR DL-4, 4B

<u>Sample No.</u>	<u>Pb</u> <u>ppm</u>	<u>Colorimetric</u> <u>As</u> <u>ppm</u>	<u>Zr</u> <u>ppm</u>	<u>Mo</u> <u>ppm</u>	<u>Th</u> <u>ppm</u>	<u>Ag</u> <u>ppm</u>	<u>Sr</u> <u>ppm</u>	<u>V</u> <u>ppm</u>	<u>Be</u> <u>ppm</u>	<u>Ba</u> <u>ppm</u>	<u>Ni</u> <u>ppm</u>	<u>Cu</u> <u>ppm</u>	<u>Zn</u> <u>ppm</u>	<u>Cr</u> <u>ppm</u>	<u>Co</u> <u>ppm</u>	<u>Cd</u> <u>ppm</u>	<u>Organic</u> <u>Carbon</u> <u>%</u>	<u>Fluori-</u> <u>metric</u> <u>U</u> <u>ppm</u>
B-1909-1914	N.D.	3	110	8	12	N.D.	55.0	139.0	1.5	608	55	43.2	134	139.0	28	N.D.	0.497	1.0
B-1939-1944	5	5	116	7	14	N.D.	55.0	124.0	1.7	621	74	64.9	129	137.0	34	20	0.405	0.8
B-1969-1974	N.D.	3	125	7	10	N.D.	105.0	97.3	1.0	420	60	41.0	97	134.0	30	N.D.	0.258	0.6
B-1999-2004	N.D.	3	154	N.D.	11	N.D.	82.0	129.0	1.8	884	75	62.9	127	162.0	51	4	0.295	1.0
B-2029-2034	N.D.	3	124	N.D.	9	N.D.	391.0	92.3	1.2	899	55	45.6	93	128.0	48	5	0.424	0.4
B-2059-2064	N.D.	3	233	N.D.	12	N.D.	72.0	171.0	2.5	1420	67	57.8	84	149.0	51	5	0.737	1.6
B-2089-2094	N.D.	1	144	N.D.	10	N.D.	83.0	113.0	1.4	1040	57	38.0	50	148.0	51	5	1.250	0.6
B-2119-2124	N.D.	3	143	N.D.	9	N.D.	73.0	153.0	1.7	1370	84	67.1	151	169.0	57	N.D.	0.405	0.4
B-2149-2154	N.D.	N.D.	139	N.D.	8	N.D.	62.0	146.0	1.6	1170	69	48.1	120	168.0	48	4	0.405	0.8
B-2179-2184	N.D.	4	145	N.D.	11	N.D.	186.0	164.0	1.9	1230	71	54.1	103	141.0	57	5	0.700	0.8
B-2209-2214	N.D.	N.D.	151	N.D.	8	N.D.	83.0	159.0	1.8	1500	85	67.1	133	178.0	61	3	0.405	0.8
B-2239-2244	N.D.	N.D.	160	N.D.	6	N.D.	143.0	130.0	1.4	1020	65	57.0	92	177.0	50	4	0.447	0.8
B-2269-2274	N.D.	1	127	N.D.	7	N.D.	183.0	112.0	1.1	658	67	44.3	87	159.0	45	4	0.184	0.8
B-2299-2304	N.D.	2	262	20	9	N.D.	308.0	401.0	1.6	758	66	542.0	116	118.0	90	5	0.239	0.4
B-2329-2334	N.D.	1	243	10	7	N.D.	353.0	328.0	1.4	962	90	524.0	113	147.0	90	5	0.184	0.4
B-2359-2364	N.D.	5	166	N.D.	10	N.D.	149.0	165.0	1.4	1510	90	44.5	123	179.0	56	3	0.147	1.0
B-2389-2394	N.D.	8	153	10	11	N.D.	96.0	186.0	1.8	1170	112	201.0	375	180.0	54	4	0.863	1.0
B-2419-2424	N.D.	5	152	N.D.	9	N.D.	404.0	100.0	1.0	921	48	31.1	63	155.0	37	N.D.	0.424	0.4
B-2449-2454	5	4	154	10	13	N.D.	108.0	229.0	1.8	1150	92	107.0	83	169.0	38	5	2.710	3.6
B-2479-2484	N.D.	5	144	N.D.	10	N.D.	219.0	116.0	1.1	904	66	53.0	99	155.0	44	4	0.295	0.6

TABULAR LIST
TRACE ELEMENTS FOR DL-4, 4B

<u>Sample No.</u>	<u>Pb</u> <u>ppm</u>	<u>Colorimetric</u> <u>As</u> <u>ppm</u>	<u>Zr</u> <u>ppm</u>	<u>Mo</u> <u>ppm</u>	<u>Th</u> <u>ppm</u>	<u>Ag</u> <u>ppm</u>	<u>Sr</u> <u>ppm</u>	<u>V</u> <u>ppm</u>	<u>Be</u> <u>ppm</u>	<u>Ba</u> <u>ppm</u>	<u>Ni</u> <u>ppm</u>	<u>Cu</u> <u>ppm</u>	<u>Zn</u> <u>ppm</u>	<u>Cr</u> <u>ppm</u>	<u>Co</u> <u>ppm</u>	<u>Cd</u> <u>ppm</u>	<u>Organic</u> <u>Carbon</u> <u>%</u>	<u>Fluori-</u> <u>metric</u> <u>U</u> <u>ppm</u>
B-2509-2514	N.D.	9	162	N.D.	9	N.D.	142.0	117.0	1.2	963	73	70.0	101	168.0	45	4	0.755	0.4
B-2539-2544	N.D.	10	156	N.D.	N.D.	N.D.	172.0	136.0	1.4	925	78	58.2	100	193.0	56	4	0.258	1.0
B-2569-2574	N.D.	5	156	N.D.	9	N.D.	88.0	212.0	1.8	1170	81	80.7	108	184.0	48	4	1.620	1.4
B-2599-2604	N.D.	5	173	N.D.	9	N.D.	88.0	241.0	1.9	1360	87	88.0	142	177.0	45	4	1.220	1.8
B-2629-2634	N.D.	15	157	N.D.	8	N.D.	102.0	146.0	1.5	1310	83	89.8	118	171.0	58	3	0.442	0.6
B-2659-2664	N.D.	17	166	N.D.	9	N.D.	146.0	130.0	1.3	993	70	61.4	84	175.0	52	4	0.700	0.6
B-2689-2694	N.D.	21	144	N.D.	9	N.D.	86.0	137.0	1.4	1220	78	83.8	125	150.0	47	4	0.258	0.8
B-2719-2724	15	14	141	10	11	N.D.	68.0	193.0	1.6	1140	89	65.1	94	156.0	36	4	1.840	1.4
B-2749-2754	5	24	130	N.D.	9	N.D.	228.0	97.9	1.3	1070	55	42.9	83	110.0	40	5	0.553	0.6
B-2779-2784	10	24	132	N.D.	11	N.D.	106.0	189.0	1.8	894	66	72.9	116	163.0	41	4	1.180	1.2
B-2809-2814	45	34	118	10	10	N.D.	140.0	186.0	1.5	691	123	760.0	604	146.0	47	7	2.870	1.6
B-2839-2844	15	5	86	N.D.	7	N.D.	108.0	186.0	1.3	228	101	278.0	519	100.0	44	10	2.870	1.8
B-2869-2874	10	26	106	20	9	N.D.	169.0	318.0	1.9	325	78	174.0	354	111.0	38	6	3.400	3.6
B-2899-2904	N.D.	8	149	40	14	N.D.	113.0	326.0	2.0	602	119	357.0	221	121.0	35	5	6.020	3.6
B-2929-2934	10	6	164	N.D.	8	N.D.	132.0	262.0	2.0	420	105	612.0	110	128.0	44	N.D.	3.920	2.8
B-2959-2964	N.D.	10	104	N.D.	7	N.D.	130.0	235.0	1.3	434	48	133.0	200	89.4	36	4	0.754	2.4
B-2989-2994	N.D.	N.D.	49	20	7	N.D.	62.0	224.0	1.2	140	41	164.0	724	75.9	24	5	3.720	5.4
B-3019-3024	N.D.	8	100	N.D.	13	N.D.	72.0	47.8	1.2	595	35	22.6	29	58.6	40	4	0.230	0.2
B-3049-3054	N.D.	N.D.	163	N.D.	14	N.D.	60.0	53.5	2.0	666	46	2.8	36	82.2	34	N.D.	0.302	0.8
B-3079-3084	N.D.	N.D.	66	N.D.	N.D.	N.D.	64.0	14.8	1.1	588	14	5.9	23	62.5	24	6	0.375	0.2

TABULAR LIST
TRACE ELEMENTS FOR DL-4, 4B

<u>Sample No.</u>	<u>Pb</u> <u>ppm</u>	<u>Colorimetric</u> <u>As</u> <u>ppm</u>	<u>Zr</u> <u>ppm</u>	<u>Mo</u> <u>ppm</u>	<u>Th</u> <u>ppm</u>	<u>Ag</u> <u>ppm</u>	<u>Sr</u> <u>ppm</u>	<u>V</u> <u>ppm</u>	<u>Be</u> <u>ppm</u>	<u>Ba</u> <u>ppm</u>	<u>Ni</u> <u>ppm</u>	<u>Cu</u> <u>ppm</u>	<u>Zn</u> <u>ppm</u>	<u>Cr</u> <u>ppm</u>	<u>Co</u> <u>ppm</u>	<u>Cd</u> <u>ppm</u>	<u>Organic</u> <u>Carbon</u> <u>%</u>	<u>Fluori-</u> <u>metric</u> <u>U</u> <u>ppm</u>
B-3109-3114	N.D.	N.D.	84	N.D.	7	N.D.	48.0	33.4	1.4	217	21	2.1	28	75.9	44	N.D.	0.469	0.8
B-3139-3144	N.D.	N.D.	125	N.D.	8	N.D.	312.0	19.0	0.7	1300	5	6.3	34	30.8	20	N.D.	0.300	0.6
B-3169-3174	N.D.	N.D.	125	N.D.	7	N.D.	230.0	49.4	0.8	1390	18	39.8	41	50.3	30	N.D.	0.563	0.6

**TABULAR LIST
TRACE ELEMENTS FOR DL-5**

<u>Sample No.</u>	<u>Pb</u> <u>ppm</u>	<u>Colorimetric</u> <u>As</u> <u>ppm</u>	<u>Zr</u> <u>ppm</u>	<u>Mo</u> <u>ppm</u>	<u>Th</u> <u>ppm</u>	<u>Ag</u> <u>ppm</u>	<u>Sr</u> <u>ppm</u>	<u>V</u> <u>ppm</u>	<u>Be</u> <u>ppm</u>	<u>Ba</u> <u>ppm</u>	<u>Ni</u> <u>ppm</u>	<u>Cu</u> <u>ppm</u>	<u>Zn</u> <u>ppm</u>	<u>Cr</u> <u>ppm</u>	<u>Co</u> <u>ppm</u>	<u>Cd</u> <u>ppm</u>	<u>Organic</u> <u>Carbon</u> <u>%</u>	<u>Fluori-</u> <u>metric</u> <u>U</u> <u>ppm</u>
364- 369	10	8	139	N.D.	13	N.D.	77.2	109.0	1.9	1640	55	57.3	120	132.0	26	N.D.	0.50	0.8
394- 399	N.D.	5	157	N.D.	15	N.D.	116.0	112.0	2.1	1960	56	32.2	105	139.0	24	N.D.	0.68	0.2
424- 429	N.D.	6	206	N.D.	14	N.D.	77.2	109.0	2.3	2150	55	35.8	127	143.0	26	6	0.20	0.4
454- 459	15	5	182	N.D.	16	N.D.	33.3	116.0	1.9	2010	93	51.6	89	166.0	21	N.D.	0.88	0.2
484- 489	N.D.	6	150	N.D.	14	N.D.	69.9	111.0	1.5	1750	61	57.8	73	115.0	28	N.D.	0.94	0.6
514- 519	15	9	182	N.D.	14	N.D.	107.0	95.4	1.4	1380	66	72.7	122	104.0	27	N.D.	0.86	1.2
544- 549	N.D.	N.D.	230	N.D.	9	N.D.	248.0	411.0	1.6	1290	68	416.0	136	120.0	76	N.D.	0.24	N.D.
574- 579	N.D.	N.D.	227	N.D.	9	N.D.	238.0	417.0	1.7	1730	66	466.0	134	113.0	71	N.D.	0.18	N.D.
604- 609	5	3	144	N.D.	10	N.D.	106.0	104.0	1.2	765	33	52.8	120	101.0	17	N.D.	0.68	0.2
634- 639	5	6	150	N.D.	16	N.D.	72.4	138.0	1.6	1690	70	62.5	129	122.0	24	N.D.	0.32	1.0
664- 669	N.D.	8	46	N.D.	N.D.	N.D.	50.4	75.9	0.7	303	16	15.1	40	63.0	13	N.D.	0.10	1.6
694- 699	N.D.	7	71	2	11	N.D.	52.8	115.0	1.3	483	32	27.8	34	92.6	19	N.D.	0.08	0.6
724- 729	N.D.	8	109	N.D.	15	N.D.	16.3	63.3	2.5	515	20	11.6	31	59.1	16	N.D.	0.70	N.D.
754- 759	N.D.	12	198	33	25	N.D.	23.6	130.0	3.0	1400	34	17.3	65	98.5	38	N.D.	0.60	0.8
784- 789	N.D.	N.D.	363	N.D.	28	N.D.	33.3	89.4	3.5	1110	26	2.9	49	90.0	26	N.D.	0.68	0.4
814- 819	N.D.	1	145	N.D.	15	N.D.	40.6	52.2	1.2	971	26	N.D.	39	50.0	28	N.D.	0.52	0.2
844- 849	N.D.	1	77	5	12	N.D.	57.7	57.4	1.3	734	38	3.1	61	55.1	41	N.D.	2.44	N.D.
874- 879	N.D.	4	251	N.D.	21	N.D.	43.1	81.0	1.8	999	29	18.8	46	65.2	30	N.D.	1.44	0.2
904- 909	N.D.	2	206	N.D.	13	N.D.	74.8	22.8	0.7	1060	10	9.3	33	45.4	17	N.D.	0.84	0.2
934- 939	N.D.	2	189	N.D.	9	N.D.	72.4	16.4	0.6	1220	8	5.3	22	41.7	14	N.D.	0.60	N.D.

**TABULAR LIST
TRACE ELEMENTS FOR DL-5**

<u>Sample No.</u>	<u>Pb</u> <u>ppm</u>	<u>Colorimetric</u> <u>As</u> <u>ppm</u>	<u>Zr</u> <u>ppm</u>	<u>Mo</u> <u>ppm</u>	<u>Th</u> <u>ppm</u>	<u>Ag</u> <u>ppm</u>	<u>Sr</u> <u>ppm</u>	<u>V</u> <u>ppm</u>	<u>Be</u> <u>ppm</u>	<u>Ba</u> <u>ppm</u>	<u>Ni</u> <u>ppm</u>	<u>Cu</u> <u>ppm</u>	<u>Zn</u> <u>ppm</u>	<u>Cr</u> <u>ppm</u>	<u>Co</u> <u>ppm</u>	<u>Cd</u> <u>ppm</u>	<u>Organic</u> <u>Carbon</u> <u>%</u>	<u>Fluori-</u> <u>metric</u> <u>U</u> <u>ppm</u>
964- 969	N.D.	2	238	N.D.	N.D.	N.D.	55.7	17.8	0.7	1480	7	4.9	9	40.9	11	N.D.	0.30	0.2
994- 999	N.D.	N.D.	74	N.D.	N.D.	N.D.	58.0	11.3	0.4	975	7	1.8	N.D.	25.9	6	N.D.	0.20	0.2
1024-1029	15	6	61	N.D.	8	N.D.	26.1	1.4	1.2	962	N.D.	4.8	35	19.5	5	N.D.	0.06	76.0
1054-1059	145	22	58	N.D.	7	N.D.	17.0	7.2	1.0	491	20	94.8	392	18.0	12	N.D.	0.06	72.0
1084-1089	N.D.	4	33	N.D.	N.D.	N.D.	76.1	221.0	0.4	1470	158	149.0	112	203.0	82	N.D.	0.36	N.D.
1114-1119	N.D.	5	30	N.D.	N.D.	N.D.	82.9	214.0	0.4	1290	124	126.0	66	202.0	63	N.D.	0.16	N.D.
1144-1148	N.D.	2	29	N.D.	N.D.	N.D.	108.0	238.0	0.5	1430	157	171.0	73	201.0	74	N.D.	0.36	N.D.

**TABULAR LIST
TRACE ELEMENTS FOR DL-6**

<u>Sample No.</u>	<u>Pb</u> <u>ppm</u>	<u>Colorimetric</u> <u>As</u> <u>ppm</u>	<u>Zr</u> <u>ppm</u>	<u>Mo</u> <u>ppm</u>	<u>Th</u> <u>ppm</u>	<u>Ag</u> <u>ppm</u>	<u>Sr</u> <u>ppm</u>	<u>V</u> <u>ppm</u>	<u>Be</u> <u>ppm</u>	<u>Ba</u> <u>ppm</u>	<u>Ni</u> <u>ppm</u>	<u>Cu</u> <u>ppm</u>	<u>Zn</u> <u>ppm</u>	<u>Cr</u> <u>ppm</u>	<u>Co</u> <u>ppm</u>	<u>Cd</u> <u>ppm</u>	<u>Organic</u> <u>Carbon</u> <u>%</u>	<u>Fluori-</u> <u>metric</u> <u>U</u> <u>ppm</u>
278- 283	N.D.	16	156	N.D.	8	N.D.	83.0	162.0	1.6	1500	77	64.3	86	159.0	51	N.D.	0.413	0.6
308- 313	N.D.	1	153	N.D.	8	N.D.	73.0	154.0	1.6	1270	74	22.9	108	165.0	47	3	0.429	0.2
338- 343	N.D.	1	132	N.D.	8	N.D.	64.0	142.0	1.3	1040	71	22.2	103	160.0	51	3	0.671	0.2
368- 373	N.D.	39	94	20	9	N.D.	52.0	104.0	0.7	455	70	381.0	82	116.0	102	N.D.	3.390	N.D.
398- 403	N.D.	2	139	N.D.	8	N.D.	74.0	142.0	2.4	1330	68	17.9	86	149.0	44	N.D.	0.559	0.2
428- 433	N.D.	55	17	N.D.	N.D.	N.D.	103.0	40.4	0.5	15	24	279.0	14	30.2	65	4	3.150	1.8
458- 463	N.D.	N.D.	123	10	9	N.D.	83.0	168.0	0.4	776	72	70.6	123	142.0	63	5	2.860	0.8
488- 493	N.D.	3	141	N.D.	9	N.D.	73.0	152.0	2.3	1440	69	42.7	97	168.0	41	6	0.445	0.2
518- 523	N.D.	2	147	N.D.	8	N.D.	76.0	151.0	2.3	1390	70	16.8	100	171.0	45	6	0.445	0.6
548- 553	N.D.	1	159	N.D.	9	N.D.	82.0	157.0	2.3	1610	74	22.3	110	174.0	49	6	0.464	0.8
578- 583	N.D.	1	147	N.D.	9	N.D.	74.0	148.0	2.1	1390	73	48.5	107	168.0	43	6	0.371	0.2
608- 613	N.D.	1	140	N.D.	9	N.D.	68.0	148.0	2.2	1300	73	14.2	102	160.0	45	6	0.482	0.2
638- 643	N.D.	27	67	20	8	N.D.	82.0	84.5	0.3	280	51	58.0	72	120.0	81	5	2.730	N.D.
668- 673	N.D.	1	146	N.D.	8	N.D.	73.0	157.0	2.2	1430	77	17.0	102	171.0	43	6	0.556	1.0
698- 703	N.D.	20	136	N.D.	7	N.D.	73.0	145.0	2.2	1430	73	74.4	94	165.0	53	6	0.445	0.6
728- 733	N.D.	22	138	N.D.	7	N.D.	72.0	146.0	2.3	1340	71	60.1	93	162.0	57	6	0.482	0.4
758- 763	N.D.	20	124	N.D.	6	N.D.	59.0	127.0	2.0	1200	68	68.0	101	154.0	63	4	0.445	0.4
788- 793	N.D.	18	127	N.D.	N.D.	N.D.	72.0	124.0	2.8	1260	72	301.0	109	154.0	64	4	0.816	0.2
818- 823	N.D.	2	119	N.D.	N.D.	N.D.	80.0	140.0	0.5	399	54	194.0	138	113.0	60	6	0.853	0.6
848- 853	N.D.	12	64	10	N.D.	N.D.	104.0	148.0	0.3	273	76	971.0	133	87.4	74	4	3.560	0.8

**TABULAR LIST
TRACE ELEMENTS FOR DL-6**

<u>Sample No.</u>	<u>Pb ppm</u>	<u>Colorimetric As ppm</u>	<u>Zr ppm</u>	<u>Mo ppm</u>	<u>Th ppm</u>	<u>Ag ppm</u>	<u>Sr ppm</u>	<u>V ppm</u>	<u>Be ppm</u>	<u>Ba ppm</u>	<u>Ni ppm</u>	<u>Cu ppm</u>	<u>Zn ppm</u>	<u>Cr ppm</u>	<u>Co ppm</u>	<u>Cd ppm</u>	<u>Organic Carbon %</u>	<u>Fluori- metric U ppm</u>
878- 883	N.D.	5	117	N.D.	N.D.	N.D.	70.0	125.0	2.5	517	47	119.0	88	140.0	59	7	1.210	0.8
908- 913	N.D.	9	179	N.D.	9	N.D.	80.0	163.0	2.6	890	60	89.2	139	148.0	59	3	1.370	1.0
938- 943	N.D.	20	156	N.D.	10	N.D.	54.0	140.0	2.9	679	52	127.0	100	113.0	57	5	0.797	1.2
968- 973	N.D.	4	21	N.D.	N.D.	N.D.	112.0	29.9	0.3	203	22	187.0	23	56.6	40	11	1.810	0.6
998-1003	N.D.	3	51	20	N.D.	N.D.	64.0	62.1	0.4	16	42	267.0	59	99.8	44	10	0.626	0.4
1028-1033	N.D.	4	361	N.D.	11	N.D.	94.0	138.0	3.4	993	44	99.3	139	106.0	51	3	0.295	1.2
1058-1063	N.D.	25	94	N.D.	N.D.	N.D.	76.0	132.0	1.5	266	61	232.0	111	107.0	69	4	4.440	1.0
1088-1093	N.D.	11	169	N.D.	9	N.D.	88.0	125.0	2.7	644	45	119.0	64	105.0	44	7	1.900	1.4

**TABULAR LIST
TRACE ELEMENTS FOR DL-7**

<u>Sample No.</u>	<u>Pb</u> <u>ppm</u>	<u>Colorimetric</u> <u>As</u> <u>ppm</u>	<u>Zr</u> <u>ppm</u>	<u>Mo</u> <u>ppm</u>	<u>Th</u> <u>ppm</u>	<u>Ag</u> <u>ppm</u>	<u>Sr</u> <u>ppm</u>	<u>V</u> <u>ppm</u>	<u>Be</u> <u>ppm</u>	<u>Ba</u> <u>ppm</u>	<u>Ni</u> <u>ppm</u>	<u>Cu</u> <u>ppm</u>	<u>Zn</u> <u>ppm</u>	<u>Cr</u> <u>ppm</u>	<u>Co</u> <u>ppm</u>	<u>Cd</u> <u>ppm</u>	<u>Organic</u> <u>Carbon</u> <u>%</u>	<u>Fluori-</u> <u>metric</u> <u>U</u> <u>ppm</u>
275- 280	N.D.	6	150	N.D.	11	N.D.	48.0	120.0	1.2	1080	76	28.5	97	170.0	38	7	0.168	0.8
305- 310	N.D.	N.D.	132	N.D.	9	N.D.	44.0	122.0	1.2	895	84	22.7	119	172.0	39	7	0.112	0.4
335- 340	40	2	153	N.D.	10	N.D.	49.0	179.0	1.8	1130	93	73.5	161	187.0	42	7	1.180	0.6
365- 370	10	9	180	N.D.	12	N.D.	43.0	135.0	1.6	1100	83	47.0	343	162.0	34	7	0.368	1.0
395- 400	20	41	149	30	10	N.D.	43.0	169.0	1.6	585	99	109.0	365	145.0	41	6	1.690	1.8
425- 430	40	36	149	20	10	N.D.	43.0	206.0	1.6	261	117	153.0	528	134.0	39	6	3.520	2.0
455- 460	35	42	165	40	13	N.D.	50.0	206.0	1.8	1040	120	160.0	299	106.0	39	7	3.700	3.6
485- 490	60	36	252	40	23	N.D.	50.0	224.0	2.0	958	96	142.0	581	86.6	38	11	3.320	3.2
515- 520	45	39	154	30	14	N.D.	46.0	276.0	1.8	969	83	223.0	384	113.0	31	12	2.820	1.2
545- 550	35	35	145	30	14	N.D.	52.0	213.0	1.6	809	81	145.0	200	99.0	33	8	3.060	1.0
575- 580	20	18	14	N.D.	N.D.	N.D.	124.0	56.0	0.8	178	21	12.0	17	55.3	23	10	0.258	1.2
605- 610	N.D.	4	15	20	N.D.	N.D.	124.0	24.4	1.0	71	17	5.2	25	36.6	24	9	3.430	0.2
635- 640	5	9	33	N.D.	N.D.	N.D.	154.0	30.3	1.6	142	17	5.6	14	39.7	27	9	1.720	N.D.
665- 670	25	2	214	N.D.	49	N.D.	643.0	30.2	1.0	3040	15	13.4	69	33.5	28	7	0.708	1.8
691- 696	15	N.D.	102	N.D.	N.D.	N.D.	369.0	14.1	0.6	2220	8	4.5	50	38.1	17	7	0.184	1.4

**TABULAR LIST
TRACE ELEMENTS FOR DL-EX**

<u>Sample No.</u>	<u>Pb</u> <u>ppm</u>	<u>Colorimetric</u> <u>As</u> <u>ppm</u>	<u>Zr</u> <u>ppm</u>	<u>Mo</u> <u>ppm</u>	<u>Th</u> <u>ppm</u>	<u>Ag</u> <u>ppm</u>	<u>Sr</u> <u>ppm</u>	<u>V</u> <u>ppm</u>	<u>Be</u> <u>ppm</u>	<u>Ba</u> <u>ppm</u>	<u>Ni</u> <u>ppm</u>	<u>Cu</u> <u>ppm</u>	<u>Zn</u> <u>ppm</u>	<u>Cr</u> <u>ppm</u>	<u>Co</u> <u>ppm</u>	<u>Cd</u> <u>ppm</u>	<u>Organic</u> <u>Carbon</u> <u>%</u>	<u>Fluori-</u> <u>metric</u> <u>U</u> <u>ppm</u>
35- 40	65	580	180	21	19	N.D.	85.2	190.0	2.1	162	114	511.0	440	68.6	30	N.D.	3.36	6.0
65- 70	50	126	179	N.D.	14	N.D.	103.0	192.0	1.9	114	90	177.0	510	58.4	26	N.D.	3.70	6.2
95- 100	40	7	140	N.D.	N.D.	N.D.	162.0	205.0	1.8	309	96	326.0	454	91.7	19	N.D.	3.08	2.6
124- 130	40	14	180	26	9	N.D.	146.0	206.0	2.4	163	144	462.0	560	76.1	32	7	3.24	2.4
155- 160	15	63	164	N.D.	12	N.D.	220.0	172.0	2.2	433	60	148.0	315	67.5	14	N.D.	2.20	1.8
185- 190	30	14	220	47	21	N.D.	233.0	195.0	2.7	323	109	448.0	447	60.6	22	N.D.	2.66	3.0
215- 220	30	24	215	14	18	N.D.	151.0	275.0	2.9	725	90	216.0	1020	86.7	22	7	3.12	3.2
245- 250	15	19	207	3	12	N.D.	130.0	213.0	2.7	638	91	225.0	405	81.4	30	N.D.	2.28	2.4
275- 280	15	16	155	16	9	N.D.	141.0	246.0	2.4	1110	66	179.0	641	85.5	18	N.D.	3.56	2.2
305- 310	35	20	183	15	14	N.D.	122.0	246.0	2.8	1220	75	189.0	584	78.9	20	N.D.	3.16	3.0
335- 340	40	21	224	13	21	N.D.	149.0	270.0	3.1	680	102	538.0	739	85.2	24	N.D.	3.64	2.8
365- 370	45	23	151	4	10	N.D.	125.0	305.0	2.4	1240	86	225.0	647	110.0	22	N.D.	4.00	2.8
395- 400	50	58	133	29	12	N.D.	114.0	286.0	2.2	909	104	242.0	846	106.0	23	N.D.	3.36	2.0
425- 430	35	28	139	81	25	N.D.	98.7	260.0	2.2	668	98	231.0	796	94.5	23	N.D.	3.64	2.4
455- 460	10	30	136	107	33	N.D.	93.4	232.0	2.2	941	88	168.0	434	107.0	30	N.D.	2.88	1.6
485- 490	25	19	144	17	15	N.D.	82.9	171.0	2.0	994	63	174.0	465	93.0	16	N.D.	3.04	3.2
515- 520	10	33	158	N.D.	19	N.D.	122.0	160.0	2.3	661	59	154.0	220	114.0	22	N.D.	1.48	1.0
545- 550	15	12	224	N.D.	18	N.D.	93.4	162.0	3.0	938	43	179.0	217	92.2	18	N.D.	1.44	3.0
575- 580	15	22	167	N.D.	11	N.D.	167.0	213.0	2.4	1460	57	175.0	435	134.0	17	N.D.	1.38	1.2
605- 610	25	28	139	18	17	N.D.	280.0	207.0	2.0	984	94	193.0	476	117.0	24	N.D.	3.68	2.2

**TABULAR LIST
TRACE ELEMENTS FOR DL-EX**

<u>Sample No.</u>	<u>Pb</u> <u>ppm</u>	<u>Colorimetric</u> <u>As</u> <u>ppm</u>	<u>Zr</u> <u>ppm</u>	<u>Mo</u> <u>ppm</u>	<u>Th</u> <u>ppm</u>	<u>Ag</u> <u>ppm</u>	<u>Sr</u> <u>ppm</u>	<u>V</u> <u>ppm</u>	<u>Be</u> <u>ppm</u>	<u>Ba</u> <u>ppm</u>	<u>Ni</u> <u>ppm</u>	<u>Cu</u> <u>ppm</u>	<u>Zn</u> <u>ppm</u>	<u>Cr</u> <u>ppm</u>	<u>Co</u> <u>ppm</u>	<u>Cd</u> <u>ppm</u>	<u>Organic</u> <u>Carbon</u> <u>%</u>	<u>Fluori-</u> <u>metric</u> <u>U</u> <u>ppm</u>
635- 640	10	40	159	4	13	N.D.	109.0	224.0	2.4	1430	78	159.0	747	112.0	22	N.D.	2.56	3.0
665- 670	20	21	174	3	14	N.D.	122.0	184.0	2.6	630	75	193.0	293	112.0	24	N.D.	1.68	2.8
695- 700	25	26	170	3	11	N.D.	133.0	196.0	2.4	1480	76	208.0	378	116.0	26	N.D.	2.50	1.4
725- 730	N.D.	16	167	N.D.	18	N.D.	157.0	107.0	2.2	1080	46	71.3	135	111.0	27	N.D.	0.80	0.6
755- 760	N.D.	14	191	N.D.	12	N.D.	107.0	131.0	2.7	1350	39	61.8	147	140.0	23	N.D.	0.88	1.4
785- 790	30	30	168	16	12	N.D.	114.0	282.0	2.5	1190	92	188.0	1150	123.0	25	6	3.00	3.0
815- 820	5	20	161	N.D.	13	N.D.	167.0	166.0	2.2	1300	87	135.0	247	133.0	29	N.D.	1.88	1.8
845- 850	5	19	178	17	20	N.D.	130.0	186.0	2.4	1640	87	146.0	464	133.0	28	N.D.	1.50	2.8
875- 880	5	23	144	5	12	N.D.	141.0	184.0	2.4	875	79	154.0	443	137.0	33	N.D.	1.72	1.6
905- 910	5	17	154	N.D.	10	N.D.	132.0	160.0	1.9	1010	78	128.0	248	125.0	24	N.D.	1.60	2.0
935- 940	5	18	128	N.D.	9	N.D.	146.0	164.0	1.9	387	88	181.0	299	123.0	30	N.D.	1.50	1.4
965- 970	10	18	134	4	8	N.D.	118.0	200.0	2.1	1070	91	143.0	662	139.0	26	N.D.	1.64	1.8
996-1000	20	18	135	N.D.	10	N.D.	104.0	218.0	2.1	308	124	219.0	804	134.0	28	N.D.	1.50	5.2
1025-1030	15	40	138	N.D.	9	N.D.	111.0	193.0	2.1	563	124	236.0	564	133.0	29	N.D.	1.36	3.6
1055-1060	N.D.	41	102	N.D.	N.D.	N.D.	154.0	241.0	1.1	757	417	123.0	345	506.0	69	N.D.	0.68	0.4
1085-1090	N.D.	13	183	4	15	N.D.	79.8	190.0	2.6	1350	99	109.0	444	124.0	22	N.D.	1.64	2.6
1115-1120	N.D.	25	112	5	11	N.D.	86.9	179.0	2.1	94	147	141.0	502	127.0	48	N.D.	0.80	2.4
1123-1128	10	18	119	N.D.	9	N.D.	89.3	182.0	2.1	87	137	121.0	481	127.0	46	N.D.	1.24	2.8

TABULAR LIST
TRACE ELEMENTS FOR SPECIAL SAMPLES

<u>Sample No.</u>	<u>Pb</u> <u>ppm</u>	<u>Colorimetric</u> <u>As</u> <u>ppm</u>	<u>Zr</u> <u>ppm</u>	<u>Mo</u> <u>ppm</u>	<u>Th</u> <u>ppm</u>	<u>Ag</u> <u>ppm</u>	<u>Sr</u> <u>ppm</u>	<u>V</u> <u>ppm</u>	<u>Be</u> <u>ppm</u>	<u>Ba</u> <u>ppm</u>	<u>Ni</u> <u>ppm</u>	<u>Cu</u> <u>ppm</u>	<u>Zn</u> <u>ppm</u>	<u>Cr</u> <u>ppm</u>	<u>Co</u> <u>ppm</u>	<u>Cd</u> <u>ppm</u>	<u>Organic</u> <u>Carbon</u> <u>%</u>	<u>Fluori-</u> <u>metric</u> <u>U</u> <u>ppm</u>
S5- 713- 714	N.D.	7	63	N.D.	N.D.	N.D.	99.0	81.3	1.7	424	28	7.1	27	61.3	46	5	4.050	0.8
S5-1059-1065	N.D.	4	74	N.D.	N.D.	N.D.	29.0	52.4	1.1	222	54	274.0	141	70.0	72	5	0.442	0.4
S5-1065-1069	N.D.	2	24	N.D.	N.D.	N.D.	50.0	59.4	0.7	174	75	380.0	95	74.6	89	4	0.203	0.2
S5-1069-1080	N.D.	2	27	N.D.	N.D.	N.D.	90.0	176.0	0.3	467	119	2010.0	111	133.0	121	9	0.166	N.D.
S5-1080-1090	N.D.	4	35	N.D.	N.D.	N.D.	106.0	185.0	0.1	1030	145	124.0	126	168.0	76	7	0.037	0.2
S5-1090-1100	N.D.	5	36	N.D.	N.D.	N.D.	124.0	286.0	0.3	1300	149	181.0	72	211.0	87	4	0.276	N.D.
S5-1100-1110	N.D.	7	41	N.D.	N.D.	N.D.	126.0	251.0	0.4	1140	190	261.0	106	226.0	124	5	0.221	0.2
S5-1110-1120	N.D.	14	48	N.D.	N.D.	N.D.	116.0	281.0	0.2	1090	208	290.0	121	193.0	145	9	0.276	1.0
S5-1120-1130	N.D.	2	32	N.D.	N.D.	N.D.	114.0	238.0	0.3	890	127	130.0	86	182.0	94	9	0.258	N.D.
7- 510- 511	50	25	132	N.D.	N.D.	N.D.	46.0	49.6	1.2	629	37	64.4	671	36.3	26	24	1.290	8.0
7- 560- 561	30	39	143	N.D.	11	N.D.	44.0	285.0	2.2	677	94	285.0	201	113.0	33	8	3.700	1.8
4-3011	30	9	13	30	7	N.D.	144.0	862.0	1.4	49	34	11.4	20	61.7	73	7	8.010	130.0