Investigation of the age and origin of the Sykesville Formation in Maryland

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Abstract

The Sykesville Formation is in the Potomac terrane in the Appalachian Mountains in Maryland. It is considered to be a metasedimentary unit. Using detrital zircon U/Pb crystallization ages, clast aspect ratio measurements, and thin section microtextural analysis, this study tested the hypothesis that the Sykesville is actually a volcaniclastic unit.

Previous studies of known volcaniclastic units have returned a near lack of inherited zircons. The wide range of eruption ages and locations of these events indicates that finding a limited number of inherited zircons is evidence that a formation could be volcaniclastic in origin. Rock samples for detrital zircon U/Pb isotopic dating were taken from outcrops of the Sykesville Formation and Setters Formation. The Setters is a known metasedimentary unit against which Sykesville crystallization ages were compared. Two samples were collected from the Sykesville and identified as a North and South outcrop location. Standard zircon separation techniques were applied. The zircons were placed on mounts, and laser ablation mass spectrometry analyses were performed at the University of Arizona. A maximum depositional age constraint of 1000 Ma was placed on the Setters Formation. A maximum depositional age constraint of 600 Ma was placed on the Sykesville Formation North. A maximum depositional age constraint of 1000 Ma was placed on the Sykesville Formation South.

Fiamme are lumps of volcanic glass that are compressed when a tuff is welded. This period of compression is in addition to later deformation experienced by the entire rock. The extra period of deformation leads to greater aspect ratios in fiamme clasts than in non-fiamme clasts. Finding a statistically significant difference between the aspect ratios of possible fiamme features and other classified clasts is evidence that a formation could be volcaniclastic in origin. Clast aspect ratio measurements were completed along a stretch of Sykesville South outcrop located along the Potomac River between Washington, D.C. and Virginia. Clasts were classified into categories according to predefined criteria. Type A clasts showed serrated edges, a dark brown color, foliations, and a grain size too fine to recognize minerals in hand sample. These were considered possible fiamme features. Type B clasts showed a white to clear color, no foliations, and were recognized as quartz. Type C clasts showed a lighter tan color, some foliations, and a quartz and plagioclase composition. Type D clasts showed a black color, no foliations, a shiny appearance, and a hornblende composition. Type E clasts were other clasts which did not meet the criteria to be classified in one of the first four categories. Aspect ratio data were collected from ten stations, totaling 281 Type A, possible fiamme, clasts and 1017 Type B/C/D, possible non-fiamme, clasts. Seven clasts were Type E, unclassified, clasts. The mean for these data were 9.4 ± 3.1 (1σ) for Type A clasts and 2.4 ± 1.3 (1σ) for Type B/C/D clasts. The medians for these data were 9.2 for Type A clasts and 2.0 for Type B/C/D clasts. These values are dimensionless. A Welch's t-test was conducted to determine if there was a difference between the categories of clasts. The mean values are different at the 99.9% confidence level.

Thin section analysis showed the possible fiamme features are mainly composed of fine grained muscovite oriented preferentially according to their crystallographic axes. The matrix is mainly composed of quartz and muscovite grains up to an order of magnitude larger than the grain sizes in the possible fiamme features. Compositional

estimates of the features showed larger K_2O and Al_2O_3 percentages than would be expected for volcanic rocks.

With contradicting implications from different sections of the study, it is uncertain but unlikely that that Sykesville Formation is a volcaniclastic unit. The U/Pb isotopic dating refutes the volcaniclastic hypothesis, while the aspect ratio comparison and thin section analysis indicates that there is a difference between the Type A and Type B/C/D clasts. It is possible that the Type A clasts were mudstone clasts in a metasedimentary rock. Due to their weak strength, they were deformed more than other clast types.

Introduction

The Sykesville Formation is located in the Potomac terrane of the Piedmont province of the Appalachian Mountains in Maryland. It is currently believed to be a metasedimentary unit. This study investigated the hypothesis that the Sykesville is a volcaniclastic unit through zircon U/Pb isotopic dating, clast aspect ratio measurements, and thin section microtextural analysis. A maximum depositional age constraint was placed on the Sykesville and the Setters Formation. Zircons were dated from multiple formations to geologically and historically relate the Sykesville to its surrounding units. A cooling curve of the Potomac terrane has been constructed from studies on amphiboles, muscovites, biotites, and potassium feldspars (Wintsch et al., 2010), but several units have still not been assigned a maximum depositional age.

Importance

A more complete knowledge of the age and origin of the Sykesville Formation is valuable information for understanding the history of the Appalachian Mountains. If the rocks were part of an island arc, then the Plummers Island fault is a major suture of the arc onto the continent. Specifying the location and timeframe of volcanic activity during the accretion of sedimentary rocks onto Laurentia can better define the past orogenic processes of the region.

Problem

This project tested the hypothesis that the Sykesville Formation is volcaniclastic in origin. This hypothesis contrasts the current view that it is a metasedimentary unit. A portion of the project was dedicated to defining a maximum depositional age constraint on the Sykesville.

Hypotheses

The tested hypothesis was that the Sykesville Formation is made of volcanic and volcaniclastic rocks. Type A category clasts are hypothesized to have a statistically significant larger aspect ratio than Type B/C/D category clasts. The Sykesville is hypothesized to have significantly less inherited zircons than the Setters Formation.

Geologic Setting

Running the length of North America, the Appalachian Mountains are the primary tectonic structure on the eastern seaboard. From west to east, the Appalachian Mountains are divided into the Appalachian Plateau province, the Valley and Ridge province, the Blue Ridge province, the Piedmont province, and the Coastal Plain provinces. All of these provinces strike northeast/southwest. The Piedmont province is separated from the Blue Ridge province by the Martic Fault (figure 1). From the west to the east, the Piedmont province is divided into the Westminster terrane, the Potomac terrane, and the Baltimore terrane. The Potomac terrane is separated from the Westminster terrane by the Pleasant Grove fault (Kunk et al., 2004). From west to east, the Potomac terrane is divided into the Mather Gorge Complex, the Sykesville Formation, and the Laurel Formation (figure 2). The Sykesville Formation is separated from the Mather Gorge Complex and Laurel Formation by the Plummers Island Fault and Rock Creek shear zone, respectively (Kunk et al., 2004). Along the Potomac River, the Sykesville structurally underlies the Mather Gorge complex under the Plummers Island fault (Kunk, 2005).

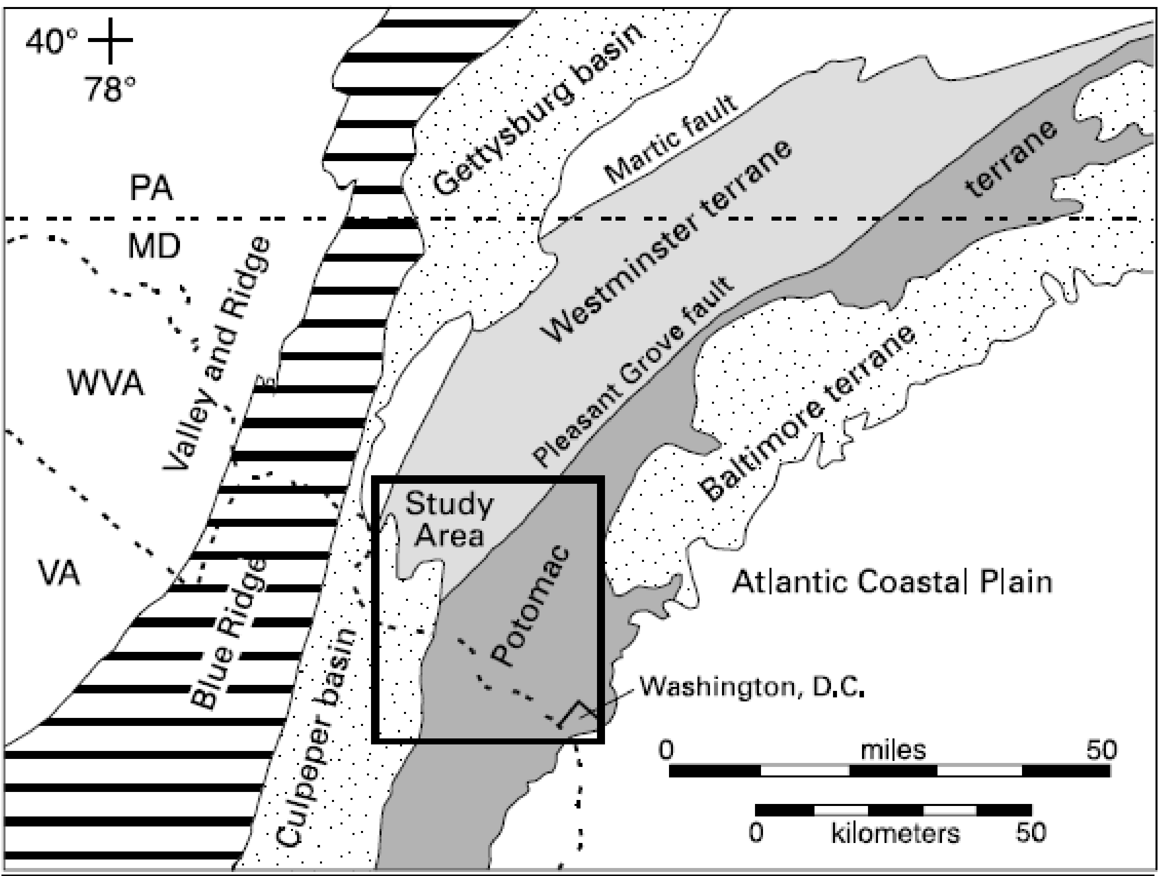


Figure 1: Geologic map of south central Appalachian provinces (Kunk et al., 2004).

The Appalachian Mountains have experienced several orogenic events. The Taconic orogeny occurred between about 440 Ma and 550 Ma. It was during this time that the Iapetus Ocean closed and sedimentary rocks of the Potomac terrane accreted onto Laurentia from an island arc (Kunk et al., 2005). The Acadian orogeny followed from about 410 Ma to 370 Ma. The Alleghenian orogeny was the final stage, occurring from about 350 Ma to 300 Ma. The Acadian and Alleghenian orogenies played little role in terrane accretion (Kunk et al., 2005).

The Piedmont province contains the highest grade metasedimentary rocks in the Appalachian Mountains. Peak metamorphism is Taconian in age (Thomas and Viele, 1989).

The Setters Formation is underlies the Piedmont province. It is the basal formation of the Glenarm Series, a sequence of early Paleozoic metasedimentary rocks (Fisher, 1971). It is located to the north and east of Washington, D.C. and to the west of Baltimore.

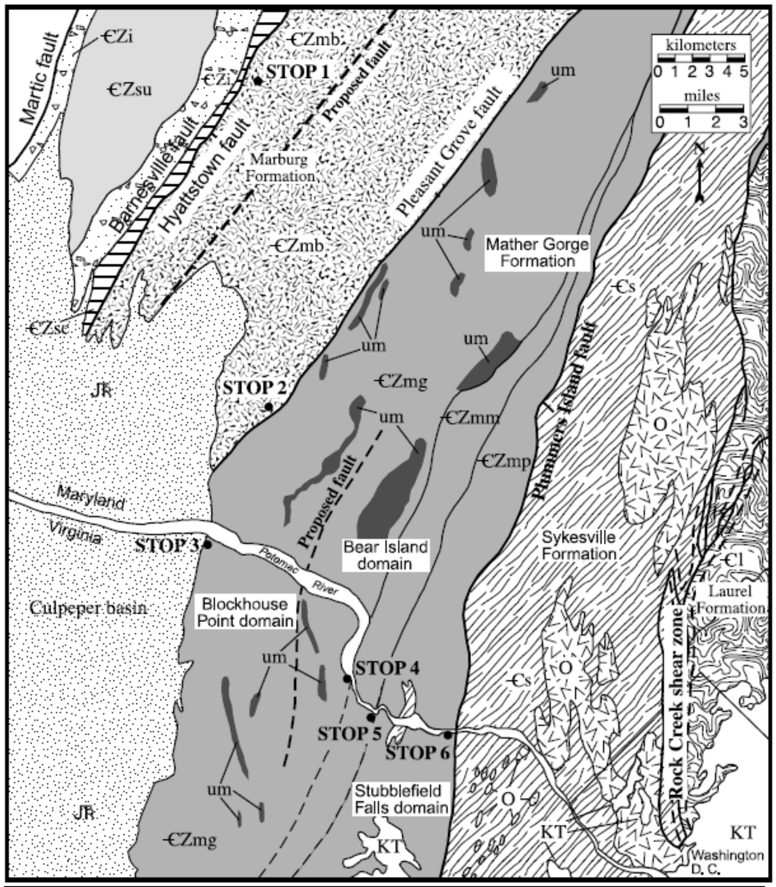


Figure 2: Geologic map of the Westminster and Potomac terranes, separated by the Pleasant Grove fault (Kunk et al., 2004). Geologic unit symbols include Ꞓs, Sykesville Formation.

Previous Research

Background knowledge provided by previous research gives a guide as to current hypotheses on the Sykesville Formation and how these hypotheses can be tested. Several studies have interpreted the Sykesville Formation as a metasedimentary unit. These explanations fit the Sykesville with surrounding metasedimentary units, such as the Setters Formation and the Loch Raven schist to the east.

Sykesville Formation Interpretations

Drake and Morgan (1981) concluded that the metasedimentary Sykesville is part of several stacked allochtons, or thrust sheets. Standard stacking chronology assembled the allochtons from east to west and from the top down. Structurally, the Sykesville Formation is the lowest of three thrust sheets. The Piney Branch allochton was emplaced on top of the Peters Creek allochton, also known as the Potomac allochton. This composite allochton then advanced onto the Sykesville. Evidence for this comes from fragments of the Peters Creek allochton found in the Sykesville. The pieces were shed during the advancement of the Peters Creek allochton.

Southworth et al., (2006) confirms the outcropping location of the Sykesville. It consists of a quartz-feldspar-muscovite granofels matrix with diamictite, migmatite, metagraywacke, mafic rocks, vein quartz, and schist. Kunk et al., (2005) interprets the clasts of the Sykesville to be derived from Mather Gorge complex rocks which were already deformed and metamorphosed. Kunk et al., (2004) found the sedimentary protoliths of the Sykesville to have been metamorphosed to upper amphibolite facies.

Aleinikoff et al., (2002) reiterated the hypothesis that the Sykesville is metasedimentary in origin. A minimum age constraint was placed on the Sykesville Formation using the Occoquan Granite, which intrudes the Sykesville. The crystallization age is 472 ± 4 Ma (2σ), determined by U/Pb isotopic dating of zircons. This Ordovician emplacement age for the granite provides a minimum age constraint on the Sykesville. By the law of cross cutting relationships, the Sykesville Formation must be at least 472 million years old.

Inherited Zircons in Known Volcaniclastic Units

Study	Eruption Age	Analyses	Inherited Ages
Bishop Tuff, CA (Simon & Reid, 2005)	760 ka	71	0
Devils Kitchen, CA (Miller & Wooden, 2004)	578 ka	55	0
Western Beijing tuff (Zhang et al., 2004)	296 Ma	20	0
Taupo, New Zealand Charlier et al., 2004)	c. 30 ka (9 eruptions)	221	6
Glass Mountain, CA (Simon & Reid, 2005)	c. 1 Ma (3 eruptions)	55	2
Yellowstone caldera, WY (Vazquez & Reid, 2002)	c. 100 ka (4 eruptions)	82	8
Bishop Tuff, CA (Reid & Coath, 2000)	768 ka	24	3
Taupo, New Zealand (Brown & Smith, 2004)	1.21 Ma	27	4

Table 1: Inherited zircon findings from previous studies of known volcaniclastic units.

Studies of known volcaniclastic units have shown a near lack of inherited zircons (table 1). Charlier et al., (2004) studied the Taupo eruption zone in New Zealand. In a series of nine eruptions spanning from 45 to 3.5 ka, only six inherited zircons were found out of 221 analyses. Zhang et al., (2007) studied the Western Beijing tuff. An eruption occurring 296 ± 4 Ma returned zero inherited zircons out of twenty analyses. Simon and Reid (2005) studied the Bishop Tuff in California. Analyses of this eruption, dated at 760 ± 2 ka, yielded no inherited zircons out of seventy one analyses. Of the researched studies, the highest percentage of returned inherited zircons was from a different study of the Taupo eruption zone (Brown and Smith, 2004). This study found four inherited zircons out of twenty seven analyses. Overall, the collection of researched studies yielded just twenty three inherited zircons from 555 total analyses, or about 4.1%. These studies span a wide range of volcanic eruption ages and locations.

Fiamme

Lumps of volcanic glass, known as fiamme, are found in many volcanic tuffs. Fiamme are compressed when the tuff is welded (Bull and McPhie, 2007). When the rock as a whole is deformed, all clasts, including fiamme, are distorted (Winter, 2001).

Previous work has interpreted greater length to height ratios of fiamme clasts than in uncompacted clasts. Fiamme aspect ratios ranged from 3:1 to 40:1 (Gifkins et al., 2005).

Sample Descriptions

Southworth et al., (2006) describe the rocks of the Sykesville Formation (figure 3) as a quartz-feldspar-muscovite granofels matrix containing diamictite, amphibolite, migmatite, schist, metagraywacke, mafic rocks, and vein quartz. Kunk et al., (2005) interprets the clasts of the Sykesville to be derived from Mather Gorge complex rocks which were already deformed and metamorphosed.

Observations of the Sykesville North showed three distinct sections within a 30 m stretch of outcrop. The northwest section had about 60% quartz, 30% biotite, 10% plagioclase, and less than 10% garnet. Quartz and biotite grains were up to 1.0 mm, and plagioclase and garnet grains were up to 0.5 mm. Foliations were less evident and the unit was characterized as more granitic. The middle section had about 50% quartz, 20% biotite, 15% muscovite, 10% plagioclase, and 5% garnet. Quartz, biotite, and plagioclase grains were up to 1.5 mm, muscovite grains were up to 1.0 mm, and garnet grains were up to 0.5 mm. The unit was characterized as a schist. The southest section had about 35% quartz, 30% biotite, 30%, plagioclase, 5% muscovite, and less than 5% garnet. Plagioclase grains were up to 2.0 mm, quartz and biotite grains were up to 1.0 mm, and muscovite grains were up to 0.5 mm. The unit was characterized as a schist. The sample for detrital zircon separation was taken from the middle unit.

Observations of the Sykesville South showed a well foliated schist with many inclusions. The composition was about 40% quartz, 40% biotite, 10% muscovite, 10% plagioclase, and less than 1% garnet. Biotite grains were up to 2.0 mm, quartz grains were up to 1.5 mm, muscovite grains were up to 1.0 mm, plagioclase grains were up to 0.75 mm, and garnet grains were up to 0.5 mm. Mulanocratic ovals up to about 30.0 cm in diameter, leucocratic quartz veins up to about 72.0 cm, and garnet clusters up to about 3.0 cm were seen. Garnet size increased to the south, up to about 1.5 mm. The sample for detrital zircon separation was taken from station 5. Station locations can be found in the Tables section.

Observations of the Setters Formation (figure 4) showed a quartz-biotite-muscovite quartzite. Bedding or secondary foliation was planar and well-defined. Some tourmaline, a common metasedimentary mineral, was found. Thinner beds showed more muscovite, indicating a mud rich protolith.

Figures 3 and 4: Outcrops of the Sykesville Formation (above) and the Setters Formation.

Methodology

Collecting zircon crystallization age data and measuring clast aspect ratios are multi-step processes which must be carefully planned and executed. Each step is performed in such a way as to minimize contamination and error. Zircon dating requires a combination of field collection, levels of lab preparation, and data analysis in order to be accurately performed. Aspect ratio measurements require a combination of extensive field work and data analysis. Thin section analyses require a combination of cutting appropriately sized and centered billets and interpreting the returned features. The steps are completed over a series of months.

Zircon Dating

Proper sample collection plays an important role in limiting the contamination in a zircon dating study. Ideal samples for detrital zircon sampling should have the least amount of mica, the coarsest grains, exhibit the least amount of weathering and alteration relative to the rest of the rock, and should not be located near any intrusions. Micas indicate a protolith of a muddy sandstone or siltstone, which are found in low energy depositional environments. Dependent on density and size, these beds yield small zircons. Weathering and alteration causes lead loss, which makes geochronologic isotopic dating less accurate. During the formation of intrusions, hot water is brought into the rock, which can lead to alteration. After a site had acceptably met the criteria for a good sampling location, a global positioning system (GPS) reading was recorded (table 2), and several pictures were taken at various scales. Strike and dip of foliation was measured using a Brunton compass.

A sledgehammer, handheld sledgehammer, chisel, and rock hammer were used to break several pieces of rock from the outcrop. All pieces of the sample were taken from a portion of the outcrop which was interpreted to be the same bed. Enough pieces were broken to fill a gallon sized plastic bag. The bags were prelabeled with the name of the sampler, location, and date. The bags were stored for cleanliness until filled by the rock. The samples were gently placed in the plastic bag, the bag was sealed, and the package was placed in an extra bag for support.

In the crushing room, all surfaced were swept and wiped for cleanliness. A single piece of the sample was set aside for preservation and hand sample observational use. A mortar, pestle, 0.4 mm mesh sieve, and collection bowl were cleaned and left to dry. When the tools were sufficiently dry, a small piece of the sample was placed in the mortar and then repeatedly crushed with the pestle. Periodically, the crushed material was poured from the mortar through the sieve. Grains which fell through the plastic mesh into the collection bowl were deemed adequately crushed. Grains which did not fall through the mesh component were placed back in the mortar for further crushing. This process was repeated until all pieces of the sample were in the form of grains small enough to fit through the 0.4 mm mesh. The plastic mesh was disposed to avoid contamination of future studies. All tools and surfaces were cleaned and dried.

In the mineral separation lab, all surfaces were swept and wiped for cleanliness. An aluminum foil boat was constructed and placed on a counter under a heat lamp. The hand pan and sink in the rock saw lab were cleaned. The sink was plugged and filled with warm water. The crushed grains of the sample were placed in the hand pan and water was used to pan the material. The material was panned until all grains small enough to float in suspension were washed from the pan. When only sand sized grains remained, the sample was taken to the mineral separation lab and ethanol was sprayed to wash the material into the aluminum foil boat. The sample was left to dry. All tools and surfaces were cleaned and dried.

In the mineral separation lab, all surfaces were swept and wiped for cleanliness. Each piece of the Frantz barrier field magnetic separator was cleaned and dried as it was assembled. A paper boat was constructed and the crushed and panned sampled poured into it. A hand magnet was wrapped in plastic and passed over the material in a grid pattern. Any magnetic grains caught in the plastic were discarded. The remaining material was poured into a controlled flow dispenser. The Frantz was set to 0.5 A and a medium vibration setting. The flow mechanism was opened and grains fell into the vibrating chute which passes between two opposing magnets. The chute was divided so that magnetic grains were held in the upper half of the barrier, while non-magnetic grains were allowed to fall under the influence of gravity into the lower half of the barrier. All grains fell into their respective magnetic or non-magnetic collection trays. The process was repeated for 1.0 A, 1.5 A, and 2.0 A. At the conclusion of the fourth separation, the non-magnetic grains were placed back into their sample bag, while the magnetic grains were placed in a separate bag (figure 5). All tools, surfaces, and components were cleaned and dried.

In the mineral separation lab, all surfaces were swept and wiped for cleanliness. Two 80 mL beakers, two glass funnels, two 1000 mL flasks, two clamp stands, a stirring rod, and a plastic funnel were cleaned. Methylene iodide (MEI) is a liquid with a density of approximately 3.33 g/cm^3. This value is such that high density minerals, such as zircons, will sink to the bottom of the container, but low density minerals, such as quartz, feldspars, and micas, will float to the top of the container. Seventy (70) mL of MEI were poured into a small beaker, and a thin layer of the non-magnetic sample was poured on top of the liquid. The stirring rod was used to assure all grains had an opportunity to move to their density based resting place. The bottom of the beaker was placed in liquid nitrogen for three minutes until the MEI was frozen approximately one third of the way up from the base. At this point, zircons and other high density mineral grains were frozen in the bottom of the MEI, and low density mineral grains were floating on the top of the MEI. The "float" material was poured and rinsed into a funnel lined with filter paper. The ice block remaining in the beaker was loosened by bathing in warm water. The "sink" material was poured into a separate funnel lined with filter paper. Acetone was used to wash the separates ten times to dissolve any remaining MEI. The filter papers were changed twice more, totaling thirty acetone baths. The separates were left to dry under heat lamps. All tools and surfaces were cleaned and dried.

Figure 5: Setters Formation magnetic separate (left) and non-magnetic separate after Frantz 2.0 A.

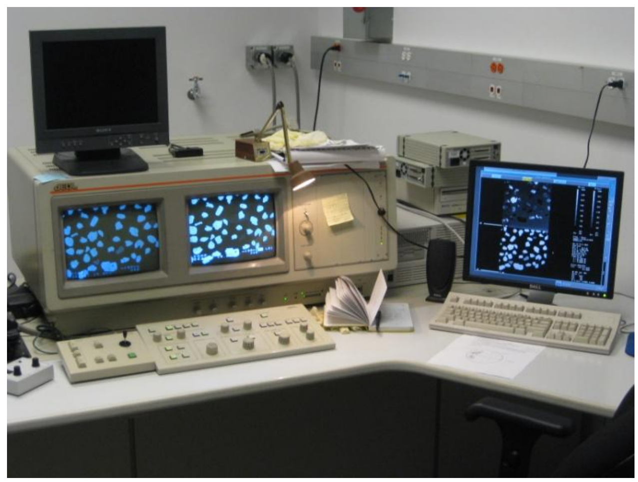
It is desirable to have only zircon grains on the finished mounts for their electron microprobe and mass spectrometer use. After all of the separation techniques, the Setters Formation sample still had a significant amount of rutile in its separate and the Sykesville Formation samples still had a significant amount of pyrite in their separates.

In the microscope lab, all surfaces were swept and wiped for cleanliness. A ceramic tile, extra fine tweezers, and a dental pick were cleaned. A 1 inch by 1 inch square of double sided tape was placed on the ceramic tile. A 1.0 inch diameter plastic ring was pressed into the tape as to leave an indentation. A 1 cm diameter metallic guide was pressed into the center of the ring circle.

In the cases of the Setters Formation and the Sykesville Formation North, the separate was relatively pure, so it was poured into the metallic guide. Under the microscope, the non-zircon grains were picked from the tape and removed from the mount. In the case of the Sykesville Formation South, the separate was not purely zircon enough, so the entire sample was poured into a Petri dish. Zircon grains were then picked from the Petri dish and placed within the guide circle on the tape. Zircon grains are identified by their shape, color, reflectivity, refractive index, and tenacity.

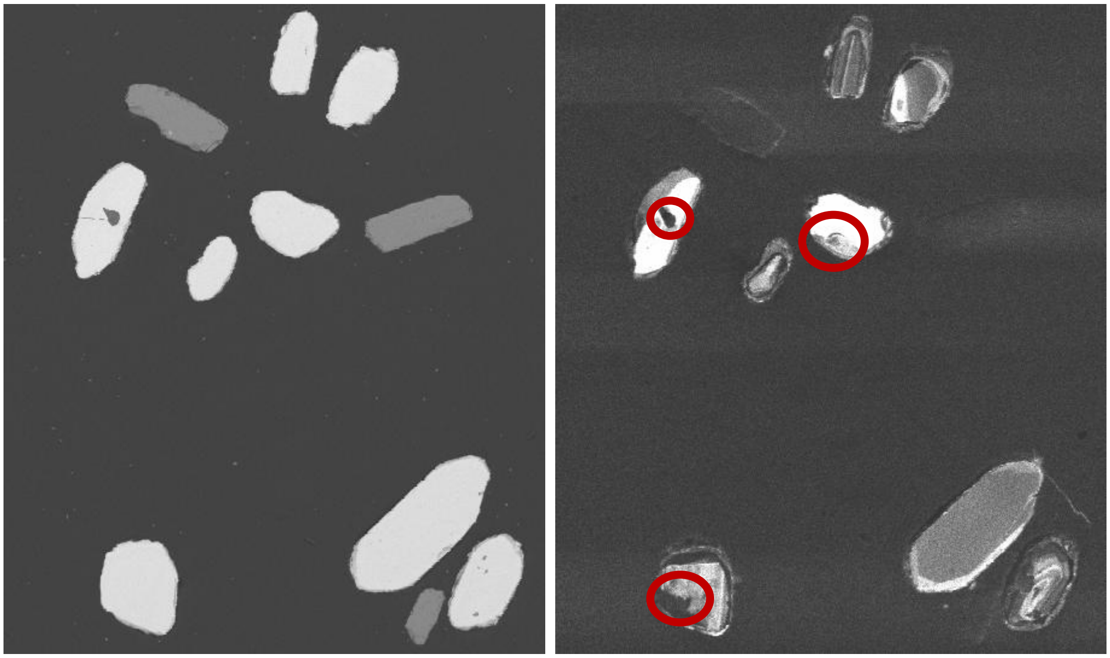
In all cases, approximately 250 zircon sample grains were placed on the eventual mount surface. The grains were laid parallel to the mount surface for maximum core exposure after polishing. Sri Lanka zircon standard grains were placed in the middle, open area of each mount as to be easily distinguishable from the sample grains. The plastic ring was placed back onto the tape. An epoxy was mixed and poured into the ring, slowly covering the sample and standard grains. The dental pick was used to pick any bubbles in the epoxy off the tape. The epoxy was left to harden.

When the mount was set, the plastic ring and attached mount were removed from the tile. 2500 grit and 3000 grit sandpaper were used to polish the mount to expose the cores of the zircon grains. The mounts were cut to a smaller size and cleaned. All tools and surfaces were cleaned and dried.



Figures 6a and 6b: JEOL JXA-8900 electron microprobe at the University of Maryland.

The JEOL JXA-8900 Superprobe electron microprobe (figures 6a and 6b) at the University of Maryland was used to take backscatter electron and cathodoluminescence images of the grain mounts (figures 7a and 7b). These images were pieced together using Adobe Illustrator to create a map of the mounts so that positioning the grains would be easier. The zircons grains were number on the images from “1” to “250” for easier positioning and locating on the mass spectrometer. The electron microprobe had an electron acceleration voltage of 15 kV and a current of 20 nA.

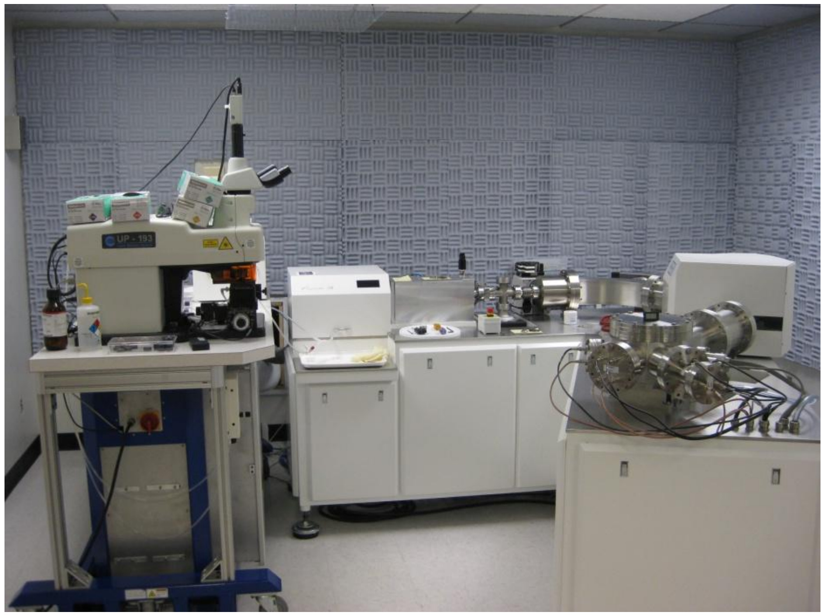


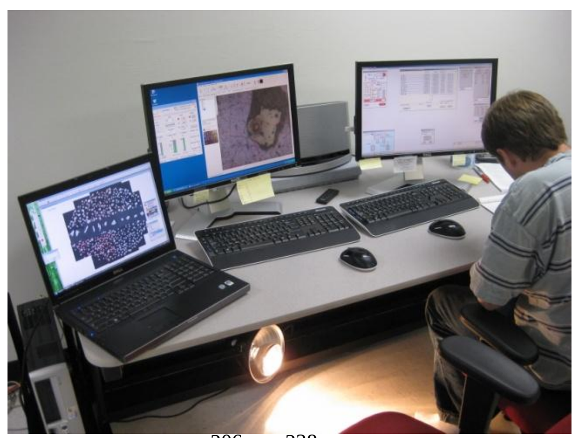
Figures 7a and 7b: Backscatter electron (left) and cathodoluminescence images of Sykesville Formation South grain mounts. Red circles indicate locations which were avoided during analysis due to inclusions (top left), cracks (top right), and multiple zones.

The Nu Plasma Laser Ablation Inductively Coupled Plasma Mass Spectrometer (LA-ICP-MS) at the University of Arizona's LaserChron Center (figures 8a and 8b) was used to collect U, Pb, and Th data for isotopic dating. The mounts were placed in an airtight chamber in the LA-ICP-MS. Starting with the grain labeled "1," each zircon grain was ablated by the laser in successive order, taking care to avoid obvious inclusions, cracks, and zoning. When initiated, the LA-ICP-MS fired a laser beam onto the zircon grain, turning the material to gas on contact. The laser fired for fifteen seconds and integrated all of its time into fifteen, one second intervals. The first three of these values were discarded, as were the maximum and minimum values of the remaining set. The produced gas was transported to the plasma using He and Ar gas, where ionization took place. The isotopes' various atomic masses caused them to be directed to their respective cups. At the collection cups, the count values were read as voltages. ^{204}Pb was measured from an ion multiplier, and the number of counts per second was converted to an equivalent voltage. A "blank" value of background noise voltages was measured and subtracted. Five of the Sri Lanka standards were analyzed before the first unknown grain, one standard was hit after each set of five unknown grains, and five standards were hit at the conclusion of all unknown grains. This followed the detailed fluctuations of the LA-ICP-MS during the entire analysis. For each sample, at least two hundred successful unknown analyses were completed. The laser had a repetition rate of 7 Hz, a fluence of 8 mJ, and a beam width of either 40 μm or 30 μm, depending on the average zircon grain size.

^{238}U decays to ^{206}Pb, ^{235}U decays to ^{207}Pb, ^{232}Th decays to ^{208}Pb, and ^{204}Pb is a stable, non-radiogenic isotope. The amount of ^{204}Pb present was used as a reference for the amount of the other isotopes which were present during crystallization and were not produced radiogenically. These other isotopes are subtracted. ^{202}Hg is measured to subtract ^{204}Hg from the Pb value. When a zircon crystallizes, it can incorporate U and Th into its crystal structure. If the starting values of these isotopes are known, then the age of the crystal can be calculated since their radiogenic decay rates are constant.

The raw data were entered in an Excel macro spreadsheet created by George Gehrels from the University of Arizona. The spreadsheet discards data points showing a ^{204}Pb value greater than 250 counts, a $^{206}Pb/^{238}U$ uncertainty greater than 10%, a $^{206}Pb/^{207}Pb$ uncertainty greater than 5%, or a concordance of less than 75%. Manual removal was conducted for readings which showed a $^{206}Pb/^{204}Pb$ ratio less than 25000. Concordia plots of $^{207}Pb/^{235}U$ versus $^{206}Pb/^{238}U$ and their error ellipses were created. Relative probability plots and histograms of the best age calculations were created. A zircon data table showing the zircons' best ages, error values, and concordance values was created.





Figures 8a and 8b: Nu Plasma LA-ICP-MS at the University of Arizona.

For each sample, a $^{206}Pb/^{207}Pb$ age and a $^{206}Pb/^{238}U$ age was determined. A break was made at 700 Ma. If the $^{206}Pb/^{238}U$ age was younger than 700 Ma, it was used. If the $^{206}Pb/^{238}U$ age was older than 700 Ma, the $^{206}Pb/^{207}Pb$ age was used. This distinction is made because the $^{206}Pb/^{207}Pb$ age is more precise for older samples, while the $^{206}Pb/^{238}U$ age is more precise for younger samples. Since ^{207}Pb has a half life of only about 800 Ma, there was already a limited amount to measure by 1 Ga, making $^{206}Pb/^{207}Pb$ readings difficult for younger grains. ^{238}U has a half life of about 4.5 Ga, so there is still plenty to be counted as part of a $^{206}Pb/^{238}U$ reading for younger grains. Whichever value was used for each grain, the $^{206}Pb/^{207}Pb$ age or the $^{206}Pb/^{238}U$, is referred to as the best age.

The maximum depositional age was determined using the youngest age peak for a set of three grains whose best ages overlap at the 1σ level. Full confidence that the youngest detrital zircon age is not younger than the depositional age can be achieved if multiple grains statistically overlap in a cluster (Dickinson and Gehrels, 2009).

Clast Aspect Ratio Measurements

An outcrop of the Sykesville Formation, approximately 0.5 km in length was selected for clast aspect ratio measurements. The outcrop was located next to the Potomac River, on the border of Washington, D.C. and Virginia (figures 9 and 10).

Starting at the southernmost point of the outcrop, a station was marked. A GPS location and foliation strike and dip measurement was recorded (table 3). The stations ranged in latitude from 38.93020 °N to 38.93409 °N and in longitude from 77.11584 °W to 77.11842 °W. Using a spreadsheet to track all data, length, width, thickness, clast classification type, plane of origin orientation, and picture records of one hundred to two hundred clasts were measured and recorded at each site. Rock faces were defined by cardinal direction. A coordinate system was created so that north and south faces measured length and thickness while east and west faces measured width and thickness. The third dimension was only measured if a full view was visible. Plane orientation was a general reference as to the side of the block from which the measurements came.

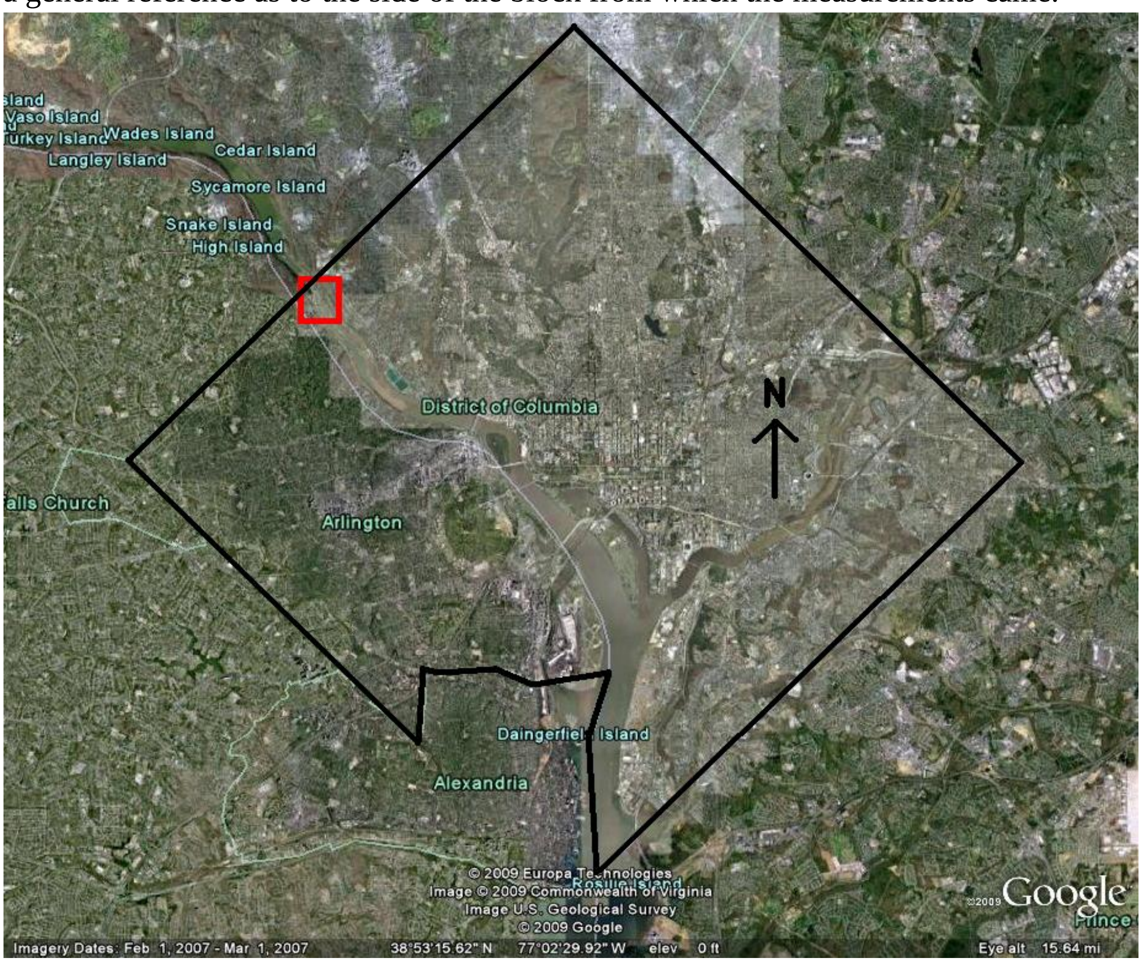


Figure 9: Map of Washington, D.C. Highlighted red box is site of Sykesville Formation South outcrop where clast aspect ratio measurements were taken. Interior of black outline is Washington, D.C.

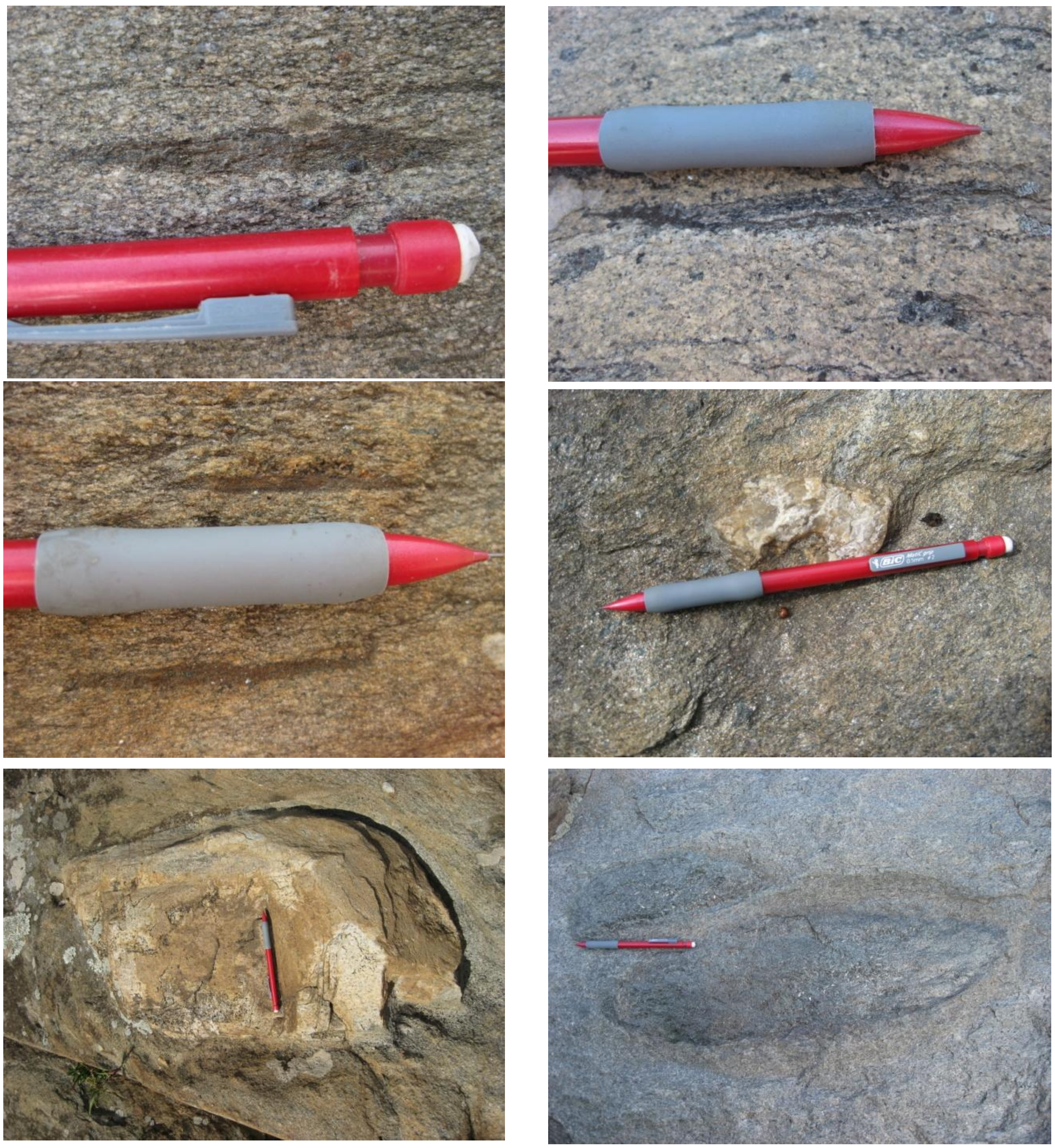
Figure 10: Map of Potomac River and Sykesville Formation South. Highlighted red box is outcrop where clast aspect ratios were measured. Outcrop and areas east are Washington, D.C., areas west are Virginia, areas north west of black line are Maryland.

Several criteria were checked to determine into which clast category type each clast would be categorized. If a clast met the necessary criteria, it was classified into the given category (figures 11a, 11b, 11c, 11d, 11e, and 11f). Type A clasts showed serrated edges, a dark brown color, foliations, and a grain size too fine to recognize minerals in hand sample. These were considered possible fiamme features. Type B clasts showed a white to clear color, no foliations, a grain size up to 2.0 mm, and were recognized as quartz. Type C clasts showed a lighter tan color, some foliations, a quartz and plagioclase composition, and a grain size up to 1.0 mm. Type D clasts showed a black color, no foliations, a shiny appearance, a very fine grain size, and a hornblende composition. Type E clasts were other clasts which did not meet the criteria to be classified in one of the first four categories.

The number of clasts measured at each station varied based on the size of the outcrop. After at least one hundred clasts had been measured at a station, the next station to the north was identified and the process repeated. Ten stations were marked in all, totaling 1305 clast measurements.

All collected data points were placed in a Microsoft Excel spreadsheet for analysis. Data points were divided into clast category types. For each clast, an aspect ratio of length to thickness or width to thickness was determined, depending on from which face the clast was measured. For each category's sum of aspect ratios, an average, standard deviation, skewness, kurtosis, and median value were calculated. The data were considered per station and as a whole.

The Type A and Type B/C/D groups were compared using the null hypothesis that the two categories' means were equal. A Welch's two sided t-test was used because the categories were assumed to have different n values, different variances, an



Figures 11a, 11b, 11c, 11d, 11e, and 11f: Examples of clast Type A (top left, top right, and middle left), Type B (middle right), Type C (bottom left), and Type D.

approximately normal distribution, and degrees of freedom approaching infinity. Degrees of freedom were calculated using the Welch-Satterthwaite equation:

$$\nu = \frac{\left(\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2}\right)^2}{\frac{s_1^4}{N_1^2 \cdot \nu_1} + \frac{s_2^4}{N_2^2 \cdot \nu_2}} = \frac{\left(\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2}\right)^2}{\frac{s_1^4}{N_1^2 \cdot (N_1 - 1)} + \frac{s_2^4}{N_2^2 \cdot (N_2 - 1)}}.$$

A t-statistic was calculated using the Welch's t-test equation:

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2}}}.$$

The calculated t-statistic and degrees of freedom were used in a Student's t-distribution table to find that the null hypothesis was incorrect at the 99.9% confidence level.

Thin Section Analysis

Two samples were collected from the Sykesville South. These samples were cut to expose possible fiamme features and matrix composition. Six billets were cut, sent to Spectrum Petrographics, and thin sections made. The billets showed possible fiamme features and the surrounding matrix. The thin sections were analyzed for their mineralogy and microstructural textures.

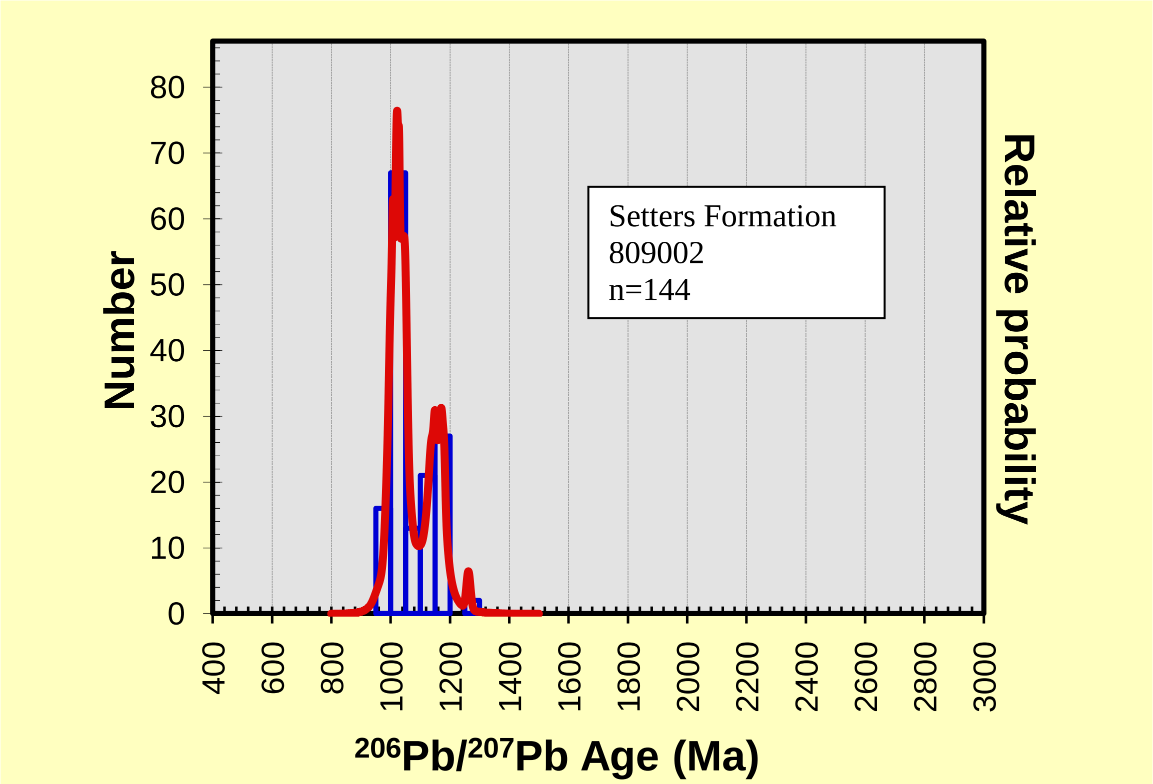
Compositional estimates were made for percentages of minerals in the possible fiamme features and approximate oxide amounts were calculated. These values were compared to known oxide percentages of island arc volcanic dacites and rhyolites.

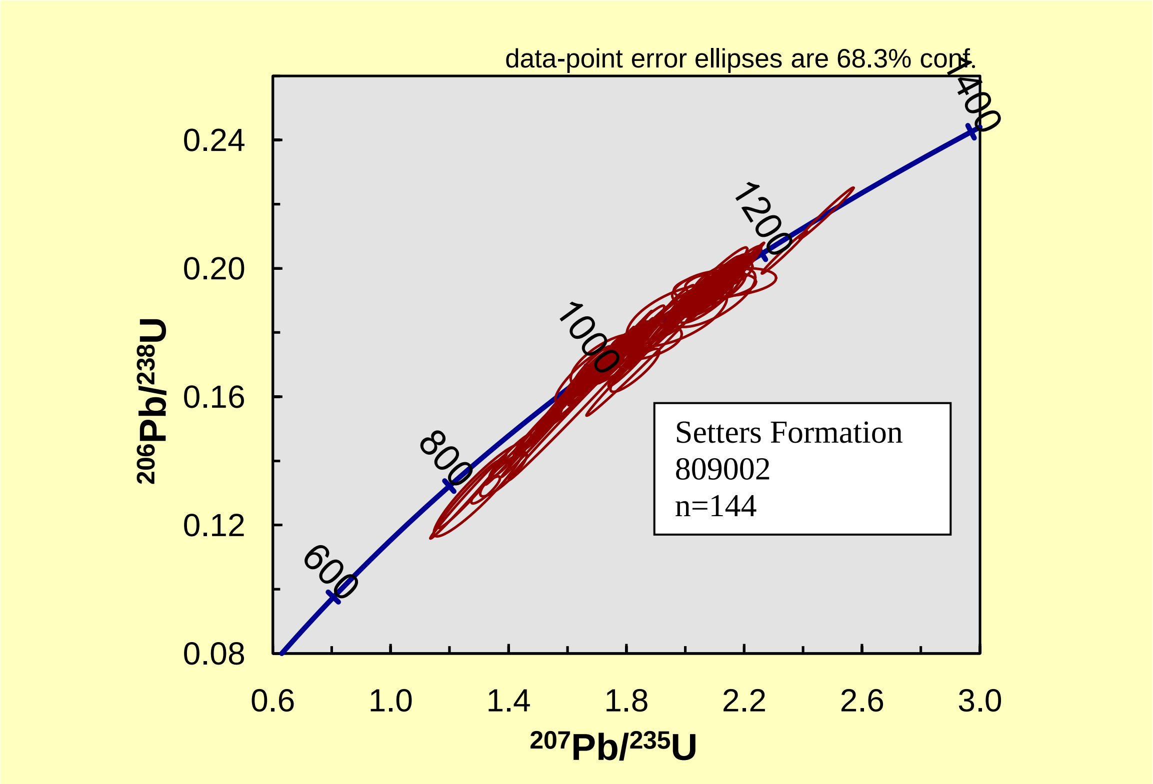
Results

Zircon Dating

The zircon analyses from the Setters Formation showed a single age bundle with two peaks at about 1020 Ma and 1160 Ma. The zircon analyses from both of the Sykesville Formation samples showed three age bundles with several peaks at about 500 Ma to 700 Ma, 1100 Ma to 1500 Ma, 1600 Ma to 2000 Ma, and 2600 Ma to 2900 Ma.

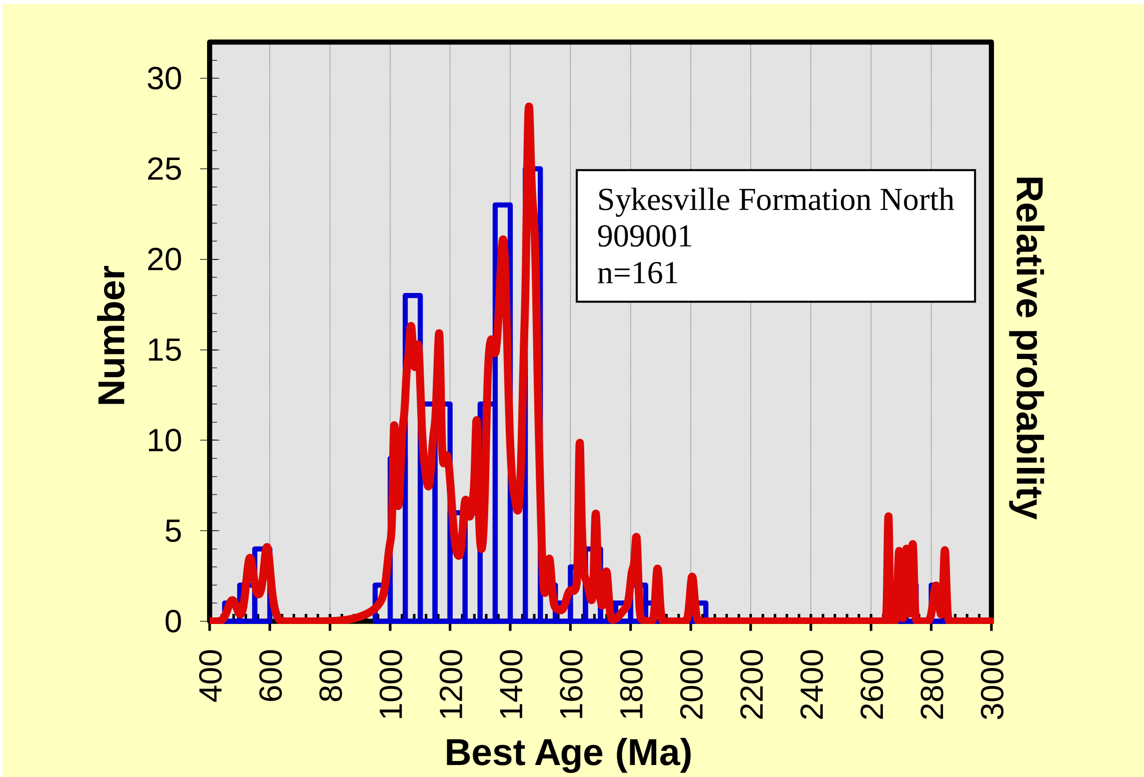
One hundred and forty four (144) unknown zircon grains were used to determine the age of the Setters Formation (table 4). They returned a single grouping of crystallization ages. This population was mainly Grenvillian in age and ranged from 954 ± 26 Ma to 1264 ± 7 Ma. The largest peak is at about 1020 Ma, and there is a smaller peak at about 1180 Ma (figure 12a). Using the youngest age at which three grains whose ages overlap at the 1σ level, and the weighted average standard deviation for those three grains, 1000 Ma (2σ, MSWD = 0.0037) is considered the maximum depositional age.

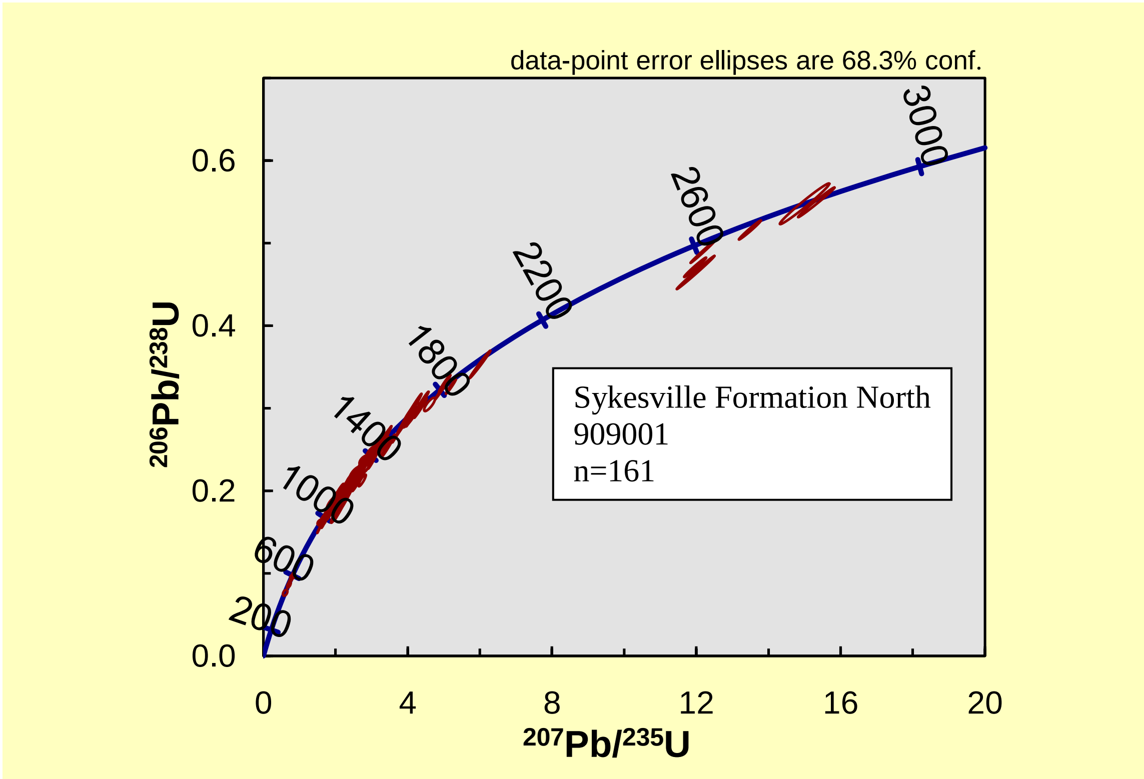




Figures 12a and 12b: Setters Formation relative probability plot (top) and unknown zircon concordia plot.

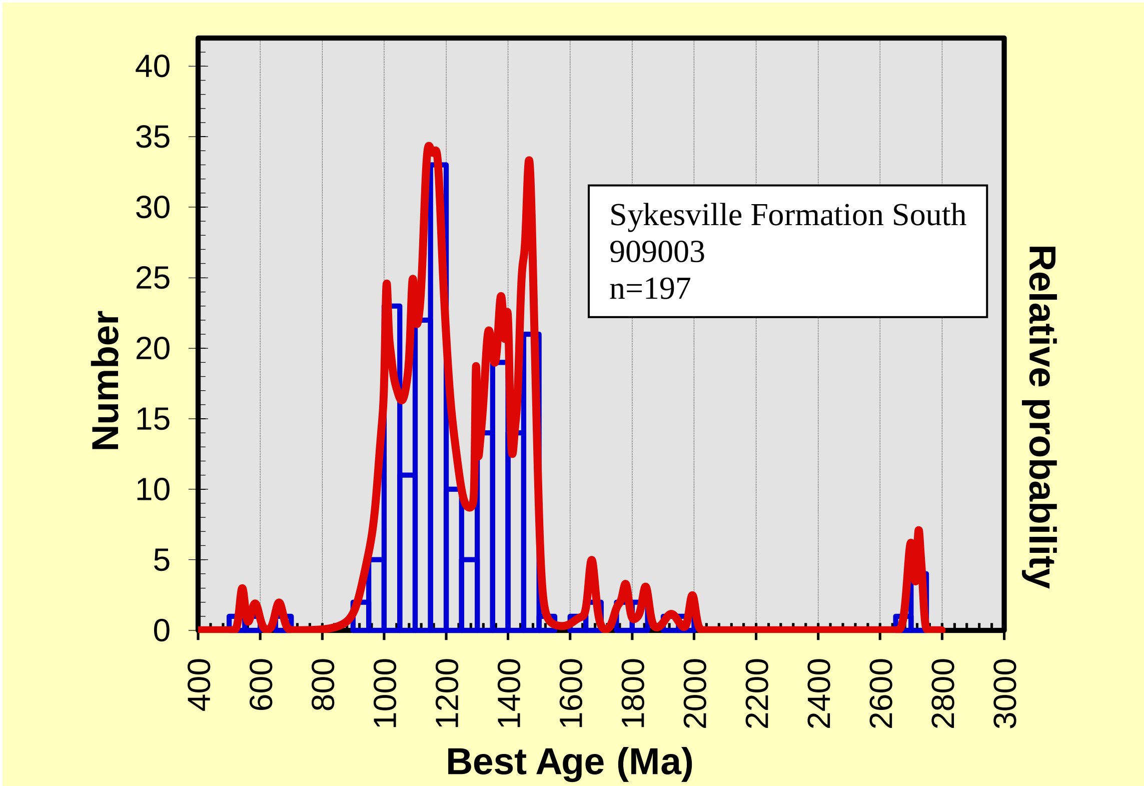
One hundred and sixty one (161) unknown zircon grains were used to determine the age of the Sykesville Formation North (table 4). They returned three groupings of crystallization ages. The populations ranged from 475 ± 15 Ma to 2845 ± 4 Ma. There are twin peaks at about 1100 Ma and 1400 Ma, a few older grains back to about 2000 Ma, a few younger grains from about 500 Ma to 600 Ma, and a few grains from the Neoarchean (figure 13a). Using the youngest age at which three grains whose ages overlap at the 1σ level, and the weighted average standard deviation for those three grains, 600 Ma (2σ, MSWD = 0.79) is considered the maximum depositional age.

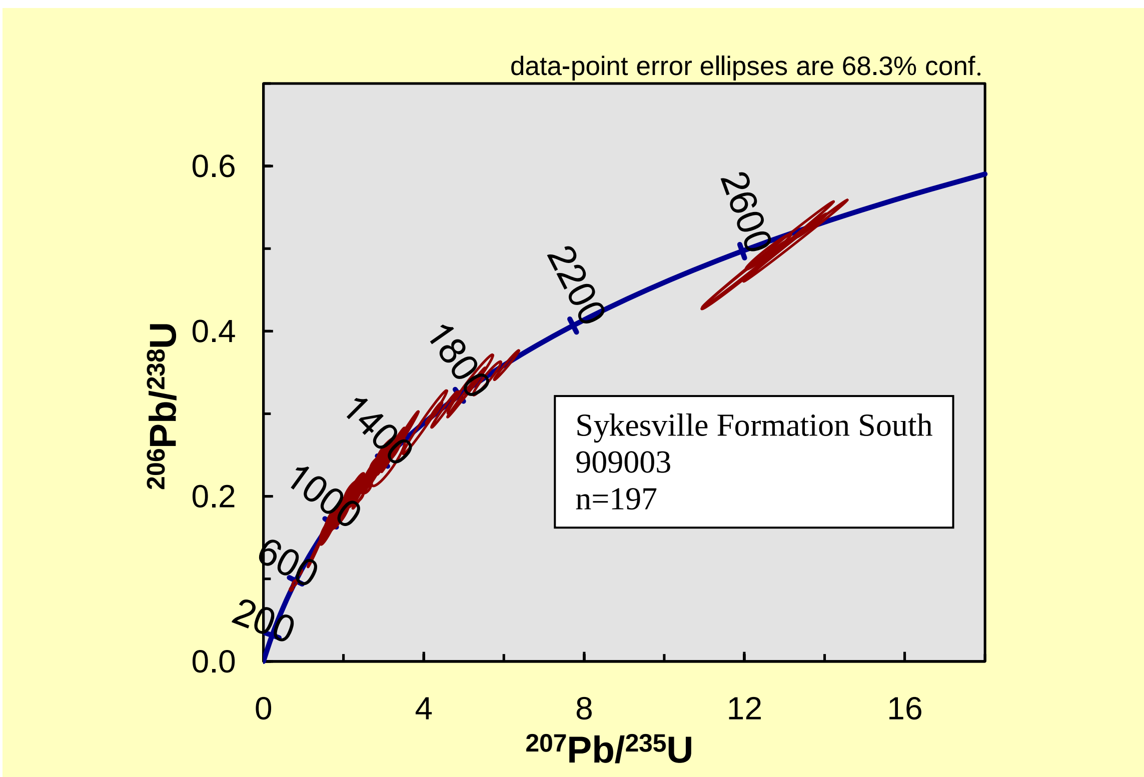




Figures 13a and 13b: Sykesville Formation North relative probability plot (top) and unknown zircon concordia plot.

One hundred and ninety seven (197) unknown zircon grains, divided between two mounts, were used to determine the age of the Sykesville Formation South (table 4). They returned three groupings of crystallization ages. The populations ranged from 542 ± 8 Ma to 2733 ± 6 Ma. There are twin peaks at about 1200 Ma and 1500 Ma, a few older grains back to about 2000 Ma, a few younger grains from about 500 Ma to 650 Ma, and a few grains from the Neoarchean (figure 14a). Using the youngest age at which three grains whose ages overlap at the 1σ level, and the weighted average standard deviation for those three grains, 1000 Ma (2σ, MSWD = 0.091) is considered the maximum depositional age.



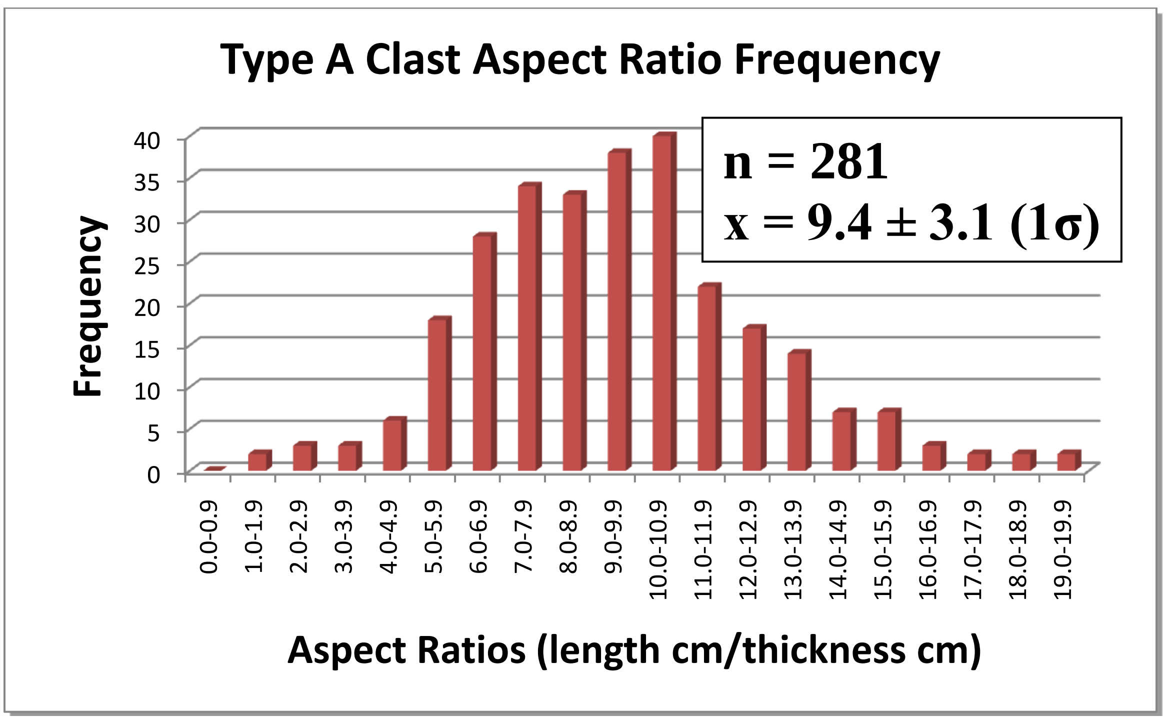


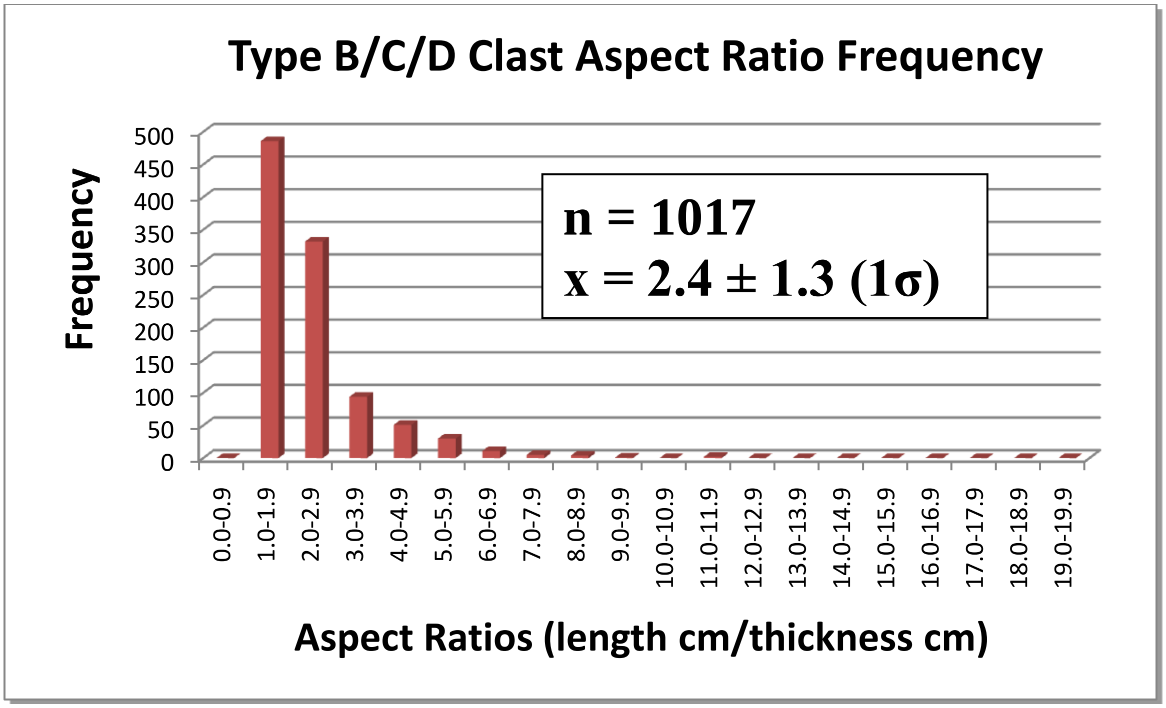
Figures 14a and 14b: Sykesville Formation South relative probability plot (top) and unknown zircon concordia plot.

The magnetic portion of the Frantz separate was not used in picking zircons, but it was analyzed for its mineralogy. The Setters Formation magnetic separate contained rutile, garnet, tourmaline, quartz, muscovite, and pieces of metal from the mortar and pestle crushing process. Many of the quartz grains, which were expected to be in the non-magnetic portion of the separate, showed inclusions in the grain or non-quartz material on the outside of the grain. The Sykesville Formation magnetic separate contained biotite, muscovite, chlorite, garnet, and tourmaline. No zircons were seen in either magnetic separate.

Clast Aspect Ratio Measurements

Ten (10) stations were marked along an approximately 0.5 km stretch of the Sykesville South outcrop. Between 109 and 160 aspect ratios were measured at each station, depending on the size of the specific location, totaling 1305 clasts. These were separated into 281 Type A clasts, 1071 Type B/C/D clasts, and 7 Type E clasts. The mean for these aspect ratios were 9.4 ± 3.1 (1σ) for Type A clasts and 2.4 ± 1.3 (1σ) for Type B/C/D clasts (figures 15a and 15b). The medians for these data were 9.2 for Type A clasts and 2.0 for Type B/C/D clasts. The Welch's t-test yielded a t-statistic of 36.7. The Welch-Satterthwaite equation yielded about 307 degrees of freedom, which is large enough to be approximated as infinite. Assuming infinite degrees of freedom, the means of the Type A and Type B/C/D groups of data are different at the 99.9% confidence level.





Figures 15a and 15b: Sykesville Formation South aspect ratio frequency plots of Type A clasts (top) and Type B/C/D clasts.

Thin Section Analysis

The thin sections showed a noticeable difference between the composition and texture of the matrix material and the possible fiamme features.

The matrix showed approximately 40% quartz grains with sizes ranging from about 0.5 to 2.0 mm, 40% muscovite grains with sizes ranging from 0.5 to 1.0 mm, less than 5% garnet grains with sizes ranging from 0.5 to 2.0 mm, less than 5% plagioclase grains with sizes ranging from 0.25 to 1.0 mm, less than 5% biotite grains with sizes ranging from 0.25 to 1.0 mm, less than 5% chlorite grains with sizes ranging from 0.25 to 0.5 mm, and less than 5% opaque grains with sizes ranging from 0.1 to 1.0 mm. The opaque grains are pyrite.

The possible fiamme features showed approximately 90% muscovite grains of less than 0.25 mm size, less than 10% quartz grains of less than 0.5 mm size, and less than 2% opaque grains of less than 0.5 mm size. Based on similarities in birefringence and orientation at extinction, the white mica grains appeared to be preferentially oriented based on crystallographic axes.

There were smaller clots of white mica throughout the sections. These appeared to be smaller versions of the possible fiamme features, and the preferential crystallographic orientation was not as evident. Rims of chlorite and plagioclase were found around some garnet grains, indicating retrogradation.

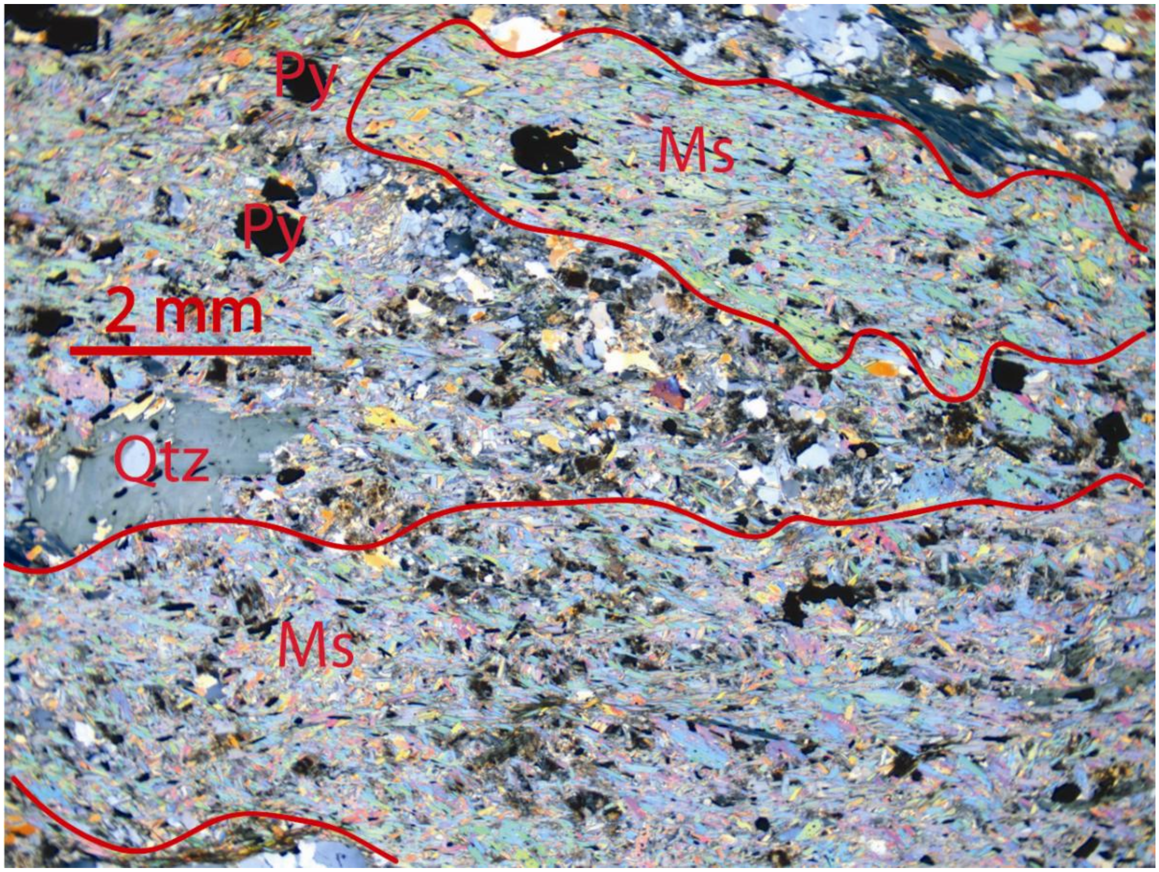


Figure 16: Thin section 0110001f2 image showing two possible fiamme features. White mica grains show preferential crystallographic orientation, as seen by similar birefringence color throughout the feature. Ms: muscovite, Qtz: quartz, Py: pyrite. Red lines are approximate boundary of each feature. Image taken in crossed polarized light.

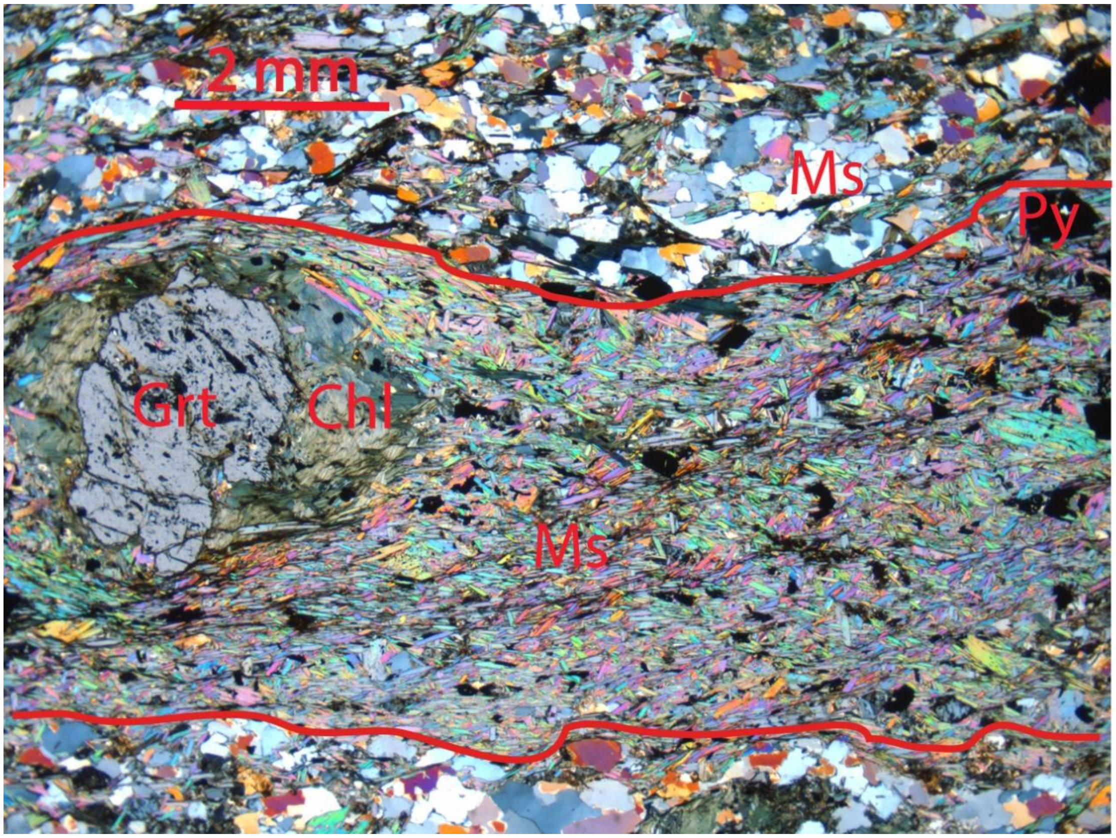


Figure 17: Thin section 0110002f1 image showing possible fiamme feature and garnet grain. White mica grains appear to wrap around retrograded garnet. Ms: muscovite, Py: pyrite, Grt: garnet, Chl: chlorite. Red lines are approximate boundaries between possible fiamme feature (middle) and matrix. Image taken in crossed polarized light.

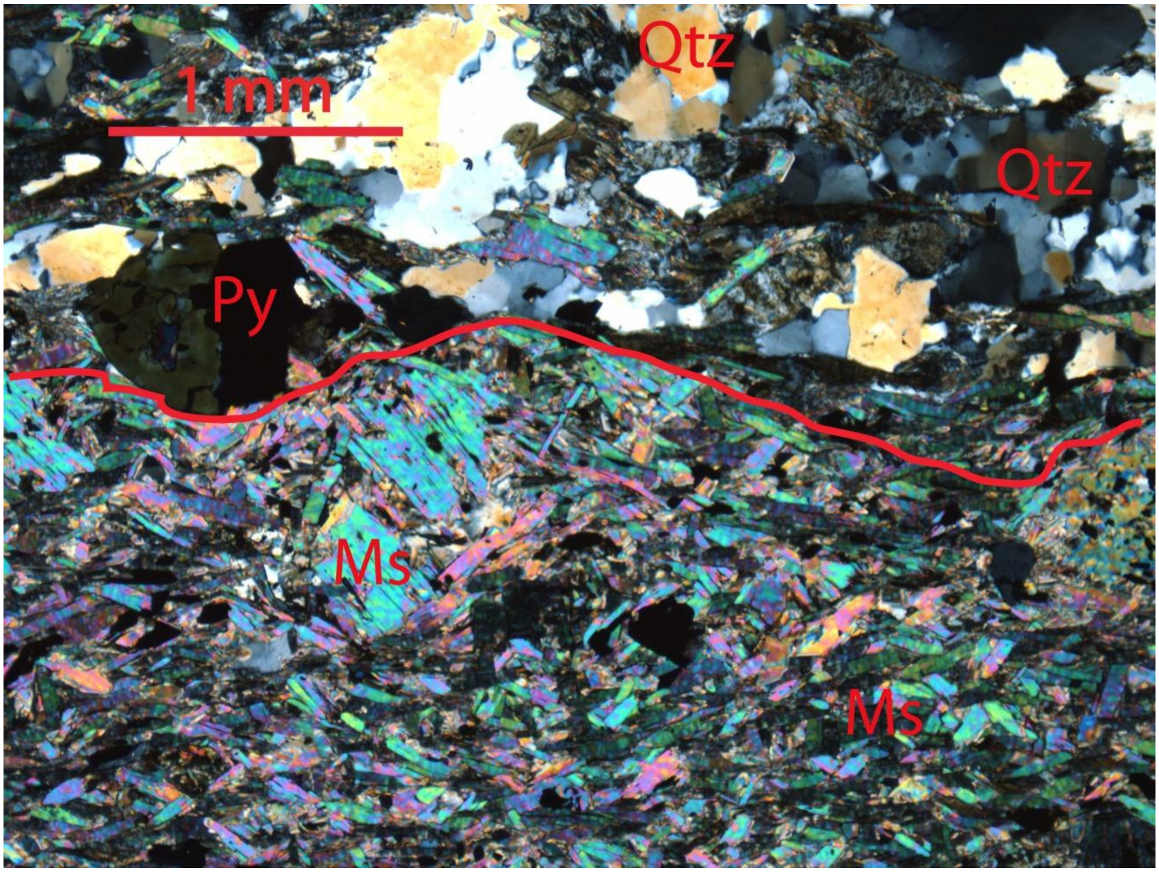


Figure 18: Thin section 0110001f4 image showing difference in possible fiamme feature and matrix texture and composition. Ms: muscovite, Qtz: quartz, Py: pyrite. Red line is approximate boundary between possible fiamme feature (bottom) and matrix. Image taken in crossed polarized light.

Uncertainty

Error is present in all measurements and calculations. It is important to understand the source and meaning of human and mechanical error so that it can be included in all analyses and discussions of results. Several steps were taken to recognize error in various portions of the study.

Zircon Dating

Each zircon U/Pb best age has an associated random and systematic error. The $^{206}Pb/^{238}U$ systematic error was 1.7% for the Setters Formation, 1.6% for the Sykesville Formation North, 2.8% for mount 024 of the Sykesville South, and 0.9% for mount 026 of the Sykesville South. The $^{206}Pb/^{207}Pb$ systematic error was 0.8% for the Setters, 0.9% for the Sykesville North, 1.0% for mount 024 the Sykesville South, and 0.8% for mount 026 of the Sykesville South. To attach an uncertainty to the maximum depositional age, a weighted average and associated 2σ uncertainty was calculated for the three youngest grains whose ages overlap at the 1σ level. The associated uncertainty was added to the weighted mean and the value was rounded up to the nearest interval of 10 Ma. This age is representative of the 95% confidence level. The mean square weighted deviation (MSWD) was recorded.

Clast Aspect Ratio Measurements

At the Sykesville Formation outcrop which was used for clast aspect ratio measurements, a large scale and small scale permanent feature was identified and measured (figures 19 and 20). These features were remeasured on all subsequent trips to the Sykesville. The spread of these data provided a constraint for the human error in the aspect ratio measurements. Since measurements were only recorded to the nearest 1 mm, no variation was found from the small permanent feature (table 5). The standard deviation found from the large permanent feature was assumed to include the small permanent feature error. The standard deviation from the large permanent feature was 0.1 cm (1σ), the human error (table 6).

Figures 19 and 20: Large (left) and small scale permanent features used for uncertainty calculations at the Sykesville South.

The permanent features at the Sykesville Formation were measured with multiple tools of measurement. The spread of these data provided a constraint for the inherent error in the primary tool of measurement, a tape measure. The difference between the tape measure value and a wooden ruler value was calculated. The standard deviation for this difference was 0.1 cm (1σ), the mechanical error (table 7).

These human and mechanical error values were directly added to get a measuring error of 0.2 cm (1σ). This measuring error was then quadratically added to the calculated error from the collected data. The result of this addition gave the total error assigned to the aspect ratios. The equation for aspect ratio error was:

$$\sigma = \sqrt{(\text{human error} + \text{mechanical error})^2 + (\text{calculated error})^2}.$$

The total error for Type A clasts was 3.1 (1σ), and the total error for Type B/C/D clasts was 1.3 (1σ).

Discussion

The results of each part of the experiment must be considered before drawing any final conclusions. Data cannot be interpreted individually, but needs to be viewed as part of the whole.

Zircon Dating

The results of the Sykesville Formation gave three bundles of crystallization ages, with maximum depositional ages of 600 Ma and 1000 Ma for the North and South samples, respectively. The Sykesville South did have one zircon grain which yielded a best age of 542 ± 8 Ma, but that was not enough to interpret that age as a true peak. For both samples, one age group fell in the latest Proterozoic to earliest Paleozoic, one age group fell in Grenvillian age in the middle of the Proterozoic, and one age group fell in the late Archean. The Grenvillian tectonomagmatic event occurred between about 950 Ma and 1250 Ma (Eriksson et al., 2003).

These three groups roughly match the findings for the surrounding units, the Laurel Formation and the Bear Island domain of the Mather Gorge complex. These units, to the east and west of the Sykesville, respectively, returned similar maximum depositional ages. The presence of intruding granites in the rocks is another consistent feature in the eastern formations.

Most of the unknown grains fell outside of the 600 Ma definition for inherited grains. Based on previous research, this evidence suggests that the Sykesville Formation is not volcaniclastic in origin. For the hypothesis to be supported, less than 10% of the returned crystallization ages could have been inherited.

The results of the Setters Formation gave one range of crystallization ages with a maximum depositional age of 1000 Ma. The relative probability signature is extremely similar to rocks from the Blue Ridge Providence to the west, including the Faquier Group (Kaufman et al., in revision). The Setters is found near the Baltimore Gneiss Dome, which has rock types and crystallization ages similar to Blue Ridge rocks and crops sporadically along the Atlantic Piedmont. There were no intrusive rocks recognized in the Setters, which is consistent with rocks from the western formations. It has been proposed that there is a fault separating the Baltimore Gneiss Dome and Piedmont rocks.

Based on the maximum depositional age constraints and similarity in relative probability plots, it is likely that the Sykesville Formation is depositionally linked to the Laurel Formation and the Bear Island domain. Although not currently linked in its surface position, the Setters Formation yielded a similar relative probability plot signature as units further to the west. There may be a boundary separating the western Laurentian rocks and eastern outboard terrane rocks that has not been recognized to this point.

The Setters and the Sykesville share a peak at about 1020 Ma. The Sykesville has many peaks in addition to this common age signature. It is clear that the Setters is a metasedimentary quartzite. It has detrital zircon grains with a wide age range. It seems likely that, given the overlapping age peak, the Sykesville grains are also detrital.

Clast Aspect Ratio Measurements

The results of the Sykesville Formation's clast aspect ratio measurements show a statistically significant difference between the means of the Type A, possible fiamme, clasts and the Type B/C/D, possible non-fiamme, clasts at the 99.9% confidence level. This evidence supports the interpretation that the Sykesville is a volcaniclastic unit. However, when considered with the laser ablation age data, another possibility must be considered. The measured features could have been clasts of a weaker rock, such as mudstone. When the rock was deformed, the lack of strength of these clasts caused them to be deformed more severely than other, stronger clasts in the rock, such as quartz or granite clasts.

The high length to thickness aspect ratios of fiamme derive from a period of deformation during welding of the volcanic tuff, then an additional period of deformation during compaction of the whole rock. If these Type A clasts were simply weak mudstones, a single period of deformation could have caused them to be deformed more than their stronger counterparts. This would yield a higher aspect ratio in a non-volcanic clast.

Thin Section Analysis

Examining the possible fiamme features under a microscope revealed that they are mainly composed of fine grained muscovite oriented preferentially according to their crystallographic axes. Since there are no volcanic rocks which are predominantly mica, this is evidence that the Sykesville Formation is not a volcaniclastic unit.

If the clasts were originally mudstones or clays, they could have turned to white mica during metamorphism. This would explain the higher aspect ratios and the composition of the Type A clasts when compared to the Type B/C/D clasts.

The amount of white mica in the possible fiamme features was estimated at 90%. There is about 10% K_2O and 37% Al_2O_3 in muscovite (Deer et al., 1993). If this mica is taken to be muscovite, there is about 9% K_2O and 33% Al_2O_3 in the feature. In high K island arc volcanic suite dacites, these composition values are only about 3.9% and 16.0%, respectively. In high K island arc volcanic suite rhyolites, these composition values are only about 4.5% and 13.3%, respectively (Winter, 2001). The estimated percentages of K_2O and Al_2O_3 in the features are larger than would be expected for volcanic rocks.

Conclusions

Results from different sections of the experiment yielded contradictory findings in terms of the original hypotheses. The significant percentage of inherited zircon crystallization ages found in the Sykesville Formation and the white mica rich composition of the possible fiamme clast features indicates that the Sykesville is not a volcaniclastic unit. The statistically significantly different mean aspect ratios for the Type A and Type B/C/D clasts from the Sykesville indicate that the formation is volcaniclastic.

The Sykesville Formation North had a maximum depositional age of 600 Ma, the Sykesville Formation South had a maximum depositional age of 1000 Ma, and the Setters Formation had a maximum depositional age of 1000 Ma. The Type A clasts, had a mean aspect ratio of 9.4 ± 3.1 (1σ) and the Type B/C/D clasts had a mean aspect ratio of 2.4 ± 1.3 (1σ). These means are different at the 99.9% confidence level. Estimated compositions of the possible fiamme features showed K_2O and Al_2O_3 percentage that are larger than expected for volcanic rocks. It is inconclusive but unlikely that the Sykesville Formation is a volcaniclastic unit.

Other hypotheses have been considered in an attempt to explain the aspect ratio variability. It is feasible that the possible fiamme features were mudstone clasts which, during a single period of deformation, were deformed more significantly than other, stronger clasts types because of their low strength. The features are made of predominantly fine grained white mica, and this idea would explain their high K_2O and Al_2O_3 percentages in comparison to volcanic island arc dacites and rhyolites.

Acknowledgements

I would like to thank Dr. Aaron Martin for his insight and direction. This project would not have been possible without his complete commitment.

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I would like to thank my parents for their continued support, Poppy for my love of the outdoors, and Dave Wolf for introducing me to the possibilities of geology.

I would like to thank my friends for always reminding me that no matter how hard I work, and no matter what I discover, I'll never be doing anything more than chizzlin.

Tables

Table 2: Collection sites of zircon age dating samples.			
Sample Name	Collection Site coordinate	Foliation Orientation	Rock Type
Setters Formation	39.37354 N, 76.85314 W	182, 18 W	quartzite
Sykesville Formation North	39.36272 N, 76.96720 W	185, 74 NW	schist
Sykesville Formation South	38.93206 N, 77.11636 W	205, 37 NW	schist

Table 3: Station sites of clast aspect ratio measurements.				
Station	Latitude (°N)	Longitude (°W)	Strike	Dip
1A	38.9302	77.11584	204	51 NW
2A	38.93067	77.116	176	63 W
3A	38.93082	77.11607	196	39 NW
4A	38.9315	77.11597	193	46 NW
5A	38.93206	77.11636	205	37 NW
6A	38.93235	77.11681	195	65 NW
7A	38.93292	77.11684	186	41 NW
8A	38.93326	77.11782	173	44 NE
9A	38.93373	77.11734	199	28 NW
10A	38.93409	77.11842	195	58 NW

TABLE 4: U-Pb GEOCHRONOLOGIC ANALYSES

				Isotope ratios							Apparent ages (Ma)								
Analysis	U conc	206Pb	U	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±	Concor
	(ppm)	204Pb	Th	207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)	(%)
SAMPLE 0809002 SETTERS FORMATION (39.37354 °N, 76.85314 °W)																			
809002-28	178	74275	6.3	14.1059	1.3	1.2666	5.5	0.1296	5.4	0.97	785	40	831	31	954	26	954	26	82
809002-169	333	41552	3.5	14.0665	0.7	1.2629	6.7	0.1288	6.7	0.99	781	49	829	38	960	14	960	14	81
809002-104	163	235839	2.1	13.8871	1.0	1.6852	2.5	0.1697	2.3	0.92	1011	22	1003	16	986	20	986	20	102
809002-126	569	131325	3.6	13.8815	0.4	1.5897	2.2	0.1600	2.2	0.98	957	19	966	14	987	8	987	8	97
809002-36	56	23833	2.4	13.8764	2.9	1.3019	7.9	0.1310	7.3	0.93	794	55	847	45	988	60	988	60	80
809002-192	1100	95092	11.9	13.8757	1.0	1.4066	3.3	0.1416	3.2	0.95	853	25	892	20	988	21	988	21	86
809002-52	739	97055	2.9	13.8657	0.4	1.5873	3.2	0.1596	3.2	0.99	955	28	965	20	989	9	989	9	96
809002-102	382	234827	5.1	13.8511	2.0	1.6581	3.9	0.1666	3.4	0.86	993	31	993	25	991	40	991	40	100
809002-58	950	72686	8.5	13.8305	0.5	1.3838	3.0	0.1388	3.0	0.99	838	23	882	18	995	9	995	9	84
809002-120	425	397992	5.6	13.8271	0.3	1.6546	2.3	0.1659	2.3	0.99	990	21	991	15	995	7	995	7	99
809002-35	302	225202	2.9	13.8119	0.6	1.5545	2.6	0.1557	2.6	0.98	933	22	952	16	997	11	997	11	94
809002-19	148	79263	3.2	13.8116	1.1	1.6544	2.5	0.1657	2.3	0.90	989	21	991	16	997	22	997	22	99
809002-42	216	194884	5.4	13.8035	0.9	1.6765	2.9	0.1678	2.7	0.95	1000	25	1000	18	998	19	998	19	100
809002-10	1466	3162261	3.2	13.8013	0.2	1.7019	3.2	0.1703	3.2	1.00	1014	30	1009	20	999	4	999	4	102
809002-81	964	1248071	4.0	13.7994	0.3	1.6687	2.3	0.1670	2.3	0.99	996	21	997	15	999	6	999	6	100
809002-40	836	520587	2.8	13.7884	0.3	1.6829	3.2	0.1683	3.2	1.00	1003	30	1002	20	1001	5	1001	5	100
809002-34	255	227664	2.3	13.7823	0.8	1.6298	2.8	0.1629	2.6	0.95	973	24	982	17	1002	17	1002	17	97
809002-9	261	287796	3.7	13.7744	0.7	1.5939	7.3	0.1592	7.3	1.00	953	64	968	46	1003	14	1003	14	95
809002-98	451	50237	5.8	13.7648	0.4	1.6407	2.3	0.1638	2.3	0.98	978	21	986	15	1004	8	1004	8	97
809002-200	835	996272	4.0	13.7603	0.2	1.6849	2.0	0.1681	2.0	1.00	1002	18	1003	13	1005	4	1005	4	100
809002-16	232	457473	2.7	13.7470	0.6	1.6754	2.9	0.1670	2.8	0.98	996	26	999	19	1007	13	1007	13	99
809002-146	418	710428	4.5	13.7382	0.4	1.6808	2.9	0.1675	2.8	0.99	998	26	1001	18	1008	8	1008	8	99
809002-113	1293	148285	4.2	13.7350	0.3	1.6129	2.1	0.1607	2.1	0.99	960	18	975	13	1009	6	1009	6	95
809002-129	934	755656	4.4	13.7347	0.1	1.6587	2.2	0.1652	2.2	1.00	986	20	993	14	1009	3	1009	3	98

809002-184	1404	1683096	3.4	13.7343	0.1	1.7261	3.8	0.1719	3.8	1.00	1023	36	1018	24	1009	3	1009	3	101
809002-84	1364	84807	21.7	13.7341	0.9	1.4104	3.7	0.1405	3.6	0.97	847	29	893	22	1009	18	1009	18	84
809002-88	323	291087	3.8	13.7341	0.6	1.6955	1.9	0.1689	1.9	0.96	1006	17	1007	12	1009	11	1009	11	100
809002-66	304	663897	4.3	13.7267	0.5	1.6859	5.0	0.1678	5.0	0.99	1000	46	1003	32	1010	11	1010	11	99
809002-48	217	226067	2.6	13.7218	0.9	1.6874	2.1	0.1679	1.9	0.91	1001	18	1004	13	1011	17	1011	17	99
809002-109	238	354388	3.3	13.7021	0.4	1.6921	3.0	0.1682	3.0	0.99	1002	27	1006	19	1013	9	1013	9	99
809002-33	229	128820	4.2	13.6970	1.0	1.6863	2.9	0.1675	2.8	0.94	998	26	1003	19	1014	20	1014	20	98
809002-123	188	148902	4.1	13.6818	0.7	1.7170	2.3	0.1704	2.2	0.95	1014	21	1015	15	1016	15	1016	15	100
809002-156	199	254289	5.4	13.6780	0.5	1.6903	2.8	0.1677	2.7	0.98	999	25	1005	18	1017	10	1017	10	98
809002-45	688	906994	1.0	13.6712	0.3	1.7487	2.0	0.1734	2.0	0.99	1031	19	1027	13	1018	7	1018	7	101
809002-108	1292	307061	5.5	13.6698	0.2	1.7224	3.1	0.1708	3.0	1.00	1016	29	1017	20	1018	4	1018	4	100
809002-18	607	533407	4.2	13.6646	0.3	1.7061	2.1	0.1691	2.1	0.99	1007	20	1011	14	1019	6	1019	6	99
809002-112	1384	153536	10.0	13.6634	0.2	1.6780	2.1	0.1663	2.1	0.99	992	19	1000	13	1019	5	1019	5	97
809002-121	523	634564	3.5	13.6601	0.4	1.7675	1.5	0.1751	1.5	0.96	1040	14	1034	10	1020	9	1020	9	102
809002-54	165	78189	3.7	13.6518	1.2	1.3225	2.4	0.1309	2.1	0.88	793	16	856	14	1021	24	1021	24	78
809002-149	791	870893	5.1	13.6486	0.2	1.7946	3.4	0.1776	3.4	1.00	1054	33	1044	22	1021	3	1021	3	103
809002-107	644	828530	4.0	13.6469	0.2	1.6564	2.0	0.1639	2.0	0.99	979	18	992	12	1022	4	1022	4	96
809002-83	663	426077	12.3	13.6433	0.5	1.7305	2.4	0.1712	2.4	0.98	1019	23	1020	16	1022	9	1022	9	100
809002-82	1033	80655	10.7	13.6383	0.7	1.5151	2.8	0.1499	2.7	0.97	900	23	937	17	1023	14	1023	14	88
809002-8	1516	2174931	5.8	13.6357	0.2	1.7635	3.4	0.1744	3.4	1.00	1036	33	1032	22	1023	5	1023	5	101
809002-106	36	19395	1.9	13.6314	3.4	1.7321	4.6	0.1712	3.1	0.68	1019	30	1021	30	1024	68	1024	68	100
809002-160	235	303174	2.3	13.6294	0.6	1.7323	2.3	0.1712	2.3	0.97	1019	21	1021	15	1024	12	1024	12	99
809002-195	521	700879	3.0	13.6289	0.3	1.7244	2.1	0.1704	2.0	0.99	1015	19	1018	13	1024	7	1024	7	99
809002-178	243	149825	3.2	13.6288	0.8	1.7010	1.7	0.1681	1.5	0.88	1002	14	1009	11	1024	17	1024	17	98
809002-150	299	229798	9.0	13.6225	0.4	1.7036	1.8	0.1683	1.7	0.97	1003	16	1010	11	1025	9	1025	9	98
809002-20	175	180188	2.5	13.6223	0.8	1.7021	2.0	0.1682	1.8	0.91	1002	16	1009	13	1025	17	1025	17	98
809002-117	445	199201	2.6	13.6221	0.5	1.7065	2.3	0.1686	2.3	0.98	1004	21	1011	15	1025	10	1025	10	98
809002-53	153	203387	6.4	13.6205	1.0	1.7534	2.0	0.1732	1.7	0.86	1030	17	1028	13	1026	21	1026	21	100
809002-157	844	391531	3.4	13.6180	0.3	1.7281	2.7	0.1707	2.7	0.99	1016	25	1019	17	1026	6	1026	6	99
809002-179	476	586926	3.7	13.6167	0.2	1.7552	2.1	0.1733	2.1	1.00	1030	20	1029	14	1026	3	1026	3	100
809002-30	494	417201	5.3	13.6114	0.3	1.6615	1.8	0.1640	1.8	0.98	979	16	994	11	1027	7	1027	7	95
809002-158	1564	1887217	3.2	13.5986	0.1	1.7748	2.5	0.1750	2.5	1.00	1040	24	1036	16	1029	2	1029	2	101

809002-93	605	367859	2.4	13.5901	0.3	1.7067	2.8	0.1682	2.8	1.00	1002	26	1011	18	1030	6	1030	6	97
809002-57	809	834667	3.3	13.5699	0.3	1.7773	3.3	0.1749	3.2	1.00	1039	31	1037	21	1033	5	1033	5	101
809002-130	366	308461	4.4	13.5674	0.5	1.7333	1.3	0.1706	1.2	0.91	1015	11	1021	8	1033	11	1033	11	98
809002-63	220	192864	3.2	13.5564	1.0	1.7208	4.6	0.1692	4.5	0.98	1008	42	1016	29	1035	20	1035	20	97
809002-85	785	602012	3.8	13.5500	0.3	1.7677	2.3	0.1737	2.3	0.99	1033	22	1034	15	1036	5	1036	5	100
809002-68	322	96066	2.8	13.5434	0.7	1.6516	3.7	0.1622	3.6	0.98	969	32	990	23	1037	15	1037	15	93
809002-124	150	264358	2.5	13.5419	0.5	1.8162	1.6	0.1784	1.5	0.95	1058	15	1051	10	1037	10	1037	10	102
809002-80	200	18738	4.2	13.5401	1.8	1.3827	3.8	0.1358	3.3	0.88	821	26	882	22	1037	37	1037	37	79
809002-59	573	731770	2.9	13.5388	0.3	1.7418	2.5	0.1710	2.5	0.99	1018	23	1024	16	1038	6	1038	6	98
809002-125	144	164706	2.7	13.5322	0.8	1.7741	2.1	0.1741	2.0	0.92	1035	19	1036	14	1039	16	1039	16	100
809002-202	419	659400	2.7	13.5187	0.4	1.7971	1.6	0.1762	1.5	0.97	1046	15	1044	10	1041	7	1041	7	101
809002-138	546	53350	7.1	13.5162	0.3	1.6457	1.7	0.1613	1.7	0.98	964	15	988	11	1041	6	1041	6	93
809002-174	229	160450	7.3	13.5137	1.1	1.7521	2.0	0.1717	1.6	0.84	1022	15	1028	13	1041	22	1041	22	98
809002-55	306	35199	8.2	13.5130	0.4	1.4779	4.5	0.1448	4.5	1.00	872	37	921	27	1042	7	1042	7	84
809002-116	508	494018	4.8	13.5072	0.3	1.8008	1.1	0.1764	1.1	0.97	1047	10	1046	7	1042	5	1042	5	100
809002-14	694	331371	3.7	13.5037	0.4	1.7813	3.4	0.1745	3.4	0.99	1037	33	1039	22	1043	8	1043	8	99
809002-166	339	283897	3.0	13.4932	0.4	1.7972	2.2	0.1759	2.2	0.98	1044	21	1044	15	1044	8	1044	8	100
809002-47	168	272148	3.6	13.4931	0.6	1.6381	3.7	0.1603	3.6	0.98	958	32	985	23	1045	13	1045	13	92
809002-71	627	57953	3.6	13.4915	0.4	1.7418	2.6	0.1704	2.6	0.99	1015	24	1024	17	1045	7	1045	7	97
809002-204	245	2556535	4.1	13.4891	0.9	1.8474	2.9	0.1807	2.8	0.95	1071	27	1062	19	1045	19	1045	19	102
809002-72	678	271889	3.8	13.4881	0.3	1.7828	3.0	0.1744	3.0	0.99	1036	29	1039	20	1045	6	1045	6	99
809002-165	176	134851	4.0	13.4824	1.2	1.8065	2.2	0.1766	1.9	0.85	1049	18	1048	15	1046	24	1046	24	100
809002-159	472	682049	4.4	13.4781	0.6	1.8113	2.3	0.1771	2.2	0.97	1051	21	1050	15	1047	12	1047	12	100
809002-32	513	537921	3.8	13.4762	0.3	1.7664	2.0	0.1726	2.0	0.99	1027	19	1033	13	1047	6	1047	6	98
809002-38	1580	250957	5.8	13.4613	0.2	1.7904	3.6	0.1748	3.6	1.00	1039	35	1042	24	1049	4	1049	4	99
809002-29	997	2736970	5.7	13.4585	0.2	1.7907	2.0	0.1748	2.0	0.99	1038	20	1042	13	1050	4	1050	4	99
809002-152	1603	1457975	3.8	13.4524	0.2	1.8028	2.3	0.1759	2.3	1.00	1044	22	1046	15	1051	5	1051	5	99
809002-67	453	36889	3.3	13.4249	0.5	1.7511	1.8	0.1705	1.7	0.95	1015	16	1028	12	1055	11	1055	11	96
809002-118	246	56877	5.9	13.4190	0.8	1.7408	2.9	0.1694	2.8	0.96	1009	26	1024	19	1056	17	1056	17	96
809002-64	567	606677	3.5	13.4164	0.2	1.7903	3.4	0.1742	3.3	1.00	1035	32	1042	22	1056	4	1056	4	98
809002-172	266	520595	2.7	13.4046	0.3	1.8502	1.7	0.1799	1.7	0.98	1066	16	1063	11	1058	6	1058	6	101
809002-122	1613	345006	33.9	13.3999	0.5	1.8526	4.9	0.1800	4.8	0.99	1067	48	1064	32	1059	10	1059	10	101

809002-128	1793	138482	9.0	13.3957	0.7	1.8236	1.7	0.1772	1.5	0.91	1051	15	1054	11	1059	14	1059	14	99
809002-188	553	493361	3.1	13.3939	0.4	1.8191	2.4	0.1767	2.3	0.99	1049	23	1052	15	1059	7	1059	7	99
809002-189	449	482240	8.8	13.3279	0.3	1.8395	2.2	0.1778	2.2	0.99	1055	21	1060	15	1069	7	1069	7	99
809002-65	206	47804	4.5	13.3272	0.9	1.8028	2.4	0.1743	2.2	0.92	1036	21	1046	15	1069	18	1069	18	97
809002-199	320	370709	4.9	13.2691	0.6	1.8391	4.8	0.1770	4.8	0.99	1050	46	1060	32	1078	11	1078	11	97
809002-170	201	216933	7.9	13.2484	0.6	1.9754	1.8	0.1898	1.7	0.94	1120	18	1107	12	1081	13	1081	13	104
809002-185	362	162364	4.4	13.1797	0.7	1.6464	9.8	0.1574	9.8	1.00	942	86	988	62	1092	14	1092	14	86
809002-21	367	411191	10.0	13.1371	0.5	1.8791	2.7	0.1790	2.6	0.98	1062	26	1074	18	1098	11	1098	11	97
809002-111	94	61662	5.2	13.0966	1.7	1.9101	4.8	0.1814	4.5	0.93	1075	44	1085	32	1104	35	1104	35	97
809002-94	146	202065	3.3	13.0909	1.0	1.9239	2.0	0.1827	1.8	0.87	1081	18	1089	14	1105	20	1105	20	98
809002-171	47	26860	2.2	13.0770	3.8	1.8658	4.3	0.1770	2.0	0.47	1050	20	1069	29	1107	76	1107	76	95
809002-99	1190	1476030	4.7	13.0455	0.7	2.0145	2.5	0.1906	2.4	0.96	1125	24	1120	17	1112	15	1112	15	101
809002-153	217	225871	2.8	12.9926	0.6	2.0225	1.2	0.1906	1.1	0.88	1125	11	1123	8	1120	11	1120	11	100
809002-46	42	42065	2.6	12.9829	2.9	2.0618	3.4	0.1941	1.7	0.51	1144	18	1136	23	1122	58	1122	58	102
809002-91	534	109172	3.3	12.9620	0.6	1.9693	3.1	0.1851	3.1	0.98	1095	31	1105	21	1125	13	1125	13	97
809002-105	39	31908	4.3	12.9602	4.6	1.9719	5.7	0.1854	3.4	0.60	1096	35	1106	38	1125	91	1125	91	97
809002-186	443	40481	3.9	12.9214	0.6	1.8099	2.6	0.1696	2.5	0.97	1010	23	1049	17	1131	12	1131	12	89
809002-41	226	127845	4.2	12.9135	1.1	2.0801	4.1	0.1948	4.0	0.96	1147	42	1142	28	1133	22	1133	22	101
809002-1	215	213069	4.1	12.9088	0.9	2.0533	2.7	0.1922	2.6	0.94	1133	27	1133	19	1133	18	1133	18	100
809002-168	315	593410	4.2	12.8846	0.4	2.0583	2.0	0.1923	1.9	0.98	1134	20	1135	14	1137	8	1137	8	100
809002-142	285	237192	2.8	12.8792	0.7	2.1091	2.4	0.1970	2.3	0.95	1159	24	1152	16	1138	14	1138	14	102
809002-176	153	133080	2.6	12.8455	1.0	2.0321	1.9	0.1893	1.6	0.86	1118	17	1126	13	1143	19	1143	19	98
809002-61	70	57400	4.0	12.8357	1.9	2.1089	2.6	0.1963	1.7	0.68	1156	18	1152	18	1145	37	1145	37	101
809002-141	194	263456	2.0	12.8187	0.5	2.0825	3.5	0.1936	3.5	0.99	1141	36	1143	24	1147	10	1147	10	99
809002-3	227	267244	2.9	12.8139	1.1	2.0100	2.9	0.1868	2.7	0.93	1104	28	1119	20	1148	21	1148	21	96
809002-177	165	180671	1.9	12.8031	0.9	2.1241	2.5	0.1972	2.4	0.93	1160	25	1157	18	1150	18	1150	18	101
809002-182	644	130920	2.6	12.8023	0.2	2.0112	3.1	0.1867	3.1	1.00	1104	32	1119	21	1150	4	1150	4	96
809002-183	151	136686	3.4	12.7924	0.8	2.0683	2.5	0.1919	2.3	0.94	1132	24	1138	17	1151	16	1151	16	98
809002-27	49	50436	4.5	12.7612	4.2	2.1007	4.4	0.1944	1.4	0.33	1145	15	1149	30	1156	82	1156	82	99
809002-15	306	95623	1.0	12.7569	0.8	1.8912	7.9	0.1750	7.9	1.00	1039	76	1078	53	1157	16	1157	16	90
809002-24	51	39367	2.2	12.7504	2.2	2.0676	3.1	0.1912	2.1	0.70	1128	22	1138	21	1158	43	1158	43	97
809002-56	220	69487	3.8	12.7469	0.7	2.1081	2.5	0.1949	2.5	0.96	1148	26	1151	18	1158	14	1158	14	99

809002-163	87	118750	2.2	12.7291	1.2	2.1377	2.7	0.1974	2.4	0.89	1161	26	1161	19	1161	25	1161	25	100
809002-44	196	80351	2.5	12.7265	0.6	2.0763	1.5	0.1916	1.4	0.92	1130	15	1141	11	1161	12	1161	12	97
809002-89	68	73407	2.2	12.7170	1.4	2.0863	2.5	0.1924	2.0	0.82	1134	21	1144	17	1163	28	1163	28	98
809002-190	305	168107	2.9	12.7093	0.6	2.0697	2.1	0.1908	1.9	0.95	1126	20	1139	14	1164	13	1164	13	97
809002-101	164	276592	3.7	12.6852	0.8	2.1279	2.7	0.1958	2.6	0.95	1153	28	1158	19	1168	17	1168	17	99
809002-62	116	59596	2.6	12.6844	1.4	1.8287	3.0	0.1682	2.6	0.88	1002	24	1056	20	1168	29	1168	29	86
809002-69	135	175449	4.2	12.6839	1.0	2.1258	1.8	0.1956	1.4	0.81	1151	15	1157	12	1168	21	1168	21	99
809002-173	170	338905	6.6	12.6772	0.7	2.1373	1.5	0.1965	1.3	0.87	1157	14	1161	10	1169	14	1169	14	99
809002-25	531	1039096	4.6	12.6770	0.3	2.1556	2.2	0.1982	2.1	0.99	1166	23	1167	15	1169	5	1169	5	100
809002-26	163	128636	2.2	12.6755	0.9	2.0984	1.6	0.1929	1.3	0.82	1137	14	1148	11	1169	18	1169	18	97
809002-145	195	450009	2.9	12.6748	0.5	2.1066	1.5	0.1937	1.5	0.95	1141	15	1151	11	1170	10	1170	10	98
809002-139	182	163946	5.5	12.6733	1.0	2.1649	2.8	0.1990	2.6	0.94	1170	28	1170	20	1170	19	1170	19	100
809002-103	75	52707	3.0	12.6580	1.9	2.0878	3.5	0.1917	3.0	0.85	1130	31	1145	24	1172	37	1172	37	96
809002-2	446	527601	4.3	12.6491	0.2	2.1829	2.5	0.2003	2.5	1.00	1177	27	1176	18	1174	5	1174	5	100
809002-60	85	46723	4.0	12.6376	1.6	2.1616	2.0	0.1981	1.3	0.64	1165	14	1169	14	1175	31	1175	31	99
809002-132	106	164158	3.2	12.6321	1.1	2.1114	2.7	0.1934	2.5	0.92	1140	26	1153	19	1176	21	1176	21	97
809002-151	148	157502	4.1	12.6128	0.9	2.1479	1.5	0.1965	1.3	0.83	1156	13	1164	11	1179	17	1179	17	98
809002-133	338	1055610	5.0	12.6062	0.4	2.1213	3.7	0.1940	3.7	0.99	1143	39	1156	26	1180	9	1180	9	97
809002-167	679	908719	2.8	12.6018	0.2	2.1982	1.8	0.2009	1.8	0.99	1180	19	1180	12	1181	4	1181	4	100
809002-119	30	43427	5.9	12.5648	3.3	2.0945	4.5	0.1909	3.1	0.69	1126	32	1147	31	1187	64	1187	64	95
809002-115	115	72889	2.2	12.5259	1.4	2.1323	2.2	0.1937	1.7	0.77	1141	18	1159	15	1193	28	1193	28	96
809002-110	35	71416	2.8	12.5208	4.5	2.1541	4.7	0.1956	1.5	0.32	1152	16	1166	33	1194	89	1194	89	96
809002-97	424	567990	3.7	12.1011	0.3	2.3362	2.2	0.2050	2.1	0.99	1202	23	1223	15	1261	6	1261	6	95
809002-22	224	155694	3.4	12.0786	0.4	2.4794	2.5	0.2172	2.4	0.99	1267	28	1266	18	1264	7	1264	7	100

SAMPLE 0909001 SYKESVILLE FORMATION NORTH (39.36272 °N, 76.96720 °W)

909001-158	106	27296	3.4	17.4792	6.4	0.6032	7.2	0.0765	3.3	0.46	475	15	479	27	500	140	475	15	NA
909001-128	162	27357	1.7	17.0149	2.8	0.6953	3.7	0.0858	2.5	0.67	531	13	536	16	559	60	531	13	95
909001-42	115	38435	2.7	16.7522	3.6	0.7094	4.2	0.0862	2.2	0.52	533	11	544	18	592	77	533	11	90
909001-186	136	38911	1.4	16.9889	2.1	0.7254	3.9	0.0894	3.3	0.84	552	17	554	17	562	47	552	17	98
909001-33	233	32136	1.5	16.5873	2.3	0.7879	3.7	0.0948	2.9	0.78	584	16	590	16	614	49	584	16	95

909001-73	113	53714	2.9	16.4005	4.7	0.8063	4.9	0.0959	1.6	0.32	590	9	600	22	638	101	590	9	92
909001-157	172	79786	2.3	16.6019	1.7	0.8066	3.1	0.0971	2.6	0.83	598	15	601	14	612	37	598	15	98
909001-18	67	59724	2.4	14.0443	3.3	1.5882	3.6	0.1618	1.5	0.41	967	13	966	23	963	68	963	68	100
909001-194	416	1007049	3.3	13.7933	0.5	1.6963	3.5	0.1697	3.5	0.99	1010	33	1007	22	1000	10	1000	10	101
909001-102	876	58913	6.4	13.7053	0.2	1.5441	2.1	0.1535	2.1	1.00	920	18	948	13	1013	4	1013	4	91
909001-13	71	50316	3.7	13.6962	2.7	1.6680	3.6	0.1657	2.4	0.67	988	22	996	23	1014	54	1014	54	97
909001-117	474	556188	6.7	13.6722	0.3	1.6101	1.9	0.1597	1.9	0.99	955	17	974	12	1018	6	1018	6	94
909001-151	106	132703	1.2	13.6680	1.5	1.7261	2.1	0.1711	1.5	0.71	1018	14	1018	14	1018	30	1018	30	100
909001-26	79	23567	4.3	13.6451	3.2	1.6463	3.7	0.1629	1.9	0.52	973	18	988	24	1022	64	1022	64	95
909001-176	596	604725	2.0	13.5168	0.3	1.7881	1.5	0.1753	1.4	0.97	1041	14	1041	10	1041	7	1041	7	100
909001-67	364	706740	5.3	13.5082	0.5	1.7622	2.5	0.1726	2.5	0.98	1027	24	1032	16	1042	10	1042	10	99
909001-25	177	175027	4.1	13.5057	1.5	1.7778	3.0	0.1741	2.5	0.86	1035	24	1037	19	1043	31	1043	31	99
909001-96	154	108408	1.4	13.4771	1.8	1.8537	4.5	0.1812	4.2	0.92	1073	42	1065	30	1047	35	1047	35	103
909001-87	737	529991	8.6	13.4219	0.3	1.8299	2.1	0.1781	2.1	0.99	1057	20	1056	14	1055	5	1055	5	100
909001-100	104	75550	3.2	13.4163	1.9	1.7439	3.3	0.1697	2.8	0.83	1010	26	1025	22	1056	37	1056	37	96
909001-53	67	79723	0.8	13.4033	1.7	1.8731	2.3	0.1821	1.6	0.68	1078	16	1072	15	1058	34	1058	34	102
909001-19	130	97340	2.9	13.3814	1.3	1.9271	2.4	0.1870	2.0	0.84	1105	20	1091	16	1061	26	1061	26	104
909001-152	499	1887461	5.6	13.3384	0.3	1.8487	2.2	0.1788	2.2	0.99	1061	21	1063	14	1068	6	1068	6	99
909001-70	509	153302	4.9	13.3344	0.6	1.7320	1.6	0.1675	1.4	0.93	998	13	1021	10	1068	11	1068	11	93
909001-121	120	115480	3.3	13.3246	1.2	1.7539	3.2	0.1695	3.0	0.93	1009	28	1029	21	1070	23	1070	23	94
909001-133	147	259333	5.8	13.3141	0.9	1.8682	4.2	0.1804	4.1	0.97	1069	40	1070	28	1071	19	1071	19	100
909001-36	28	21963	1.3	13.3038	2.8	1.8194	3.9	0.1756	2.7	0.70	1043	26	1052	26	1073	56	1073	56	97
909001-17	307	660734	7.8	13.2973	0.5	1.8005	2.3	0.1736	2.2	0.98	1032	21	1046	15	1074	10	1074	10	96
909001-198	64	35634	3.8	13.2833	1.5	1.7767	2.6	0.1712	2.1	0.81	1019	20	1037	17	1076	31	1076	31	95
909001-155	234	71126	4.4	13.2649	0.9	1.7128	4.0	0.1648	3.9	0.97	983	36	1013	26	1079	18	1079	18	91
909001-21	159	135982	12.6	13.2523	1.4	1.8228	2.4	0.1752	1.9	0.80	1041	18	1054	16	1081	29	1081	29	96
909001-129	450	564681	5.1	13.2489	0.7	1.9244	4.1	0.1849	4.0	0.99	1094	40	1090	27	1081	14	1081	14	101
909001-35	32	75965	1.3	13.2307	4.1	1.9043	5.3	0.1827	3.4	0.65	1082	34	1083	35	1084	81	1084	81	100
909001-37	46	64845	3.4	13.1927	2.4	1.8574	4.3	0.1777	3.6	0.83	1055	35	1066	28	1090	47	1090	47	97
909001-61	675	630670	3.0	13.1786	0.3	1.9477	1.7	0.1862	1.7	0.98	1101	17	1098	12	1092	7	1092	7	101
909001-172	506	358858	2.6	13.1492	0.3	1.9282	2.6	0.1839	2.6	0.99	1088	26	1091	18	1096	7	1096	7	99
909001-88	137	235037	1.9	13.1110	1.7	1.8968	6.1	0.1804	5.9	0.96	1069	58	1080	41	1102	34	1102	34	97

909001-120	59	86064	1.9	13.1035	2.3	1.9500	3.5	0.1853	2.6	0.75	1096	27	1098	24	1103	46	1103	46	99
909001-57	49	30324	1.5	13.1014	1.9	2.0495	2.8	0.1947	2.0	0.73	1147	21	1132	19	1104	38	1104	38	104
909001-108	56	89488	1.4	13.0988	1.4	1.9460	2.9	0.1849	2.6	0.87	1094	26	1097	20	1104	28	1104	28	99
909001-4	111	72478	2.6	13.0626	1.2	1.9634	3.4	0.1860	3.2	0.94	1100	33	1103	23	1110	23	1110	23	99
909001-27	303	178719	2.2	13.0611	0.5	1.9475	3.2	0.1845	3.1	0.99	1091	31	1098	21	1110	11	1110	11	98
909001-8	85	46000	2.0	12.9142	1.7	2.1136	3.8	0.1980	3.4	0.89	1164	37	1153	26	1132	34	1132	34	103
909001-204	124	110621	2.7	12.9002	1.1	1.8468	3.1	0.1728	2.9	0.94	1027	28	1062	21	1135	22	1135	22	91
909001-85	59	71127	2.7	12.8557	2.4	2.1274	3.8	0.1984	3.0	0.78	1166	32	1158	26	1141	48	1141	48	102
909001-160	125	158347	2.3	12.8383	1.7	2.0443	2.8	0.1904	2.2	0.80	1123	23	1130	19	1144	33	1144	33	98
909001-181	537	128770	3.2	12.8312	0.4	1.9501	1.3	0.1815	1.2	0.96	1075	12	1098	8	1145	7	1145	7	94
909001-38	144	142335	2.5	12.8234	0.6	2.1029	2.8	0.1956	2.8	0.98	1151	29	1150	20	1146	12	1146	12	100
909001-60	139	119400	2.3	12.7653	0.9	2.0837	2.7	0.1929	2.6	0.94	1137	27	1143	19	1155	18	1155	18	98
909001-80	555	531897	2.2	12.7536	0.3	2.0369	1.9	0.1884	1.9	0.99	1113	19	1128	13	1157	5	1157	5	96
909001-150	141	244450	1.8	12.7265	1.2	2.0788	1.8	0.1919	1.4	0.77	1132	15	1142	12	1161	23	1161	23	97
909001-189	488	681045	3.1	12.7077	0.2	2.1433	2.4	0.1975	2.4	1.00	1162	26	1163	17	1164	4	1164	4	100
909001-178	360	568318	1.9	12.7060	0.3	2.1939	1.0	0.2022	1.0	0.95	1187	11	1179	7	1165	6	1165	6	102
909001-132	45	34549	1.7	12.6568	3.3	2.1337	4.0	0.1959	2.3	0.57	1153	24	1160	28	1172	66	1172	66	98
909001-104	82	70410	2.3	12.6553	0.9	2.1747	2.1	0.1996	1.9	0.90	1173	20	1173	14	1173	18	1173	18	100
909001-170	200	153135	1.4	12.5810	0.6	2.2369	2.4	0.2041	2.3	0.96	1197	25	1193	17	1184	13	1184	13	101
909001-113	99	70841	2.0	12.5642	1.2	2.2060	2.0	0.2010	1.6	0.81	1181	18	1183	14	1187	24	1187	24	99
909001-24	160	160035	3.9	12.5450	0.7	2.1266	2.9	0.1935	2.8	0.97	1140	29	1157	20	1190	13	1190	13	96
909001-191	146	251780	1.9	12.5141	0.9	2.2469	2.5	0.2039	2.3	0.93	1196	25	1196	18	1195	18	1195	18	100
909001-66	378	90268	1.8	12.5096	0.6	2.1948	2.7	0.1991	2.7	0.98	1171	28	1179	19	1195	12	1195	12	98
909001-149	129	165966	5.2	12.4041	1.4	2.0856	5.0	0.1876	4.8	0.96	1109	49	1144	34	1212	27	1212	27	91
909001-46	50	50946	2.1	12.2683	1.5	2.3728	2.5	0.2111	2.0	0.80	1235	22	1234	18	1234	29	1234	29	100
909001-95	45	63753	3.0	12.2265	2.2	2.3899	3.3	0.2119	2.5	0.76	1239	29	1240	24	1240	43	1240	43	100
909001-205	72	32203	1.9	12.1772	2.8	2.2440	6.4	0.1982	5.7	0.90	1166	61	1195	45	1248	55	1248	55	93
909001-126	63	114850	2.5	12.1761	1.7	2.4155	2.5	0.2133	1.8	0.74	1246	21	1247	18	1249	33	1249	33	100
909001-1	179	65874	2.2	12.1697	0.4	2.2540	2.2	0.1989	2.2	0.99	1170	23	1198	16	1250	7	1250	7	94
909001-98	99	66339	2.2	12.1132	1.0	2.5060	2.4	0.2202	2.2	0.91	1283	26	1274	18	1259	20	1259	20	102
909001-15	171	70004	2.8	12.0500	0.9	2.4228	4.2	0.2117	4.1	0.97	1238	46	1249	30	1269	18	1269	18	98
909001-72	191	212575	2.4	12.0151	0.8	2.4552	1.7	0.2139	1.5	0.88	1250	17	1259	12	1275	16	1275	16	98

909001-116	298	150831	1.9	11.9624	0.6	2.2033	3.9	0.1912	3.8	0.99	1128	39	1182	27	1283	13	1283	13	88
909001-30	198	103961	3.1	11.9412	0.4	2.5731	2.4	0.2228	2.4	0.98	1297	28	1293	18	1287	9	1287	9	101
909001-82	465	432696	3.6	11.9321	0.2	2.5731	2.7	0.2227	2.7	1.00	1296	32	1293	20	1288	4	1288	4	101
909001-11	123	10394	4.3	11.7909	1.5	2.0000	4.1	0.1710	3.8	0.93	1018	36	1116	28	1311	29	1311	29	78
909001-94	20	26745	2.4	11.7194	4.2	2.5829	5.2	0.2195	3.1	0.59	1279	36	1296	38	1323	82	1323	82	97
909001-92	274	616436	2.4	11.7133	0.3	2.7146	2.4	0.2306	2.4	0.99	1338	29	1332	18	1324	6	1324	6	101
909001-89	196	283645	2.9	11.7045	0.6	2.7060	1.8	0.2297	1.7	0.95	1333	20	1330	13	1325	11	1325	11	101
909001-62	147	185099	2.7	11.6836	0.6	2.5032	3.1	0.2121	3.0	0.98	1240	34	1273	22	1329	12	1329	12	93
909001-138	136	353600	4.5	11.6617	0.8	2.6962	2.6	0.2280	2.5	0.95	1324	30	1327	19	1333	16	1333	16	99
909001-76	123	107277	3.1	11.6388	0.4	2.7833	2.9	0.2349	2.8	0.99	1360	35	1351	21	1336	8	1336	8	102
909001-148	207	212092	2.1	11.6260	0.8	2.7374	2.8	0.2308	2.7	0.96	1339	33	1339	21	1338	16	1338	16	100
909001-44	194	233779	3.9	11.6046	0.8	2.7997	1.9	0.2356	1.7	0.91	1364	21	1355	14	1342	15	1342	15	102
909001-114	186	326936	2.6	11.6046	0.7	2.7788	2.8	0.2339	2.8	0.97	1355	34	1350	21	1342	13	1342	13	101
909001-124	75	96884	2.4	11.5923	0.9	2.5728	4.6	0.2163	4.5	0.98	1262	52	1293	34	1344	18	1344	18	94
909001-197	73	65034	1.4	11.5904	1.2	2.7040	2.9	0.2273	2.6	0.91	1320	32	1330	21	1344	23	1344	23	98
909001-145	189	216979	3.1	11.5538	0.8	2.6467	3.7	0.2218	3.6	0.97	1291	43	1314	27	1351	16	1351	16	96
909001-99	209	47509	3.5	11.5531	1.2	2.2782	9.4	0.1909	9.3	0.99	1126	96	1206	66	1351	23	1351	23	83
909001-29	27	21204	2.5	11.5259	3.5	2.8277	3.9	0.2364	1.9	0.48	1368	23	1363	30	1355	67	1355	67	101
909001-51	56	77002	2.4	11.5070	1.3	2.8690	2.2	0.2394	1.8	0.83	1384	23	1374	17	1358	24	1358	24	102
909001-20	98	102802	1.2	11.4933	1.0	2.7724	2.5	0.2311	2.3	0.92	1340	28	1348	18	1361	19	1361	19	99
909001-182	227	423787	1.4	11.4822	0.6	2.7193	1.7	0.2265	1.7	0.95	1316	20	1334	13	1362	11	1362	11	97
909001-107	157	325265	3.4	11.4624	0.6	2.8380	2.0	0.2359	1.9	0.95	1366	24	1366	15	1366	12	1366	12	100
909001-12	150	194733	2.3	11.4397	0.7	2.8935	2.9	0.2401	2.8	0.97	1387	35	1380	22	1370	14	1370	14	101
909001-55	103	186754	2.5	11.4388	1.4	2.9233	2.8	0.2425	2.5	0.88	1400	31	1388	21	1370	26	1370	26	102
909001-65	126	128569	0.7	11.3997	0.9	2.6987	2.7	0.2231	2.6	0.95	1298	30	1328	20	1376	17	1376	17	94
909001-162	360	88487	2.3	11.3974	0.5	2.3498	4.6	0.1942	4.6	0.99	1144	48	1228	33	1377	10	1377	10	83
909001-165	187	107946	1.8	11.3910	0.4	2.7846	2.0	0.2301	2.0	0.97	1335	24	1351	15	1378	9	1378	9	97
909001-166	80	61311	1.1	11.3815	0.9	2.7199	3.2	0.2245	3.1	0.96	1306	36	1334	24	1379	18	1379	18	95
909001-115	227	396072	0.8	11.3784	0.6	2.9143	1.5	0.2405	1.4	0.92	1389	18	1386	12	1380	11	1380	11	101
909001-84	116	129705	1.7	11.3780	0.8	2.9162	1.3	0.2406	1.1	0.81	1390	14	1386	10	1380	15	1380	15	101
909001-173	109	182037	1.2	11.3726	1.1	2.8984	2.2	0.2391	2.0	0.88	1382	24	1382	17	1381	20	1381	20	100
909001-14	143	164218	1.3	11.3598	0.7	2.8699	3.0	0.2364	2.9	0.97	1368	36	1374	23	1383	13	1383	13	99

909001-86	67	63610	1.9	11.3502	0.7	2.9437	2.3	0.2423	2.1	0.95	1399	27	1393	17	1385	14	1385	14	101
909001-131	116	63190	1.0	11.3284	0.9	2.8171	3.7	0.2315	3.6	0.97	1342	43	1360	28	1388	17	1388	17	97
909001-47	155	151978	3.6	11.3281	0.8	2.5637	2.3	0.2106	2.1	0.94	1232	24	1290	17	1388	15	1388	15	89
909001-137	67	46207	2.7	11.3020	3.4	2.8470	5.2	0.2334	4.0	0.77	1352	49	1368	39	1393	65	1393	65	97
909001-118	44	43287	3.1	11.2955	2.5	2.9964	3.4	0.2455	2.3	0.69	1415	30	1407	26	1394	48	1394	48	102
909001-146	174	365121	2.9	11.2758	1.6	2.9775	1.9	0.2435	0.9	0.49	1405	11	1402	14	1397	31	1397	31	101
909001-48	396	46872	2.7	11.1809	1.0	2.6209	4.2	0.2125	4.1	0.97	1242	46	1307	31	1414	20	1414	20	88
909001-54	216	190799	4.2	11.1630	0.5	3.0470	1.4	0.2467	1.4	0.94	1421	17	1419	11	1417	9	1417	9	100
909001-7A	57	114150	3.7	11.0446	2.0	3.1204	3.2	0.2500	2.6	0.79	1438	33	1438	25	1437	38	1437	38	100
909001-140	50	41891	1.6	11.0415	1.7	2.9733	4.5	0.2381	4.2	0.93	1377	52	1401	35	1437	33	1437	33	96
909001-190	344	184358	2.9	11.0393	0.4	3.1082	2.3	0.2489	2.2	0.98	1433	29	1435	17	1438	8	1438	8	100
909001-164	542	194728	1.9	10.9922	0.3	3.1458	2.2	0.2508	2.1	0.99	1443	28	1444	17	1446	6	1446	6	100
909001-10	65	63335	1.9	10.9789	0.9	3.2891	2.1	0.2619	1.9	0.90	1500	25	1478	16	1448	17	1448	17	104
909001-142	167	179839	2.3	10.9615	0.6	3.0899	4.0	0.2456	4.0	0.99	1416	50	1430	31	1451	11	1451	11	98
909001-3	110	88622	2.6	10.9535	0.5	3.1934	2.3	0.2537	2.2	0.98	1457	29	1456	18	1453	9	1453	9	100
909001-79	603	861004	5.9	10.9308	0.2	3.0628	2.5	0.2428	2.5	1.00	1401	31	1423	19	1457	4	1457	4	96
909001-154	621	93937	2.6	10.9286	0.7	3.2734	2.9	0.2595	2.8	0.97	1487	37	1475	22	1457	14	1457	14	102
909001-110	93	153676	3.8	10.9144	1.0	3.1859	1.5	0.2522	1.0	0.72	1450	14	1454	11	1460	19	1460	19	99
909001-90	130	160490	2.4	10.9131	0.8	3.2783	2.9	0.2595	2.8	0.96	1487	37	1476	23	1460	16	1460	16	102
909001-171	330	470857	2.3	10.9050	0.4	3.1276	1.9	0.2474	1.9	0.98	1425	24	1439	15	1461	8	1461	8	98
909001-195	175	174831	1.7	10.9049	0.6	3.0872	4.1	0.2442	4.0	0.99	1408	51	1430	31	1461	11	1461	11	96
909001-193	480	494736	1.6	10.8980	0.2	3.1640	2.2	0.2501	2.2	1.00	1439	28	1448	17	1462	4	1462	4	98
909001-188	163	510875	1.5	10.8831	0.9	3.2394	2.2	0.2557	2.0	0.90	1468	26	1467	17	1465	18	1465	18	100
909001-16	194	346986	3.0	10.8785	0.6	3.1399	1.4	0.2477	1.2	0.91	1427	16	1443	11	1466	10	1466	10	97
909001-49	338	480758	1.8	10.8742	0.4	3.2582	1.6	0.2570	1.5	0.97	1474	20	1471	12	1467	8	1467	8	101
909001-106	117	124756	1.9	10.8622	0.5	3.2153	2.3	0.2533	2.2	0.97	1455	29	1461	18	1469	10	1469	10	99
909001-58	169	239300	1.8	10.8592	0.6	3.2169	2.5	0.2534	2.5	0.98	1456	32	1461	20	1469	10	1469	10	99
909001-5	517	498481	2.5	10.8491	0.3	3.2820	1.9	0.2582	1.9	0.99	1481	25	1477	15	1471	6	1471	6	101
909001-59	79	138918	2.3	10.8463	1.0	3.3183	2.9	0.2610	2.7	0.94	1495	36	1485	23	1471	19	1471	19	102
909001-167	95	71692	2.0	10.8336	0.8	3.3309	3.5	0.2617	3.4	0.97	1499	45	1488	27	1474	15	1474	15	102
909001-56	142	656761	1.7	10.8022	0.6	3.3136	4.8	0.2596	4.7	0.99	1488	63	1484	37	1479	11	1479	11	101
909001-153	560	1080759	1.2	10.8014	0.3	3.3428	3.2	0.2619	3.1	1.00	1499	42	1491	25	1479	5	1479	5	101

909001-203	257	564265	1.1	10.7844	0.5	3.2120	1.3	0.2512	1.1	0.91	1445	15	1460	10	1482	10	1482	10	97
909001-177	347	78067	2.6	10.7736	0.5	3.0196	2.6	0.2359	2.6	0.98	1366	32	1413	20	1484	10	1484	10	92
909001-28	161	148289	2.0	10.7684	0.3	3.2865	1.5	0.2567	1.5	0.98	1473	19	1478	12	1485	5	1485	5	99
909001-143	355	641408	1.7	10.7442	0.4	3.2713	1.2	0.2549	1.1	0.95	1464	14	1474	9	1489	7	1489	7	98
909001-147	120	206788	3.5	10.6966	1.2	2.7381	2.5	0.2124	2.2	0.88	1242	25	1339	19	1498	22	1498	22	83
909001-77	139	220969	2.1	10.6938	0.3	3.2978	2.1	0.2558	2.1	0.99	1468	27	1481	16	1498	6	1498	6	98
909001-169	337	46302	2.8	10.5181	0.4	3.3537	2.4	0.2558	2.3	0.99	1469	31	1494	18	1530	7	1530	7	96
909001-7	92	89539	1.7	10.4153	1.4	3.3475	2.9	0.2529	2.6	0.87	1453	33	1492	23	1548	27	1548	27	94
909001-64	196	52599	2.0	10.1408	0.7	3.4586	3.6	0.2544	3.6	0.98	1461	47	1518	29	1598	13	1598	13	91
909001-134	245	229110	2.3	9.9820	0.6	4.0380	5.7	0.2923	5.6	0.99	1653	82	1642	46	1627	12	1627	12	102
909001-9	448	372487	2.2	9.9685	0.2	3.8191	4.2	0.2761	4.2	1.00	1572	59	1597	34	1630	3	1630	3	96
909001-199	454	473882	1.1	9.9450	0.3	3.9937	2.7	0.2881	2.7	0.99	1632	39	1633	22	1634	5	1634	5	100
909001-139	145	149694	1.3	9.8528	0.6	4.0322	2.7	0.2881	2.6	0.97	1632	38	1641	22	1652	12	1652	12	99
909001-168	52	89558	1.6	9.8471	1.7	4.0800	3.7	0.2914	3.3	0.89	1648	48	1650	30	1653	32	1653	32	100
909001-184	186	262456	1.1	9.6832	0.2	4.0865	2.1	0.2870	2.1	0.99	1626	31	1652	18	1684	4	1684	4	97
909001-187	174	226866	1.3	9.6535	0.5	4.3627	3.2	0.3055	3.2	0.99	1718	48	1705	27	1689	10	1689	10	102
909001-31	200	44366	1.6	9.4974	0.4	4.3537	2.6	0.2999	2.6	0.99	1691	39	1704	22	1719	7	1719	7	98
909001-156	55	88262	1.1	9.1273	1.2	4.6019	2.2	0.3046	1.8	0.82	1714	27	1750	18	1792	23	1792	23	96
909001-112	105	197725	1.2	9.0512	0.4	5.0219	2.1	0.3297	2.1	0.98	1837	33	1823	18	1807	8	1807	8	102
909001-2	257	400612	5.9	8.9881	0.3	4.9552	2.6	0.3230	2.6	0.99	1804	41	1812	22	1820	5	1820	5	99
909001-192	311	582345	1.2	8.6490	0.3	5.1964	1.8	0.3260	1.8	0.98	1819	28	1852	15	1890	6	1890	6	96
909001-136	191	317089	0.6	8.1090	0.4	6.0037	3.2	0.3531	3.1	0.99	1949	53	1976	28	2005	7	2005	7	97
909001-109	353	456141	0.9	5.5396	0.2	12.1738	1.8	0.4891	1.8	0.99	2567	38	2618	17	2658	3	2658	3	97
909001-179	267	136498	1.7	5.4213	0.3	11.9687	1.7	0.4706	1.7	0.99	2486	34	2602	16	2693	5	2693	5	92
909001-119	107	317317	4.4	5.3413	0.3	11.9832	2.9	0.4642	2.9	1.00	2458	59	2603	27	2718	4	2718	4	90
909001-97	106	380165	1.8	5.2748	0.3	13.4855	1.5	0.5159	1.5	0.99	2682	33	2714	14	2739	4	2739	4	98
909001-78	45	73163	1.6	5.0321	0.5	15.0043	3.0	0.5476	3.0	0.98	2815	68	2816	29	2816	9	2816	9	100
909001-159	133	475435	2.7	4.9413	0.3	15.3300	2.2	0.5494	2.2	0.99	2823	49	2836	21	2845	4	2845	4	99

SAMPLE 0909003 SYKESVILLE FORMATION SOUTH (38.93209 °N, 77.11639 °W)

909003_26-44	124	44712	1.8	17.2940	3.0	0.6993	3.4	0.0877	1.6	0.47	542	8	538	14	523	65	542	8	101

909003_26-43	111	51392	1.8	16.8076	3.7	0.7770	4.3	0.0947	2.3	0.53	583	13	584	19	585	80	583	13	84
909003_24-146	127	50715	2.0	16.2617	2.4	0.9150	3.1	0.1079	2.0	0.64	661	12	660	15	657	51	661	12	100
909003_24-11	192	51652	90.6	14.1780	1.1	1.2702	8.4	0.1306	8.3	0.99	791	62	832	48	944	22	944	22	102
909003_24-30	114	83687	2.3	14.1711	2.8	1.5434	5.3	0.1586	4.6	0.86	949	40	948	33	945	56	945	56	105
909003_26-37	104	87496	1.8	13.9878	1.7	1.5843	3.4	0.1607	2.9	0.86	961	26	964	21	971	35	971	35	100
909003_26-52	127	158507	2.3	13.9353	1.3	1.6012	1.9	0.1618	1.3	0.70	967	12	971	12	979	27	979	27	101
909003_24-64	746	272813	7.0	13.9200	1.7	1.6596	6.0	0.1675	5.7	0.96	999	53	993	38	981	35	981	35	100
909003_24-40	116	43350	1.1	13.8910	4.0	1.7238	6.2	0.1737	4.7	0.76	1032	45	1017	40	986	81	986	81	96
909003_24-188	364	275461	2.5	13.8488	0.7	1.6635	2.8	0.1671	2.7	0.97	996	25	995	18	992	14	992	14	96
909003_24-12	171	88717	1.5	13.7718	2.4	1.7073	7.5	0.1705	7.1	0.95	1015	67	1011	48	1003	50	1003	50	98
909003_24-122	301	201133	2.3	13.7652	1.1	1.6944	4.5	0.1692	4.4	0.97	1007	41	1006	29	1004	22	1004	22	104
909003_24-82	331	161337	1.5	13.7651	1.1	1.6222	3.4	0.1620	3.2	0.95	968	29	979	21	1004	22	1004	22	103
909003_24-150	164	274612	2.5	13.7459	2.1	1.6305	5.8	0.1626	5.4	0.93	971	49	982	37	1007	43	1007	43	97
909003_24-85	167	53040	2.0	13.7443	1.3	1.6653	5.8	0.1660	5.7	0.98	990	52	995	37	1007	25	1007	25	100
909003_24-14	1368	1202427	5.9	13.7435	0.2	1.7790	2.8	0.1773	2.8	1.00	1052	27	1038	18	1007	4	1007	4	98
909003_24-118	210	231185	2.8	13.6985	0.9	1.7772	5.1	0.1766	5.1	0.98	1048	49	1037	33	1014	18	1014	18	99
909003_26-65	325	407081	3.2	13.6928	0.4	1.7335	1.6	0.1722	1.5	0.97	1024	15	1021	10	1015	8	1015	8	101
909003_24-31	66	38030	1.3	13.6709	3.4	1.6712	6.3	0.1657	5.3	0.84	988	48	998	40	1018	68	1018	68	92
909003_24-109	197	141777	2.0	13.6653	1.1	1.7267	2.8	0.1711	2.6	0.92	1018	24	1019	18	1019	23	1019	23	93
909003_24-58	80	73820	1.3	13.6630	2.4	1.6916	4.8	0.1676	4.2	0.86	999	39	1005	31	1019	49	1019	49	99
909003_26-59	93	103078	3.2	13.6562	1.7	1.7377	2.4	0.1721	1.7	0.69	1024	16	1023	16	1020	35	1020	35	99
909003_24-141	52	13583	4.7	13.6553	4.8	1.7054	7.4	0.1689	5.7	0.76	1006	53	1011	48	1020	98	1020	98	101
909003_24-143	149	86469	4.0	13.6487	1.4	1.7612	3.6	0.1743	3.3	0.92	1036	31	1031	23	1021	29	1021	29	100
909003_24-43	179	21771	4.1	13.6078	1.3	1.6022	5.5	0.1581	5.3	0.97	946	47	971	34	1027	26	1027	26	97
909003_26-5	148	140768	1.0	13.6007	1.2	1.7142	2.4	0.1691	2.0	0.85	1007	19	1014	15	1028	25	1028	25	98
909003_24-107	74	38488	1.8	13.5793	3.3	1.6330	8.6	0.1608	8.0	0.92	961	71	983	54	1032	67	1032	67	97
909003_24-25	149	96482	2.7	13.5693	2.5	1.7548	8.2	0.1727	7.9	0.95	1027	75	1029	53	1033	50	1033	50	98
909003_24-117	128	72998	2.8	13.5626	2.4	1.7498	5.1	0.1721	4.6	0.89	1024	43	1027	33	1034	48	1034	48	100
909003_24-74	94	48533	1.6	13.5518	1.8	1.7922	5.4	0.1762	5.1	0.94	1046	49	1043	35	1036	36	1036	36	102
909003_26-31	134	104608	3.4	13.5496	0.8	1.7121	2.2	0.1683	2.0	0.93	1002	19	1013	14	1036	16	1036	16	99
909003_24-119	570	263589	4.6	13.5070	0.9	1.7955	4.1	0.1759	4.0	0.98	1044	39	1044	27	1042	18	1042	18	100
909003_24-151	90	47661	2.5	13.4951	3.1	1.7397	8.0	0.1703	7.4	0.92	1014	69	1023	51	1044	62	1044	62	103

909003_26-25	265	292263	3.8	13.4101	1.0	1.8149	2.5	0.1765	2.3	0.91	1048	22	1051	16	1057	21	1057	21	101
909003_26-7	46	45857	1.1	13.3782	2.7	1.9022	3.0	0.1846	1.5	0.48	1092	15	1082	20	1062	53	1062	53	96
909003_24-35	243	180923	1.5	13.2881	1.0	1.8497	6.1	0.1783	6.0	0.99	1057	59	1063	40	1075	19	1075	19	95
909003_24-92	289	75664	8.1	13.2697	1.0	1.8215	3.3	0.1753	3.1	0.95	1041	30	1053	22	1078	21	1078	21	98
909003_24-84	179	81945	1.4	13.2675	1.0	1.8448	3.5	0.1775	3.4	0.96	1053	33	1062	23	1078	20	1078	20	100
909003_24-18	56	28277	0.9	13.2406	4.0	1.8963	4.5	0.1821	2.1	0.46	1078	21	1080	30	1082	81	1082	81	98
909003_24-101	94	177070	1.8	13.2086	1.2	1.9564	4.0	0.1874	3.8	0.95	1107	39	1101	27	1087	24	1087	24	100
909003_24-61	190	127776	0.9	13.1803	1.5	1.9037	2.4	0.1820	1.8	0.77	1078	18	1082	16	1092	30	1092	30	93
909003_24-60	519	1100538	2.4	13.1799	0.3	1.9399	3.0	0.1854	2.9	1.00	1097	30	1095	20	1092	5	1092	5	96
909003_24-37	580	740270	5.7	13.1741	0.7	1.9969	4.0	0.1908	4.0	0.98	1126	41	1114	27	1093	15	1093	15	96
909003_24-23	694	207579	3.2	13.1641	1.7	1.9592	8.9	0.1871	8.7	0.98	1105	88	1102	60	1094	33	1094	33	101
909003_26-2	113	48168	2.6	13.1071	1.5	1.8726	2.3	0.1780	1.8	0.76	1056	17	1071	15	1103	30	1103	30	98
909003_24-41	194	57419	1.1	13.0990	0.9	1.8711	2.6	0.1778	2.4	0.94	1055	24	1071	17	1104	18	1104	18	95
909003_24-93	103	163236	3.4	13.0653	2.5	1.8735	6.5	0.1775	6.0	0.92	1053	58	1072	43	1109	50	1109	50	103
909003_26-20	83	97139	3.3	13.0470	1.0	2.0298	4.3	0.1921	4.1	0.97	1133	43	1126	29	1112	20	1112	20	100
909003_24-99	151	151852	1.9	13.0252	1.7	1.9659	4.5	0.1857	4.2	0.93	1098	42	1104	30	1115	34	1115	34	101
909003_24-96	154	91134	2.7	12.9823	1.6	2.0218	2.4	0.1904	1.8	0.75	1123	19	1123	16	1122	32	1122	32	99
909003_24-123	82	36874	1.4	12.9706	2.1	1.9860	3.4	0.1868	2.7	0.79	1104	28	1111	23	1124	42	1124	42	102
909003_24-111	62	41320	1.3	12.9643	1.5	2.0328	6.3	0.1911	6.1	0.97	1128	63	1127	43	1125	29	1125	29	103
909003_26-14	232	411053	4.5	12.9619	0.7	1.8946	3.1	0.1781	3.0	0.98	1057	30	1079	21	1125	13	1125	13	98
909003_24-44	110	51219	2.1	12.9411	1.8	1.8739	6.3	0.1759	6.1	0.96	1044	58	1072	42	1128	36	1128	36	103
909003_24-140	118	137120	1.5	12.9169	1.2	1.9543	4.7	0.1831	4.5	0.96	1084	45	1100	32	1132	25	1132	25	96
909003_24-113	55	42232	1.8	12.9074	3.3	1.9595	6.6	0.1834	5.7	0.87	1086	57	1102	44	1133	66	1133	66	99
909003_24-134	71	52604	1.9	12.9070	2.5	2.0699	4.4	0.1938	3.6	0.82	1142	38	1139	30	1133	51	1133	51	97
909003_24-145	558	252405	2.5	12.9059	0.5	2.0034	3.9	0.1875	3.8	0.99	1108	39	1117	26	1134	10	1134	10	104
909003_24-165	158	83668	4.4	12.8928	2.1	1.9442	4.4	0.1818	3.8	0.87	1077	38	1096	29	1136	43	1136	43	101
909003_24-67	978	706865	5.5	12.8891	0.5	2.1199	3.1	0.1982	3.1	0.99	1166	33	1155	21	1136	10	1136	10	98
909003_24-130	117	95767	6.6	12.8767	3.0	2.0694	8.1	0.1933	7.6	0.93	1139	79	1139	56	1138	59	1138	59	87
909003_24-152	152	95596	2.9	12.8743	1.7	2.0806	5.3	0.1943	5.0	0.95	1144	52	1142	36	1139	34	1139	34	101
909003_24-88	689	94342	4.1	12.8500	0.5	2.0610	2.1	0.1921	2.0	0.97	1133	21	1136	14	1142	10	1142	10	98
909003_24-105	406	346127	1.1	12.8420	0.9	2.1192	4.5	0.1974	4.5	0.98	1161	47	1155	31	1144	17	1144	17	104
909003_24-71	234	98036	2.0	12.8289	1.2	2.1480	2.6	0.1999	2.3	0.89	1175	25	1164	18	1146	23	1146	23	97

909003_24-86	111	83126	2.4	12.8149	1.4	2.0416	4.4	0.1898	4.2	0.95	1120	43	1130	30	1148	28	1148	28	95
909003_24-95	70	54225	1.5	12.7984	2.2	2.1626	5.8	0.2007	5.4	0.92	1179	58	1169	41	1150	44	1150	44	100
909003_26-15	264	268473	2.6	12.7817	0.6	2.1346	1.4	0.1979	1.2	0.89	1164	13	1160	10	1153	12	1153	12	102
909003_24-24	187	44543	3.1	12.7799	1.8	2.0140	6.0	0.1867	5.7	0.95	1103	58	1120	41	1153	36	1153	36	102
909003_24-38	96	43743	2.9	12.7698	2.5	2.0981	3.8	0.1943	2.9	0.76	1145	30	1148	26	1155	50	1155	50	97
909003_24-137	444	126555	1.4	12.7685	0.7	2.0582	6.0	0.1906	5.9	0.99	1125	61	1135	41	1155	15	1155	15	98
909003_24-190	63	42734	1.3	12.7647	4.1	2.2199	5.9	0.2055	4.3	0.72	1205	47	1187	41	1156	81	1156	81	96
909003_24-125	106	79648	2.8	12.7524	2.7	2.1407	5.0	0.1980	4.2	0.84	1165	45	1162	35	1157	54	1157	54	102
909003_24-51	122	78108	3.2	12.7492	1.2	2.0717	6.9	0.1916	6.7	0.98	1130	70	1139	47	1158	25	1158	25	101
909003_24-175	150	104888	12.7	12.7474	2.7	1.8411	4.5	0.1702	3.5	0.79	1013	33	1060	29	1158	54	1158	54	100
909003_24-20	54	29615	0.9	12.7459	3.0	2.1526	4.1	0.1990	2.8	0.69	1170	30	1166	28	1158	59	1158	59	96
909003_24-128	521	24116	3.4	12.7356	0.8	2.0962	8.1	0.1936	8.1	1.00	1141	85	1148	56	1160	15	1160	15	100
909003_26-6	132	229021	2.9	12.7197	0.9	2.2369	3.1	0.2064	2.9	0.96	1209	32	1193	22	1163	18	1163	18	86
909003_24-156	150	67339	3.0	12.7064	0.7	2.2354	2.3	0.2060	2.2	0.95	1208	25	1192	16	1165	14	1165	14	102
909003_26-19	35	80289	1.2	12.6902	4.1	2.1791	4.8	0.2006	2.5	0.52	1178	27	1174	34	1167	82	1167	82	98
909003_24-132	257	198396	1.9	12.6861	0.7	2.0946	4.7	0.1927	4.7	0.99	1136	49	1147	33	1168	15	1168	15	101
909003_24-163	159	321839	2.2	12.6694	1.3	2.0438	5.1	0.1878	4.9	0.97	1109	50	1130	35	1170	26	1170	26	97
909003_24-90	227	185527	2.3	12.6642	0.9	2.1726	4.6	0.1995	4.5	0.98	1173	49	1172	32	1171	17	1171	17	97
909003_24-29	96	56326	6.8	12.6533	2.1	2.2196	4.1	0.2037	3.5	0.86	1195	38	1187	29	1173	42	1173	42	99
909003_24-124	378	472810	2.1	12.6463	0.4	2.2276	4.2	0.2043	4.1	0.99	1198	45	1190	29	1174	8	1174	8	99
909003_24-121	40	15594	2.5	12.6177	4.9	2.1307	5.9	0.1950	3.4	0.58	1148	36	1159	41	1178	96	1178	96	96
909003_24-102	165	97015	1.9	12.6140	1.2	2.1480	4.1	0.1965	3.9	0.95	1157	42	1164	29	1179	25	1179	25	102
909003_24-52	78	78429	2.2	12.5933	1.8	2.1134	4.3	0.1930	3.9	0.91	1138	41	1153	30	1182	35	1182	35	96
909003_24-72	76	70964	2.8	12.5871	3.1	2.2576	7.6	0.2061	7.0	0.91	1208	77	1199	54	1183	61	1183	61	94
909003_24-100	97	66320	2.6	12.5784	1.5	2.2448	2.5	0.2048	2.0	0.81	1201	22	1195	17	1185	29	1185	29	100
909003_24-171	120	83675	2.1	12.5652	1.5	2.2254	3.6	0.2028	3.2	0.91	1190	35	1189	25	1187	29	1187	29	104
909003_24-65	207	115111	1.8	12.5558	0.9	2.1347	3.7	0.1944	3.6	0.97	1145	38	1160	26	1188	18	1188	18	99
909003_24-78	276	222122	2.3	12.5483	0.8	2.2160	6.5	0.2017	6.5	0.99	1184	70	1186	46	1189	16	1189	16	91
909003_24-104	280	211133	2.4	12.5323	0.8	1.9055	4.5	0.1732	4.4	0.99	1030	42	1083	30	1192	15	1192	15	96
909003_26-41	30	11628	1.9	12.5196	2.8	1.9750	5.5	0.1793	4.8	0.87	1063	47	1107	37	1194	55	1194	55	104
909003_24-70	70	69986	2.3	12.5163	2.0	2.2901	3.8	0.2079	3.2	0.84	1218	35	1209	27	1194	40	1194	40	101
909003_24-22	39	7867	0.5	12.5118	4.4	2.1973	6.1	0.1994	4.3	0.70	1172	46	1180	43	1195	86	1195	86	98

909003_24-157	64	30406	1.9	12.5041	3.3	2.2622	5.5	0.2052	4.4	0.80	1203	49	1201	39	1196	65	1196	65	95
909003_26-53	98	53711	1.6	12.4818	1.9	2.2057	7.7	0.1997	7.5	0.97	1174	80	1183	54	1200	38	1200	38	99
909003_24-55	60	30978	2.2	12.4794	2.6	2.1872	4.7	0.1980	3.9	0.84	1164	42	1177	33	1200	51	1200	51	101
909003_24-3	121	75824	2.0	12.4582	1.8	2.1967	5.3	0.1985	5.0	0.94	1167	54	1180	37	1204	35	1204	35	98
909003_24-53	149	91923	1.6	12.4143	1.4	2.2736	2.7	0.2047	2.3	0.85	1201	25	1204	19	1211	28	1211	28	102
909003_24-142	111	53698	1.8	12.3702	2.3	2.2949	4.8	0.2059	4.2	0.87	1207	46	1211	34	1218	46	1218	46	99
909003_24-33	90	78021	3.2	12.3419	2.4	2.2206	3.4	0.1988	2.3	0.69	1169	25	1188	23	1222	48	1222	48	102
909003_24-83	108	143295	1.4	12.3304	1.7	2.3814	4.2	0.2130	3.8	0.92	1245	43	1237	30	1224	33	1224	33	102
909003_24-120	46	29360	1.7	12.3047	3.5	2.2533	6.0	0.2011	4.8	0.81	1181	52	1198	42	1228	68	1228	68	104
909003_26-64	153	254141	2.7	12.2905	0.8	2.3159	1.3	0.2064	1.0	0.75	1210	11	1217	9	1230	17	1230	17	102
909003_24-129	56	55516	1.6	12.2890	2.8	2.2100	4.6	0.1970	3.7	0.79	1159	39	1184	32	1230	56	1230	56	99
909003_24-112	135	129992	1.4	12.2179	1.4	2.3934	4.1	0.2121	3.8	0.94	1240	43	1241	29	1242	27	1242	27	99
909003_24-110	125	87944	2.5	12.0118	0.9	2.6107	2.9	0.2274	2.8	0.96	1321	33	1304	21	1275	17	1275	17	92
909003_24-114	62	85134	2.0	11.9879	2.5	2.4950	3.6	0.2169	2.6	0.72	1266	30	1271	26	1279	49	1279	49	99
909003_26-9	110	79655	2.0	11.9689	1.3	2.4504	2.7	0.2127	2.4	0.87	1243	27	1258	19	1282	25	1282	25	100
909003_24-73	35	16415	1.2	11.9247	4.6	2.3034	5.4	0.1992	2.7	0.51	1171	29	1213	38	1289	90	1289	90	102
909003_26-26	654	1451082	3.4	11.8810	0.1	2.5752	2.6	0.2219	2.6	1.00	1292	30	1294	19	1296	3	1296	3	97
909003_24-108	50	10923	1.1	11.8201	2.3	2.5041	3.2	0.2147	2.3	0.71	1254	26	1273	23	1306	44	1306	44	102
909003_26-51	86	144526	1.2	11.8099	1.1	2.5863	1.8	0.2215	1.5	0.81	1290	17	1297	13	1308	21	1308	21	104
909003_24-138	146	100591	1.2	11.7992	0.6	2.7458	7.8	0.2350	7.7	1.00	1361	95	1341	58	1310	12	1310	12	93
909003_24-27	269	22010	2.3	11.7728	1.2	2.6830	3.9	0.2291	3.7	0.95	1330	45	1324	29	1314	23	1314	23	87
909003_26-32	91	107205	2.1	11.7003	0.8	2.6787	1.2	0.2273	0.9	0.77	1320	11	1323	9	1326	15	1326	15	100
909003_24-81	152	103994	3.3	11.7003	1.1	2.6208	5.4	0.2224	5.2	0.98	1295	61	1306	39	1326	22	1326	22	103
909003_26-35	272	621472	1.2	11.6918	1.1	2.7317	2.0	0.2316	1.7	0.85	1343	21	1337	15	1328	21	1328	21	102
909003_24-98	41	25884	2.6	11.6727	2.8	2.5652	4.0	0.2172	2.8	0.71	1267	32	1291	29	1331	54	1331	54	99
909003_24-147	96	114818	2.6	11.6548	1.3	2.6801	4.1	0.2265	3.9	0.95	1316	46	1323	30	1334	24	1334	24	101
909003_26-3	172	351867	1.4	11.6538	0.5	2.6511	1.7	0.2241	1.7	0.97	1303	20	1315	13	1334	9	1334	9	100
909003_24-131	200	152121	1.8	11.6099	0.7	2.7670	3.6	0.2330	3.5	0.98	1350	43	1347	27	1341	13	1341	13	98
909003_24-8	100	60936	1.3	11.6008	1.3	2.6867	5.2	0.2260	5.0	0.97	1314	60	1325	38	1343	24	1343	24	96
909003_24-57	228	298337	2.4	11.5953	0.7	2.8063	3.6	0.2360	3.5	0.98	1366	43	1357	27	1344	13	1344	13	102
909003_26-11	73	88470	1.9	11.5713	1.7	2.6718	3.6	0.2242	3.2	0.89	1304	38	1321	27	1348	32	1348	32	100
909003_26-45	47	76880	2.2	11.5443	1.3	2.5936	1.8	0.2172	1.2	0.70	1267	14	1299	13	1352	24	1352	24	102

909003_24-75	139	29458	2.0	11.5410	1.2	2.7600	4.4	0.2310	4.2	0.96	1340	51	1345	33	1353	22	1353	22	98
909003_24-34	74	45770	1.2	11.5193	1.7	2.8574	3.3	0.2387	2.8	0.86	1380	35	1371	25	1356	32	1356	32	100
909003_24-7	112	121120	4.0	11.5148	3.5	2.8639	4.5	0.2392	2.8	0.62	1382	34	1372	34	1357	68	1357	68	105
909003_24-148	141	244661	1.5	11.4972	1.0	2.9315	5.7	0.2444	5.7	0.99	1410	72	1390	44	1360	19	1360	19	100
909003_24-133	335	206086	3.6	11.4795	0.9	2.8964	5.6	0.2411	5.5	0.99	1393	69	1381	42	1363	16	1363	16	103
909003_24-10	141	13081	3.4	11.4625	1.8	2.8150	7.7	0.2340	7.5	0.97	1356	92	1360	58	1366	34	1366	34	100
909003_24-173	125	121254	3.1	11.4498	1.4	2.8009	6.8	0.2326	6.6	0.98	1348	80	1356	51	1368	27	1368	27	93
909003_26-58	53	94643	2.0	11.4340	1.4	2.9654	2.5	0.2459	2.1	0.84	1417	27	1399	19	1371	26	1371	26	100
909003_24-46	165	89327	2.6	11.4118	1.3	2.6045	9.5	0.2156	9.4	0.99	1258	107	1302	70	1374	25	1374	25	98
909003_24-149	200	150016	3.0	11.4114	0.6	2.8491	2.2	0.2358	2.1	0.96	1365	26	1369	17	1374	12	1374	12	102
909003_24-126	158	96656	1.9	11.4107	0.5	2.8859	3.7	0.2388	3.7	0.99	1381	46	1378	28	1375	10	1375	10	99
909003_26-1	254	268755	2.5	11.3894	0.4	2.9363	3.1	0.2426	3.1	0.99	1400	38	1391	23	1378	8	1378	8	99
909003_24-87	217	203217	2.3	11.3594	0.5	2.9650	2.1	0.2443	2.1	0.98	1409	26	1399	16	1383	9	1383	9	99
909003_24-5	160	184057	2.1	11.3522	0.9	2.8010	7.8	0.2306	7.8	0.99	1338	94	1356	59	1384	17	1384	17	96
909003_26-34	81	92290	1.2	11.3371	1.2	2.8839	1.9	0.2371	1.5	0.77	1372	18	1378	14	1387	23	1387	23	91
909003_24-69	736	558651	2.3	11.2671	0.3	3.0232	4.8	0.2470	4.8	1.00	1423	62	1413	37	1399	5	1399	5	104
909003_26-10	193	317158	1.5	11.2668	0.4	2.8999	1.4	0.2370	1.4	0.96	1371	17	1382	11	1399	8	1399	8	100
909003_26-63	142	179346	2.0	11.2616	0.4	3.0388	1.8	0.2482	1.7	0.97	1429	22	1417	13	1400	8	1400	8	99
909003_26-47	55	166910	2.3	11.2330	1.9	2.8658	3.3	0.2335	2.7	0.82	1353	33	1373	24	1405	36	1405	36	99
909003_24-32	183	160626	4.7	11.2269	4.3	3.1208	6.3	0.2541	4.6	0.74	1460	61	1438	49	1406	82	1406	82	101
909003_24-26	103	89157	2.3	11.2241	1.0	2.7656	4.3	0.2251	4.2	0.97	1309	50	1346	32	1406	19	1406	19	100
909003_24-76	122	81726	1.3	11.1606	1.8	2.5877	2.5	0.2095	1.8	0.70	1226	20	1297	18	1417	34	1417	34	98
909003_24-179	61	45441	2.1	11.1513	2.3	3.0301	4.7	0.2451	4.1	0.87	1413	51	1415	36	1419	44	1419	44	97
909003_26-24	557	110602	3.5	11.1323	0.4	2.8745	3.1	0.2321	3.0	0.99	1345	37	1375	23	1422	7	1422	7	99
909003_24-169	286	244068	2.5	11.0822	1.1	3.1850	7.0	0.2560	6.9	0.99	1469	91	1454	54	1430	21	1430	21	103
909003_26-42	56	121692	2.5	11.0605	1.4	3.1626	3.0	0.2537	2.6	0.89	1458	34	1448	23	1434	26	1434	26	96
909003_24-19	161	167223	2.9	11.0569	1.1	3.1708	4.9	0.2543	4.8	0.97	1460	62	1450	38	1435	21	1435	21	102
909003_24-9	488	323834	2.4	11.0154	0.5	3.1136	5.8	0.2488	5.8	1.00	1432	74	1436	45	1442	9	1442	9	94
909003_26-18	131	215106	1.5	11.0134	0.5	3.2030	1.4	0.2558	1.3	0.94	1469	18	1458	11	1442	9	1442	9	101
909003_26-61	129	219222	2.2	11.0098	0.5	3.2182	3.6	0.2570	3.6	0.99	1474	47	1462	28	1443	9	1443	9	104
909003_26-54	102	264010	0.9	10.9975	0.9	3.0246	1.4	0.2412	1.0	0.73	1393	13	1414	10	1445	18	1445	18	101
909003_26-4	164	164979	0.9	10.9838	0.6	3.0906	1.6	0.2462	1.5	0.92	1419	18	1430	12	1447	12	1447	12	89

909003_24-189	607	297694	2.6	10.9665	0.6	3.1955	7.3	0.2542	7.3	1.00	1460	95	1456	57	1450	12	1450	12	98
909003_24-115	166	55942	2.7	10.9585	0.8	3.1782	5.4	0.2526	5.3	0.99	1452	69	1452	42	1452	15	1452	15	98
909003_24-161	148	113697	2.2	10.9387	1.0	3.1252	2.2	0.2479	2.0	0.91	1428	26	1439	17	1455	18	1455	18	97
909003_24-56	513	403723	10.4	10.8831	0.4	3.0908	2.8	0.2440	2.8	0.99	1407	35	1430	21	1465	8	1465	8	100
909003_26-62	77	54923	2.3	10.8751	1.2	3.2589	2.7	0.2570	2.4	0.90	1475	32	1471	21	1466	22	1466	22	99
909003_26-33	165	380989	2.9	10.8726	0.6	3.2328	2.7	0.2549	2.7	0.98	1464	35	1465	21	1467	11	1467	11	100
909003_24-68	106	136022	1.5	10.8691	1.4	3.3143	3.3	0.2613	3.0	0.91	1496	41	1484	26	1467	26	1467	26	101
909003_26-13	117	141566	1.8	10.8634	0.5	3.2589	2.9	0.2568	2.9	0.99	1473	38	1471	23	1468	9	1468	9	98
909003_26-12	171	492370	1.7	10.8627	0.5	3.3268	2.5	0.2621	2.5	0.98	1501	33	1487	20	1469	9	1469	9	97
909003_24-54	78	58703	1.8	10.8586	1.5	3.2609	4.0	0.2568	3.8	0.93	1473	50	1472	31	1469	28	1469	28	94
909003_26-49	135	222300	2.9	10.8580	0.9	3.1874	3.9	0.2510	3.8	0.97	1444	49	1454	30	1469	17	1469	17	103
909003_26-60	131	158855	1.1	10.8558	0.7	3.2497	1.1	0.2559	0.9	0.80	1469	12	1469	9	1470	13	1470	13	102
909003_24-2	163	137783	2.2	10.8356	0.6	3.3261	4.9	0.2614	4.8	0.99	1497	64	1487	38	1473	12	1473	12	99
909003_24-63	164	143239	1.8	10.8349	0.9	3.1889	4.5	0.2506	4.4	0.98	1442	57	1454	35	1473	16	1473	16	98
909003_24-94	127	124055	1.1	10.8341	0.9	3.2636	3.7	0.2564	3.6	0.97	1472	47	1472	29	1474	16	1474	16	102
909003_24-106	145	194016	1.3	10.8144	1.0	3.4507	7.9	0.2707	7.9	0.99	1544	108	1516	62	1477	19	1477	19	96
909003_26-30	139	196921	1.9	10.8099	0.6	3.3024	4.2	0.2589	4.2	0.99	1484	55	1482	33	1478	12	1478	12	95
909003_24-66	257	179575	3.0	10.8053	0.7	3.2765	5.7	0.2568	5.7	0.99	1473	74	1475	44	1479	13	1479	13	102
909003_26-29	74	49073	1.2	10.8022	1.4	3.2363	3.4	0.2535	3.1	0.91	1457	40	1466	26	1479	27	1479	27	102
909003_24-180	211	163110	2.3	10.7779	0.5	3.4167	3.8	0.2671	3.8	0.99	1526	52	1508	30	1483	10	1483	10	102
909003_24-6	168	170295	1.3	10.7320	0.5	3.3349	7.7	0.2596	7.7	1.00	1488	102	1489	60	1492	10	1492	10	96
909003_24-45	45	31749	1.5	10.6706	4.0	3.1147	8.8	0.2410	7.8	0.89	1392	98	1436	67	1502	75	1502	75	98
909003_24-15	69	68704	2.9	9.9106	1.5	4.0292	8.9	0.2896	8.8	0.99	1640	127	1640	73	1641	28	1641	28	101
909003_26-28	253	485715	2.7	9.7650	0.5	4.1389	1.3	0.2931	1.2	0.92	1657	17	1662	10	1668	9	1668	9	100
909003_26-50	130	70389	1.5	9.7310	0.7	4.3027	2.3	0.3037	2.2	0.96	1709	33	1694	19	1675	12	1675	12	100
909003_24-164	222	200175	2.9	9.3093	0.8	4.5159	4.7	0.3049	4.7	0.99	1716	71	1734	39	1756	14	1756	14	102
909003_26-38	111	195658	0.7	9.1883	0.5	4.8126	1.4	0.3207	1.3	0.93	1793	20	1787	12	1780	9	1780	9	98
909003_24-139	240	120681	3.6	8.9697	1.5	5.1622	7.2	0.3358	7.0	0.98	1867	114	1846	61	1824	27	1824	27	100
909003_24-170	109	56705	2.1	8.8690	0.6	5.0605	6.1	0.3255	6.1	1.00	1817	96	1830	52	1844	10	1844	10	100
909003_24-153	97	183549	1.5	8.4734	1.2	5.5763	4.1	0.3427	3.9	0.96	1900	65	1912	35	1926	21	1926	21	98
909003_24-13	186	259206	1.1	8.1564	0.6	6.0636	3.3	0.3587	3.3	0.99	1976	56	1985	29	1994	10	1994	10	99
909003_26-16	49	188146	3.2	5.4296	0.6	12.6000	2.9	0.4962	2.9	0.98	2597	61	2650	28	2691	11	2691	11	102

909003_24-50	75	173386	1.1	5.3993	0.5	12.5857	8.6	0.4928	8.6	1.00	2583	183	2649	81	2700	9	2700	9	101
909003_24-97	110	187200	2.9	5.3779	0.6	11.9996	5.9	0.4680	5.8	0.99	2475	120	2604	55	2707	10	2707	10	97
909003_26-56	71	352762	2.0	5.3220	0.3	13.6762	1.8	0.5279	1.8	0.99	2733	39	2728	17	2724	5	2724	5	100
909003_26-40	57	187094	1.7	5.2913	0.4	13.2744	6.4	0.5094	6.4	1.00	2654	139	2699	61	2733	6	2733	6	97

*=radiogenic lead.

Notes:

1. Uncertainties for individual analyses are reported at the 1-sigma level, and include only measurement errors.
2. Systematic errors for 206Pb/238U and 206Pb/207Pb ages are about 1% (2-sigma).
3. U concentration and U/Th are calibrated relative to Sri Lanka zircon standard, and are accurate to about 20%.
4. Common Pb correction is from measured 204Pb.
5. Common Pb composition interpreted from Stacey and Kramers (1975).
6. Common Pb composition assigned uncertainties of 1.0 for 206Pb/204Pb, 0.3 for 207Pb/204Pb, and 2.0 for 208Pb/204Pb.
7. U/Pb and 206Pb/207Pb fractionation is calibrated relative to fragments of a large Sri Lanka zircon with age 563.5 ± 3.2 Ma (2-sigma).
8. U decay constants and composition as follows: 238U = 9.8485 x 10-10, 235U =1.55125 x 10-10, 238U/235U = 137.88.
9. Best age is 206Pb/238U for ages younger than 700 Ma and 206Pb/207Pb for ages older than 700 Ma.
10. Discordance values calculated only for analyses with 206Pb/238U age >600 Ma.

Reference:

Stacey, J., and J. Kramers (1975), Approximation of terrestrial lead isotope evolution by a two-stage model, Earth Planet. Sci. Lett., 26, 207–221.

Table 5: Sykesville Formation South, small permanent feature data. Used for error calculation.

small permanent feature					
	length (cm)		length (cm)		length (cm)
tape measure	1.4	wood ruler	1.4	plastic ruler	1.4
	1.4		1.4		1.4
	1.4		1.4		1.4
	1.4		1.4		1.4
average	1.4	average	1.4	average	1.4
stdev	n/a	stdev	n/a	stdev	n/a

Table 6: Sykesville Formation South, large permanent feature data. Used for error calculation.

large permanent feature					
	length (cm)		length (cm)		length (cm)
tape measure	37.5	wood ruler	37.6	plastic ruler	37.8
	37.4		37.6		37.7
	37.5		37.6		37.8
	37.5		37.7		37.7
	37.5		37.7		37.8
	37.4		37.6		37.7
	37.4		37.7		37.7
	37.5		37.6		37.7
average	37.4625	average	37.6375	average	37.7375
stdev	0.0517549	stdev	0.0517549	stdev	0.0517549

Table 7: Sykesville Formation South, difference between tape measure and wood ruler large permanent feature measurements. Used for error calculation.

difference between tape measure and wood ruler			
reading	tape measure	wood ruler	difference
1	37.5	37.6	-0.1
2	37.4	37.6	-0.2
3	37.5	37.6	-0.1
4	37.5	37.7	-0.2
5	37.5	37.7	-0.2
6	37.4	37.6	-0.2

7	37.4	37.7	-0.3
8	37.5	37.6	-0.1
average			-0.175
stdev			0.0707107

Table 8: Sykesville Formation South, clast aspect ratio measurements.

overall data					
clast types	criteria				
A	serrated edges, darker brown color, fine grained, foliations (generally w/ rock)				
B	white to clear, no foliations, more rounded, fine grained				
C	made of Qtz & Pl, laminated				
D	not laminated, black, made of Hbl, shiny appearance, eye shaped				
E	other				
station	clast	length (cm)	width (cm)	thickness (cm)	clast type
station 1A	1	1.1		0.6	B
	2	4.6		0.4	A
	3	3.5		0.6	D
	4	8.4		0.7	A
	5	0.5		0.4	B
	6	0.7		0.3	B
	7	6.6		2.3	D
	8	3.5		1.2	B
	9	4.0		1.9	C
	10	4.1		0.8	A
	11	3.1		0.2	A
	12	3.4		0.3	A
	13	0.7		0.6	B
	14	1.9		0.9	D
	15	1.1		0.9	C
	16	4.1		1.6	B
	17	1.0		0.5	C
	18	1.6		0.7	B
	19	2.7		0.4	A
	20	4.9		0.3	A
	21	8.6		2.1	D
	22	2.6		1.8	D
	23	3.3		0.2	A
	24	3.6		0.5	B
	25	2.6		0.5	A
	26	2.4		0.7	D
	27	3.8		1.8	C
	28	2.1		1.4	B
	29	3.1		0.3	A
	30	3.7		0.4	A

	31	3.7		1.7	B
	32	2.0		1.4	C
	33	1.5		0.9	B
	34	21.9		9.1	D
	35	2.9		1.4	B
	36	2.6		1.7	B
	37	6.3		2.1	D
	38	9.1		1.6	A
	39	4.2		1.6	C
	40	3.0		1.9	B
	41	3.9		0.3	A
	42	8.0		2.0	D
	43	4.2		2.1	B
	44	7.6		4.4	D
	45	3.8		0.3	A
	46	2.8		0.3	A
	47	1.9	0.9		B
	48	1.6	1.0		B
	49	1.1	1.0		B
	50	3.2	1.6		C
	51	1.7	1.1		D
	52	3.6	2.4		B
	53	1.8	1.0		B
	54	1.9	0.8		B
	55	4.6	1.9		D
	56	2.4	2.1		B
	57	6.8	3.1		D
	58	3.3	1.5		B
	59	1.9	0.7		B
	60	2.4	1.4		B
	61	61.4	20.6		D
	62	4.2	1.7		D
	63	3.3	1.4		B
	64	4.6	2.5		B
	65	1.4	1.1		B
	66	1.0	1.0		B
	67	7.5	2.4		D
	68	4.6	1.8		C
	69	2.6	1.9		B
	70	3.1	1.2		B
	71	5.2	3.1		B
	72	2.7	1.1		C
	73	7.2	3.1		B
	74	4.0	2.6		B
	75	4.4	2.5		D
	76	3.0	3.0		E
	77	7.6		0.8	A
	78	3.7		0.4	A

	79	1.4		1.0	B
	80	1.9		1.1	B
	81	3.9		0.3	A
	82	3.2		1.3	B
	83	3.6		1.2	D
	84	4.0		0.3	A
	85	8.2		1.7	C
	86	3.4		2.0	B
	87	5.1		0.5	A
	88	3.7		0.3	A
	89	3.3		1.7	B
	90	2.9		0.3	A
	91	4.0		0.3	A
	92	3.0		0.3	A
	93	3.6		0.5	A
	94	1.6		0.7	B
	95	2.0		1.0	B
	96	3.1		1.6	D
	97	2.4		0.9	C
	98	3.3		0.8	D
	99	2.5		1.9	B
	100	4.4		1.7	B
	101	2.4		1.0	A
	102	1.1		0.7	A
	103	3.4		0.9	C
	104	3.0		1.6	C
	105	5.2		0.9	A
	106	4.2		0.3	A
	107	2.1		0.8	C
	108	0.8		0.6	B
	109	3.0		0.3	A
	110	0.9		0.4	B
	111	9.8		4.0	E
	112	2.1		1.8	B
	113	8.6		2.5	C
	114	3.3		1.7	B
	115	7.2		0.7	A
	116	4.1		0.4	A
	117	1.5		1.2	B
	118	2.4		1.2	B
	119	1.6		0.7	B
	120	2.9		0.9	D
	121	3.1		0.4	A
	122	5.8		2.1	C
	123	8.0		1.9	C
	124	1.0		0.9	B
	125	3.6		0.3	A
	126	2.5		1.2	D

	127	3.0		2.3	B
	128	1.6		1.0	B
	129	4.0		0.4	A
	130	4.2		0.3	A
	131	7.4	4.1		B
	132	9.4	4.9		C
	133	4.1	1.5		D
	134	9.6	4.4		D
	135	28.4	10.9		C
	136	2.2	0.8		B
	137	7.3	2.9		C
	138	7.6	4.8		C
	139	3.9	2.5		B
	140	7.9	4.2		B
	141	4.6	1.6		D
	142	6.1	2.9		D
	143	5.6	2.4		B
	144	1.9	0.9		B
	145	3.6	1.8		B
	146	5.3	2.2		C
	147	2.3	1.1		B
	148	7.8	3.0		C
	149	1.4	1.3		B
	150	4.1	2.0		D
station 2A	1	3.9	2.6		B
	2	0.9	0.8		B
	3	6.2	2.0		C
	4	3.0	2.1		B
	5	11.6	4.7		D
	6	7.1	2.8		C
	7	3.2	2.2		D
	8	3.1	2.5		B
	9	9.4	4.3		C
	10	3.1	1.9		B
	11	8.9	3.7		D
	12	2.3	1.4		B
	13	5.2	3.2		C
	14	4.3	2.5		B
	15	14.0	8.0		D
	16	2.7	2.5		B
	17	1.7	1.6		B
	18	2.6	2.1		B
	19	6.9	2.4		C
	20	2.0	1.6		B
	21	5.2	2.6		C
	22	2.5	1.7		B
	23	15.9	7.2		C
	24	3.1	1.1		D

	25	5.4	2.6		B
	26	6.4	2.7		B
	27	3.6	1.7		D
	28	1.9	1.3		B
	29	10.6	4.3		C
	30	6.8	3.1		D
	31	7.7	3.4		C
	32	2.9	2.3		B
	33	4.4	2.4		C
	34	6.2	3.9		C
	35	1.2	0.9		B
	36	1.1	1.1		B
	37	8.3	6.0		D
	38	1.5	1.1		B
	39	0.7	0.5		B
	40	1.4	0.9		D
	41	2.7		0.8	B
	42	1.2		0.7	B
	43	3.7		0.3	A
	44	1.9		1.1	B
	45	3.4		0.3	A
	46	2.3		0.3	A
	47	4.4		0.5	A
	48	6.8		0.5	A
	49	4.4		0.4	A
	50	1.8		1.5	B
	51	4.9		0.4	A
	52	1.8		1.3	B
	53	11.5		6.7	C
	54	16.3		5.5	C
	55	5.6		0.3	A
	56	1.7		0.3	A
	57	1.4		0.7	B
	58	1.3		0.8	B
	59	17.2		4.3	D
	60	6.3		0.6	A
	61	5.4		0.6	A
	62	5.7		0.4	A
	63	9.8		3.1	C
	64	3.0		2.2	B
	65	2.4		1.0	C
	66	8.6		0.9	C
	67	6.5		0.5	A
	68	3.0		1.8	B
	69	11.6		1.2	A
	70	1.0		1.0	B
	71	1.2		1.1	B
	72	1.3		1.0	B

	73	2.0		0.3	A
	74	2.8		0.3	A
	75	3.3		0.3	A
	76	1.4		0.7	B
	77	2.4		1.9	C
	78	2.0		1.2	C
	79	5.3		0.4	A
	80	4.0		0.3	A
	81	3.4		1.4	C
	82	1.3		0.7	B
	83	5.2		2.8	C
	84	3.6		1.1	D
	85	5.9		1.9	C
	86	3.2		1.1	D
	87	3.3		2.1	B
	88	5.6		0.9	D
	89	3.5		1.4	C
	90	1.6		0.8	B
	91	4.3		1.6	D
	92	23.6		9.7	D
	93	5.1		0.3	A
	94	3.1		0.4	A
	95	1.3		0.9	B
	96	3.7		1.3	D
	97	5.2	0.7		D
	98	2.6	1.0		B
	99	14.1	4.7		C
	100	4.3	3.2		B
	101	10.9	1.9		D
	102	2.0	0.9		B
	103	2.2	1.1		B
	104	4.0	0.9		B
	105	6.2	1.2		D
	106	9.9	1.9		D
	107	3.6	1.4		C
	108	1.5	1.1		D
	109	9.3	3.1		C
	110	1.1	0.6		B
	111	7.2	2.6		C
	112	0.9	0.6		B
	113	12.4	2.0		D
station 3A	1	20.4	3.8		C
	2	3.9	1.0		B
	3	9.3	4.8		C
	4	2.6	1.5		B
	5	5.6	3.2		D
	6	3.4	2.6		C
	7	11.5	4.4		D

	8	3.8	2.7		B
	9	2.4	1.2		B
	10	9.2	5.5		C
	11	4.8	2.0		D
	12	1.3	1.2		B
	13	1.7	1.7		B
	14	4.6	2.9		D
	15	2.5	1.9		B
	16	5.8	4.9		B
	17	11.9	5.6		C
	18	0.8	0.8		B
	19	3.1	2.0		B
	20	3.5	1.6		D
	21	2.9	1.9		B
	22	4.2	2.5		B
	23	5.0	2.2		C
	24	3.3	1.8		B
	25	2.7	2.1		B
	26	5.0	3.6		B
	27	4.0	2.8		C
	28	15.2	7.4		C
	29	4.9	3.5		C
	30	1.6	0.7		B
	31	11.0	1.4		D
	32	6.4	1.3		D
	33	2.3	1.0		B
	34	2.5	1.8		B
	35	13.1	6.7		D
	36	11.4	6.4		C
	37	8.3	3.8		C
	38	1.2	0.4		B
	39	4.9	0.6		D
	40	2.8	0.7		D
	41	1.5	1.2		B
	42	2.3	1.2		B
	43	7.9	4.3		D
	44	2.8	2.1		D
	45	2.0	0.7		B
	46	1.6	1.2		B
	47	2.0	1.8		B
	48	7.1	4.6		C
	49	1.5	1.2		B
	50	8.2	3.8		C
	51	2.5	1.6		B
	52	3.5	2.4		B
	53	2.8	1.7		D
	54	3.0	1.6		D
	55	4.5	1.2		B

	56	3.2	1.5		C
	57	10.7	5.4		C
	58	2.1	1.3		B
	59	9.1	4.4		D
	60	11.1	6.2		D
	61	2.1	1.9		B
	62	2.0	1.7		B
	63	8.9	4.5		C
	64	5.4	3.1		C
	65	12.5	4.4		C
	66	1.3	0.8		B
	67	2.6	1.2		B
	68	1.3	0.9		B
	69	5.3	2.0		D
	70	12.2	4.5		D
	71	3.0		0.4	A
	72	2.1		0.3	A
	73	2.2		0.3	A
	74	3.1		0.3	A
	75	1.1		0.5	B
	76	2.6		0.3	A
	77	0.4		0.3	B
	78	2.2		0.7	D
	79	5.2		0.6	A
	80	3.6		0.2	A
	81	1.2		0.9	B
	82	2.3		0.6	D
	83	9.3		2.4	C
	84	10.1		4.9	C
	85	2.5		0.2	A
	86	1.8		0.3	A
	87	2.7		2.0	B
	88	1.2		0.7	B
	89	4.0		0.5	A
	90	3.1		0.3	A
	91	1.3		0.9	B
	92	0.6		0.3	C
	93	3.6		0.6	A
	94	3.9		0.2	A
	95	6.8		2.3	D
	96	6.1		1.0	A
	97	9.4		4.1	C
	98	0.9		0.5	B
	99	2.1		0.2	A
	100	3.1		0.7	C
	101	3.8		1.9	C
	102	2.0		0.7	B
	103	4.3		1.9	B

	104	5.0		1.3	D
	105	3.0		0.2	A
	106	1.2		0.6	B
	107	4.0		1.2	B
	108	2.2		2.1	B
	109	3.2		0.5	A
	110	6.3		0.4	A
	111	2.0		1.1	D
	112	4.8		1.0	D
	113	3.1		0.2	A
	114	2.9		0.3	A
	115	6.9		1.1	A
	116	2.4		1.1	C
	117	2.1		0.2	A
	118	3.0		1.1	C
	119	1.8		1.3	B
	120	1.7		0.8	D
	121	4.1		1.6	B
	122	3.9		3.4	B
	123	4.1		4.0	C
	124	3.0		1.9	B
	125	4.2		2.2	C
	126	3.0		2.1	D
	127	4.2		0.3	A
	128	4.0		2.3	C
	129	3.5		1.4	E
	130	1.0		0.6	B
	131	2.1		1.2	C
	132	5.3		0.5	A
	133	2.9		0.2	A
	134	3.6		0.7	D
	135	3.7		1.5	B
	136	2.9		1.3	B
	137	6.7		3.0	C
	138	1.6		1.1	B
	139	3.7		0.4	A
	140	3.1		0.4	A
	141	3.4		2.6	C
	142	2.5		0.9	B
	143	5.3		0.5	A
	144	1.4		1.1	B
	145	3.6		1.4	C
	146	2.7		1.6	B
	147	1.4		1.0	B
	148	1.2		1.1	B
	149	3.1		1.4	D
	150	6.0		2.1	E
	151	1.9		0.2	A

	152	2.6		1.8	B
	153	3.6		0.6	A
	154	14.4		3.5	C
	155	2.1		1.3	B
	156	3.0		3.3	B
	157	3.6		1.0	C
	158	1.6		0.9	D
	159	2.3		0.2	A
	160	3.1		0.3	A
station 4A	1	1.3		0.7	B
	2	6.8		3.0	C
	3	2.3		0.7	B
	4	3.1		1.6	B
	5	3.2		0.3	A
	6	8.0		0.9	A
	7	3.8		0.6	C
	8	2.6		1.5	D
	9	7.6		0.6	A
	10	4.4		0.4	A
	11	2.1		0.8	B
	12	1.0		0.5	B
	13	1.2		0.7	B
	14	6.1		0.4	A
	15	2.6		0.8	B
	16	3.4		1.5	B
	17	6.8		1.2	C
	18	3.4		0.9	C
	19	2.6		1.3	B
	20	3.1		0.2	A
	21	4.9		0.4	A
	22	4.4		0.5	A
	23	2.2		1.2	B
	24	1.9		1.0	B
	25	2.1		0.8	B
	26	8.6		2.0	C
	27	5.6		1.4	D
	28	0.9		0.5	B
	29	4.4		1.6	B
	30	7.4		4.1	B
	31	3.1		1.1	A
	32	2.1		0.2	A
	33	1.9		0.1	A
	34	2.6		0.2	A
	35	8.6		2.9	C
	36	11.7		4.0	C
	37	2.8		1.4	B
	38	4.2		1.6	C
	39	3.7		1.4	B

	40	1.2		0.6	B
	41	8.2	6.2		B
	42	3.9	2.3		B
	43	7.1	4.0		D
	44	3.2	2.2		D
	45	11.9	3.1		C
	46	3.1	1.6		D
	47	2.8	0.5		D
	48	3.4	0.8		D
	49	2.2	1.7		B
	50	2.0	1.1		B
	51	3.3	1.7		B
	52	1.9	1.6		B
	53	1.6	1.2		D
	54	1.7	1.0		B
	55	3.8	1.8		C
	56	1.1	0.6		B
	57	2.5	2.4		B
	58	1.7	1.0		B
	59	2.4	1.3		B
	60	1.5	1.1		B
	61	9.6	4.0		E
	62	6.5	2.8		D
	63	3.3	1.9		B
	64	1.1	0.9		B
	65	12.6	3.6		D
	66	6.4	4.1		C
	67	14.6	4.4		C
	68	1.9	0.9		B
	69	9.0	6.1		C
	70	7.8	4.6		D
	71	2.8	2.1		B
	72	1.5	1.2		B
	73	3.9	3.2		B
	74	2.2	1.1		B
	75	1.7	0.7		D
	76	2.3	2.1		B
	77	5.9		0.8	A
	78	4.8		2.1	B
	79	5.7		2.2	C
	80	1.3		0.6	B
	81	2.1		0.2	A
	82	1.8		0.2	A
	83	1.4		0.9	B
	84	3.1		0.3	A
	85	4.2		0.4	A
	86	3.2		1.6	B
	87	5.9		3.5	B

	88	7.1		1.6	E
	89	1.0		0.8	B
	90	1.2		3.3	C
	91	1.2		0.7	B
	92	4.3		2.4	B
	93	3.2		1.9	B
	94	1.1		0.7	B
	95	1.9		0.3	A
	96	3.1		0.9	D
	97	4.4		0.7	A
	98	1.3		0.7	B
	99	2.7		1.7	B
	100	13.2		3.5	D
	101	3.7		1.9	C
	102	4.6		0.9	C
	103	2.3		0.3	A
	104	1.8		1.2	B
	105	6.1		1.4	E
	106	6.8		3.0	C
	107	1.2		0.5	B
	108	1.0		0.6	B
	109	1.3		0.7	B
	110	0.4		0.4	C
station 5A	1	82.6	34.8	9.2	C
	2	19.2	7.6		C
	3	6.9	3.1		D
	4	3.6	2.1		B
	5	0.9	0.7		B
	6	2.9	1.0		C
	7	6.3	3.5		D
	8	4.3	2.8		D
	9	2.1	0.8		B
	10	2.5	1.4		B
	11	4.5	1.8		B
	12	1.7	1.2		B
	13	4.1	1.6		D
	14	7.4	1.0		A
	15	2.9	1.4		B
	16	1.5	1.0		B
	17	2.3	1.4		C
	18	1.2	0.6		B
	19	3.9	1.0		D
	20	3.6	3.6		B
	21	3.5	1.9		B
	22	1.3	0.9		B
	23	7.0	1.8		D
	24	1.1	0.6		B
	25	5.8	1.0		D

	26	5.1	1.1		D
	27	0.9	0.5		B
	28	3.4	2.1		E
	29	3.8	1.4		D
	30	6.3	1.2		C
	31	1.2	1.1		B
	32	1.9	1.4		B
	33	1.5	1.3		B
	34	3.2	1.1		C
	35	3.7	1.1		C
	36	6.4	2.5		D
	37	1.3	1.2		C
	38	1.6	0.7		B
	39	3.5	1.4		B
	40	1.8	1.6		B
	41	4.6	1.1		D
	42	4.1	1.3		C
	43	3.2	1.4		D
	44	5.1	3.5		C
	45	2.1	1.2		B
	46	5.4	2.8		B
	47	1.5	1.2		B
	48	9.2	1.8		D
	49	1.6	0.9		B
	50	1.5	1.1		B
	51	1.4	1.1		B
	52	17.4	4.1		C
	53	14.6	5.9		C
	54	3.7	1.0		D
	55	1.1	0.5		B
	56	1.6	0.4		D
	57	1.8	0.8		C
	58	5.4	2.6		D
	59	2.2	1.8		D
	60	0.9	0.4		B
	61	2.0		0.9	B
	62	1.5		0.4	B
	63	2.1		0.3	A
	64	3.2		0.7	A
	65	1.8		1.6	B
	66	6.3		1.6	B
	67	9.4		2.0	D
	68	8.1		1.1	D
	69	3.0		0.3	A
	70	3.3		0.6	A
	71	1.6		1.5	B
	72	1.1		0.7	B
	73	0.6		0.4	C

	74	7.3		1.7	D
	75	3.7		0.4	A
	76	3.3		0.4	A
	77	13.8		3.2	D
	78	2.2		1.8	B
	79	2.0		0.8	B
	80	1.0		0.9	B
	81	3.9		0.4	A
	82	7.0		0.6	A
	83	4.5		0.3	A
	84	3.1		0.8	A
	85	5.3		0.5	A
	86	2.2		0.3	A
	87	5.4		2.6	C
	88	9.5		1.7	C
	89	2.9		0.3	A
	90	1.8		0.2	A
	91	1.1		0.5	B
	92	0.8		0.5	B
	93	2.1		1.0	B
	94	3.2		0.7	C
	95	2.5		0.3	A
	96	2.8		0.3	A
	97	1.5		0.6	C
	98	0.9		0.5	C
	99	3.4		0.3	A
	100	4.6		0.4	A
	101	17.7		8.0	C
	102	1.3		0.4	B
	103	3.5		0.4	A
	104	3.7		0.3	A
	105	2.9		1.8	B
	106	0.9		0.5	C
	107	3.6		1.2	D
	108	3.3		0.4	E
	109	2.1		0.2	A
	110	2.9		0.7	D
	111	1.7		0.8	B
	112	1.1		0.7	B
	113	3.3		0.3	A
	114	1.9		0.2	A
	115	3.9		0.4	A
	116	1.1		0.1	A
	117	7.1		3.5	C
	118	3.4		1.6	B
	119	17.2		3.1	C
	120	2.7		1.1	B
	121	4.8		0.9	D

	122	13.4		3.3	C
	123	1.6		0.2	A
	124	3.7		0.5	A
	125	10.4		1.6	C
	126	4.8		0.9	C
	127	2.6		0.2	A
	128	3.3		0.3	A
	129	1.6		0.8	B
	130	2.7		0.9	B
	131	7.0		3.9	C
station 6A	1	6.4		3.5	C
	2	1.4		0.4	B
	3	1.5		0.7	A
	4	1.6		1.1	A
	5	2.4		0.3	A
	6	2.7		0.4	A
	7	4.2		0.5	A
	8	1.6		0.2	A
	9	0.4		0.7	B
	10	1.8		1.7	B
	11	2.1		0.2	A
	12	2.0		0.2	A
	13	2.2		1.4	B
	14	1.8		0.8	B
	15	3.5		1.6	B
	16	1.1		0.5	B
	17	4.7		2.6	C
	18	3.0		0.9	B
	19	9.6		5.2	D
	20	5.1		1.3	D
	21	2.0		1.5	B
	22	2.1		1.9	C
	23	3.2		0.3	A
	24	2.4		0.4	A
	25	9.2		1.2	C
	26	6.6		1.7	C
	27	3.3		0.4	A
	28	3.1		0.3	A
	29	1.5		0.9	C
	30	1.1		0.6	C
	31	6.0		3.4	C
	32	2.4		1.2	C
	33	1.9		1.5	B
	34	4.6		3.1	C
	35	5.2		2.4	D
	36	3.7		2.1	D
	37	2.2		0.2	A
	38	3.0		0.3	A

	39	6.2		2.5	C
	40	1.4		1.2	B
	41	3.1		0.5	A
	42	3.3		0.4	A
	43	2.5		0.3	A
	44	3.0		0.3	A
	45	3.4		2.2	C
	46	5.5		1.4	C
	47	7.1		3.5	C
	48	5.1		2.6	C
	49	6.3		3.2	C
	50	1.5		0.9	B
	51	2.0		1.3	B
	52	1.6		1.0	C
	53	2.7		1.3	B
	54	1.3		0.8	B
	55	3.7		0.3	A
	56	6.4		0.7	A
	57	2.6		0.5	A
	58	3.4		0.3	A
	59	1.3		0.4	B
	60	3.0		0.7	D
	61	4.7		1.9	C
	62	6.6		3.5	C
	63	3.2		0.4	A
	64	5.2		0.7	A
	65	8.9		2.2	C
	66	6.4		2.7	C
	67	3.6		1.2	B
	68	1.3		0.4	B
	69	1.9		0.2	A
	70	2.7		0.4	A
	71	1.8		0.4	C
	72	0.6		0.5	C
	73	1.0		0.5	B
	74	1.4		1.2	B
	75	2.0		0.8	B
	76	3.6		1.5	B
	77	4.6	2.6		B
	78	2.7	1.3		B
	79	1.0	0.6		C
	80	2.3	0.5		C
	81	1.9	0.7		B
	82	1.8	1.0		B
	83	2.8	0.2		A
	84	5.8	0.8		A
	85	1.9	0.9		B
	86	1.1	0.4		B

	87	3.8	0.6		C
	88	0.7	0.7		C
	89	1.2	0.5		C
	90	1.1	0.5		C
	91	3.5	1.9		D
	92	2.9	1.6		D
	93	3.2	1.3		C
	94	0.7	0.4		C
	95	0.6	0.4		B
	96	1.6	0.8		B
	97	0.9	0.4		B
	98	5.3	1.5		B
	99	1.8	1.1		B
	100	1.5	1.0		B
	101	2.1	1.1		B
	102	5.0	1.7		B
	103	5.7	2.3		C
	104	8.2	2.2		E
	105	1.7	0.7		B
	106	2.6	1.9		B
	107	3.1	0.7		C
	108	1.2	0.6		B
	109	5.6	3.2		D
	110	4.0	0.7		B
	111	3.1	2.0		B
	112	3.9	1.4		B
	113	6.0	1.6		B
	114	2.1	1.8		B
	115	1.3	0.9		C
	116	1.0	0.6		C
	117	5.0	0.9		C
	118	1.1	0.5		C
	119	1.1	0.6		B
	120	1.5	0.8		C
	121	5.9		2.9	B
	122	2.6		1.9	B
	123	13.0		4.9	C
	124	1.4		1.0	B
	125	2.0		1.7	B
	126	1.3		1.1	B
	127	1.7		1.2	B
	128	1.8		1.3	B
	129	2.3		1.1	B
	130	1.2		0.9	B
	131	1.4		1.2	B
	132	1.1		0.9	B
	133	2.4		1.5	D
	134	1.6		1.1	C

	135	2.8		0.9	B
	136	0.6		0.5	B
	137	0.7		0.5	C
	138	0.6		0.5	C
	139	14.8		7.4	B
	140	1.8		0.9	B
	141	1.2		1.1	C
	142	0.6		0.5	D
	143	2.5		1.2	B
	144	0.7		0.4	C
	145	3.9		1.1	B
	146	3.0		1.6	B
	147	1.1		0.7	B
	148	1.1		0.5	B
	149	0.9		0.8	C
	150	1.0		0.8	C
station 7A	1	4.9		3.0	B
	2	1.2		0.8	B
	3	2.4		1.5	B
	4	1.6		0.6	B
	5	2.8		0.6	A
	6	3.9		0.3	A
	7	1.3		0.3	A
	8	2.6		0.9	D
	9	26.1		8.5	C
	10	3.7		1.3	C
	11	3.8		0.5	A
	12	3.2		0.4	A
	13	3.4		1.8	D
	14	1.4		0.7	B
	15	1.1		0.8	B
	16	1.0		0.5	C
	17	3.3		0.5	A
	18	2.9		0.4	A
	19	10.8		4.5	C
	20	1.2		0.7	B
	21	1.2		0.8	C
	22	2.6		1.4	C
	23	2.3		1.6	C
	24	2.6		1.4	C
	25	3.2		1.1	B
	26	2.2		0.6	B
	27	3.2		0.6	D
	28	4.2		1.2	E
	29	2.4		1.1	B
	30	2.0		0.9	B
	31	2.7		0.4	A
	32	2.7		0.5	A

	33	5.3		4.3	D
	34	7.5		1.2	D
	35	3.6		2.6	B
	36	2.4		1.4	B
	37	5.8		1.0	A
	38	2.9		0.4	A
	39	2.3		1.3	C
	40	4.1		1.0	B
	41	2.3		0.4	A
	42	2.1		0.2	A
	43	2.0		1.2	B
	44	1.1		0.6	B
	45	2.7		0.9	D
	46	1.0		0.9	D
	47	2.3		0.2	A
	48	2.5		0.5	A
	49	3.9		0.9	C
	50	2.4		1.5	C
	51	2.2		0.2	A
	52	4.7		0.6	A
	53	13.6		2.4	D
	54	4.7		1.7	D
	55	9.1		4.1	C
	56	0.8		0.5	C
	57	10.7		1.3	D
	58	7.6		2.0	D
	59	7.4		3.1	C
	60	6.3		1.6	C
	61	2.8		0.4	A
	62	4.0		0.5	A
	63	3.2		0.4	C
	64	4.3		3.4	C
	65	3.6		0.6	A
	66	4.1		0.6	A
	67	1.8		0.2	A
	68	13.3		3.4	C
	69	2.1		0.9	B
	70	4.2		1.5	C
	71	2.2		0.9	B
	72	4.7		1.5	D
	73	2.9		1.1	D
	74	4.1		1.7	B
	75	1.4		0.8	B
	76	5.2		4.0	D
	77	4.2		1.2	D
	78	4.4		1.0	C
	79	2.2		1.3	C
	80	6.4		0.7	A

	81	3.6		0.3	A
	82	17.6		7.5	C
	83	2.2		1.2	B
	84	3.0		1.2	C
	85	5.2		2.1	C
	86	8.3		1.0	C
	87	10.5		4.4	C
	88	3.0		0.4	A
	89	2.3		0.5	A
	90	1.5		0.7	D
	91	4.6		1.3	D
	92	2.9	1.2		B
	93	2.6	1.2		B
	94	3.0	1.6		C
	95	0.7	0.3		C
	96	3.0	1.0		B
	97	1.2	0.7		B
	98	0.8	0.5		C
	99	3.6	0.9		D
	100	7.1	1.1		D
	101	4.0	0.5		A
	102	8.9	0.9		A
	103	2.6	1.3		B
	104	2.4	1.2		B
	105	1.0	0.7		C
	106	0.8	0.6		B
	107	2.5	1.1		D
	108	1.9	1.0		C
	109	5.0	1.6		C
station 8A	1	4.1	0.4		A
	2	1.7	0.9		B
	3	3.3	1.0		B
	4	0.8	0.8		C
	5	6.9		0.4	A
	6	3.2		0.3	A
	7	2.8		0.5	A
	8	2.6		0.4	A
	9	3.2		0.4	A
	10	2.2		0.4	B
	11	0.8		0.3	B
	12	1.9		0.5	B
	13	1.3		0.5	B
	14	1.1		0.7	C
	15	1.0		0.5	C
	16	1.2		0.5	C
	17	1.5		0.6	B
	18	3.1		0.9	C
	19	1.9		0.8	B

	20	2.4		0.3	A
	21	2.3		0.3	A
	22	0.7		0.4	B
	23	2.2		1.1	B
	24	0.9		0.5	C
	25	0.7		0.4	C
	26	5.6	0.6		A
	27	1.7	0.2		A
	28	2.3	1.1		B
	29	2.5	0.9		B
	30	3.4	0.7		B
	31	1.2	1.0		B
	32	2.5	0.2		A
	33	2.6	0.5		A
	34	4.1	0.3		A
	35	2.5	0.3		A
	36	1.2	0.8		C
	37	0.5	0.4		C
	38	1.2	0.6		B
	39	1.1	0.9		B
	40	1.6	0.4		B
	41	1.1	0.7		B
	42	0.8	0.4		C
	43	0.6	0.4		C
	44	5.8	0.8		A
	45	4.2	0.4		A
	46	2.4	0.7		B
	47	3.4	0.4		A
	48	3.3	0.3		A
	49	12.4	2.9		D
	50	8.3	1.5		D
	51	1.1	0.5		B
	52	1.7	0.6		B
	53	0.8	0.5		C
	54	0.7	0.4		B
	55	2.2	1.0		B
	56	1.1	0.6		B
	57	1.5	0.4		B
	58	0.8	0.4		C
	59	5.0	0.5		A
	60	2.3	0.3		A
	61	2.5	0.2		A
	62	1.4	0.2		A
	63	3.1	1.1		E
	64	1.3	0.7		B
	65	4.4	3.0		B
	66	1.1	1.0		B
	67	1.3	0.4		B

	68	1.6	0.9		B
	69	4.8	2.5		B
	70	1.7	0.4		B
	71	3.5	0.5		A
	72	2.4	0.4		A
	73	8.0	2.8		B
	74	2.1	0.9		B
	75	3.2	0.4		A
	76	2.9	0.6		A
	77	3.7	0.8		A
	78	3.0	0.4		A
	79	1.3	0.4		B
	80	1.9	0.9		B
	81	1.2	0.6		B
	82	0.9	0.5		B
	83	1.1	0.4		B
	84	1.4	0.3		B
	85	9.1	3.4		C
	86	2.2	1.2		C
	87	2.0	0.7		B
	88	2.1	1.0		B
	89	3.6	1.0		B
	90	1.3	0.8		B
	91	4.4	1.2		C
	92	0.6	0.3		C
	93	1.6	1.1		B
	94	2.0	0.8		B
	95	14.6	2.5		D
	96	6.5	1.4		D
	97	4.6	1.9		B
	98	3.9	0.6		C
	99	0.5	0.4		C
	100	1.5	0.4		C
	101	1.2	0.5		B
	102	1.0	0.5		B
	103	1.8	0.2		A
	104	3.3	0.4		A
	105	3.7		0.4	A
	106	2.6		0.3	A
	107	0.7		0.4	C
	108	0.7		0.4	B
	109	1.2		0.5	B
	110	1.5		0.7	B
	111	5.7		0.5	A
	112	4.1		0.6	A
	113	5.2		2.2	B
	114	2.9		2.3	B
	115	1.6		1.6	B

	116	2.1		1.2	B
	117	2.0		1	B
	118	1.8		0.5	C
	119	1.7		0.6	D
	120	1.7		0.5	B
	121	2.2		0.2	A
	122	2.5		0.4	A
	123	0.4		0.3	C
	124	0.6		0.2	C
	125	1.2		0.4	C
	126	2.5		0.8	C
	127	2.2		0.6	B
	128	2.0		0.8	B
	129	5.6		1.5	D
	130	2.0		0.7	B
Station 9A	1	1.2	1.0		B
	2	1.8	1.1		B
	3	1.6	0.7		C
	4	0.9	0.6		C
	5	1.5	1.0		B
	6	1.8	1.6		B
	7	0.8	0.5		C
	8	1.1	0.4		C
	9	1.7	1.1		B
	10	2.0	1.4		B
	11	15.9	4.2		C
	12	5.0	3.2		B
	13	3.1	2.1		D
	14	8.7	4.3		D
	15	3.4	2.1		B
	16	6.3	4.5		B
	17	0.9	0.5		B
	18	1.3	0.7		B
	19	1.9	0.7		D
	20	4.6	2.8		D
	21	1.0	0.5		C
	22	0.8	0.4		C
	23	17.5	4.2		C
	24	4.8	2.1		B
	25	4.9	1.5		D
	26	2.4	1.5		D
	27	1.2	0.9		C
	28	1.6	0.9		C
	29	1.1	1.0		C
	30	1.5	0.8		C
	31	2.4	1.4		B
	32	2.7	1.8		B
	33	14.3	2.4		C

	34	4.6	1.7		C
	35	5.6	2.2		D
	36	2.7	1.2		D
	37	16.2	3.1		D
	38	5.9	2.6		D
	39	1.1	0.6		B
	40	1.5	1.5		B
	41	21.6	4.3		C
	42	20.1	5.0		C
	43	4.7	2.5		D
	44	2.8	1.4		D
	45	1.4	0.9		B
	46	0.7	0.5		B
	47	1.7	1.1		B
	48	1.6	1.0		B
	49	7.9	1.9		C
	50	13.0	3.1		C
	51	3.2	1.7		B
	52	2.0	0.7		B
	53	5.3	2.9		C
	54	23.6	5.2		C
	55	1.6	1.5		B
	56	1.1	0.8		B
	57	3.4	2.2		D
	58	3.6	1.9		D
	59	8.0	4.8		C
	60	12.1	4.7		C
	61	3.0		0.4	A
	62	6.5		0.6	A
	63	2.3		0.3	A
	64	2.0		0.3	A
	65	4.1		0.7	A
	66	6.4		0.9	A
	67	2.4		1.3	B
	68	2.1		1.1	B
	69	2.6		0.3	A
	70	3.7		0.3	A
	71	2.9		0.3	A
	72	2.3		0.4	A
	73	1.1		0.6	B
	74	1.0		0.7	B
	75	3.6		0.4	A
	76	4.7		0.5	A
	77	2.5		0.2	A
	78	1.9		0.2	A
	79	3.4		1.6	B
	80	5.4		2.2	B
	81	2.4		0.8	B

	82	1.4		0.9	B
	83	1.2		0.4	C
	84	4.6		2.8	C
	85	1.9		0.2	A
	86	3.6		0.4	A
	87	4.1		0.3	A
	88	3.5		0.3	A
	89	3.3		1.6	B
	90	2.4		0.8	B
	91	1.6		0.6	B
	92	2.6		0.7	B
	93	1.9		1.2	B
	94	1.7		0.4	B
	95	3.3		0.2	A
	96	1.8		0.2	A
	97	2.1		0.4	A
	98	2.3		0.6	A
	99	1.7		0.7	B
	100	0.7		0.4	B
	101	1.8		0.2	A
	102	1.0		0.1	A
	103	0.5		0.2	C
	104	7.4		4.3	C
	105	5.3	4.2		B
	106	2.3	1.4		B
	107	17.6	3.2		C
	108	2.5	1.7		C
	109	3.3	2.9		D
	110	5.4	2.1		D
	111	1.4	1.0		B
	112	0.9	0.5		B
	113	1.0	0.6		B
	114	1.3	1.1		B
	115	20.4	4.3		C
	116	1.8	1.5		B
	117	2.0	0.6		B
	118	1.1	0.6		B
	119	1.2	1.1		D
	120	1.6	1.2		D
	121	2.7	1.2		C
	122	2.5	1.3		C
	123	1.9	1.6		B
	124	1.8	1.5		D
	125	3.2	1.5		B
	126	3.6	1.7		B
Station 10A	1	5.6	3.6		B
	2	4.0	2.0		B
	3	1.9	1.2		B

	4	2.1	1.1		B
	5	2.2	1.3		B
	6	1.9	0.9		B
	7	0.7	0.4		C
	8	5.2	2.6		C
	9	3.1	1.7		D
	10	3.0	2.0		D
	11	18.2	10.1		C
	12	1.7	0.8		B
	13	2.4	0.7		C
	14	0.5	0.5		C
	15	1.6	0.6		B
	16	0.9	0.7		C
	17	1.7	1.1		B
	18	1.8	0.6		B
	19	2.7	0.7		D
	20	13.4	4.8		D
	21	8.9	4.3		C
	22	4.2	1.2		C
	23	4.8	2.0		D
	24	4.7	0.7		D
	25	2.8	0.1		D
	26	2.6	1.1		D
	27	1.2	0.8		B
	28	0.9	0.3		B
	29	4.3	2.6		B
	30	3.1	2.7		B
	31	14.0	11.1		D
	32	10.3	5.1		D
	33	3.2	2.7		B
	34	2.4	1.9		B
	35	4.9	3.1		D
	36	12.2	4.8		D
	37	14.7	2.5		C
	38	3.2	2.0		B
	39	2.2	1.2		B
	40	1.0	0.8		B
	41	3.6	1.7		D
	42	4.4	1.6		D
	43	3.3	1.5		D
	44	3.7	1.9		D
	45	2.6	0.9		B
	46	3.7	0.7		B
	47	3.4	1.2		D
	48	2.1	0.5		D
	49	1.5	0.6		B
	50	1.4	0.9		B
	51	1.4	0.5		B

	52	0.6	0.3		B
	53	2.4	1.1		D
	54	3.6	1.4		D
	55	1.0	0.9		B
	56	1.0	0.5		B
	57	34.5	8.3		C
	58	8.2	2.8		C
	59	2.7	2.1		B
	60	1.8	0.8		B
	61	2.6		0.5	A
	62	3.3		0.4	A
	63	2.7		0.3	A
	64	1.9		0.3	A
	65	3.2		0.3	A
	66	4.6		0.5	A
	67	2.7		1.9	B
	68	2.0		1.0	B
	69	1.3		0.9	B
	70	1.2		0.5	B
	71	2.6		0.3	A
	72	1.6		0.2	A
	73	2.4		0.3	A
	74	1.3		0.2	A
	75	2.7		0.3	A
	76	2.6		0.2	A
	77	5.8		5.0	C
	78	0.8		0.5	C
	79	1.7		1.4	B
	80	1.5		1.1	B
	81	2.4		1.8	C
	82	11.2		10.4	C
	83	4.9		1.9	C
	84	0.7		0.4	C
	85	1.1		1.0	B
	86	0.8		0.5	B
	87	5.1		0.7	A
	88	3.2		0.5	A
	89	3.2		0.6	A
	90	3.6		0.3	A
	91	2.1		0.8	B
	92	0.9		0.5	B
	93	2.0		0.5	B
	94	1.1		0.8	B
	95	6.0		2.6	C
	96	4.8		1.3	C
	97	11.2		7.9	C
	98	8.2		1.9	E
	99	7.2		0.5	A

	100	4.3		0.4	A
	101	5.9		0.9	A
	102	3.3		0.9	A
	103	4.2		0.4	A
	104	4.1		0.4	A
	105	10.9		4.0	C
	106	3.9		2.0	C
	107	1.3		0.7	B
	108	1.0		0.6	B
	109	2.1		1.2	B
	110	1.1		0.8	B
	111	2.2		1.2	C
	112	6.8		4.8	C
	113	4.3		0.6	A
	114	1.9		0.3	A
	115	5.3		0.9	D
	116	2.6		0.6	D
	117	5.8		1.3	C
	118	1.6		1.6	C
	119	2.1		0.3	A
	120	3.4		0.3	A
	121	1.4		1.0	B
	122	0.6		0.4	C
	123	0.8		0.4	C
	124	0.6		0.4	C
	125	16.9		7.3	C
	126	1.2		0.7	B
n (Total)					1305
n (Type A)					281
n (Type B/C/D)					1017
n (Type E)					7

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Honor Code

I pledge on my honor that I have neither given nor received an unauthorized assistance on this assignment.

Steven Fisher