# An Exploratory pXRF Analysis of Non-Vitreous Igneous Artifacts From the Little John Site, Yukon Territory


**by**

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## Abstract

Portable x-ray fluorescence was performed on a sample of artifacts exhibiting basaltic attributes from the Little John site, Yukon Territory. This research assessed the potential of this method on archaeological basalts. Results of this analysis are tentative, as basalt and other non-vitreous igneous source locations are unknown, and largely unexplored, within the region. However, the characterization of nine statistically distinct lithic groups, with varying degrees of confidence, suggests the existence of discrete source locales for some of the defined lithic groups. Investigation of spatial and temporal patterns has revealed interesting patterns, particularly for the Nenana/Chindadn component. This research suggests that there is great potential in the pXRF analysis of basaltic and other more homogenous igneous materials. Furthermore, this method of analysis indicates high potential for intra- and inter-site interpretation particularly regarding the prehistoric movement and use of such materials. Possibilities for further interpretation and advanced understandings of archaeological basalts within the subarctic and Beringian contexts relies on the discovery of basalt sources and the regional expansion of this data set.



**Keywords**: portable x-ray fluorescence; basalt; southwest Yukon; Beringian archaeology; provenance studies; archaeometry

## Dedication

This thesis is dedicated to our friends along the Yukon-Alaska Borderlands. Their mentorship and support has put my research goals and interests into a much more meaningful context. However, more significantly, their friendship has enriched this process on a personal level beyond measure.

## Acknowledgements

This thesis would not have been possible without the support of our friends from the White River First Nations. They have not only graciously allowed me to study these exceptional remnants of their distant heritage but, have guided me through these pursuits with their knowledge and friendship since 2011. I have much appreciation as the recipient of direction from two influential mentors. My advisor, Dr. Rudy Reimer, has been not only supportive but, motivational, particularly during the most overwhelming of times. I am also grateful for his expertise and instruction in the methodologies of x-ray fluorescence. Norman Easton has been a source of constant encouragement. Without the numerous opportunities and Norm's belief in my abilities I would not be where I am today. Finally, to the Little John site, where my love for archaeology was born and where my curiosity of northern North America's most ancient past continues to foster.

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# Chapter 1.

# Introduction

## 1.1. Archaeological Background

The Tanana River valley of the Alaskan and Canadian western subarctic has been a region of extensive archaeological investigation for decades. It consists of some of the New World's most ancient remnants of human activity. The valley's prehistory dates from the terminal Pleistocene, to the most recent past in which occupants were the direct ancestors of contemporary aboriginal bands. In 2002, the discovery of Borden site KdVo-6 in the Yukon-Alaska borderlands, extended the archaeology of this region to encompass not only the lower and middle Tanana valley, but the upper extension as well (Yesner et al. 2011:308). A segment of Norman Alexander Easton's long-term project, the Scottie Creek Culture History Project, which had begun ten years prior, included the field survey that led to the initial identification of the site (Easton & MacKay 2008:33).

KdVo-6 is situated on a hillside meters from the frequently traveled, historically significant, Alaska Highway. It is approximately 12 km northwest of the village of Beaver Creek, Yukon Territory, and only 2 km southeast of the international American-Canadian border. The site is located in an area known locally as *Haah Tu Taiy*, roughly meaning "trail at the end of hill" in the Scottie Creek dialect of Upper Tanana *Dineh* language (Easton & MacKay 2008:33). KdVo-6 overlooks a vast valley, within which lies the upper reach of *Cheejil Niik*, translating in English to "Grayling Creek", however, it is popularly referred to as Mirror Creek by the non-indigenous (Easton et al. 2011:289).

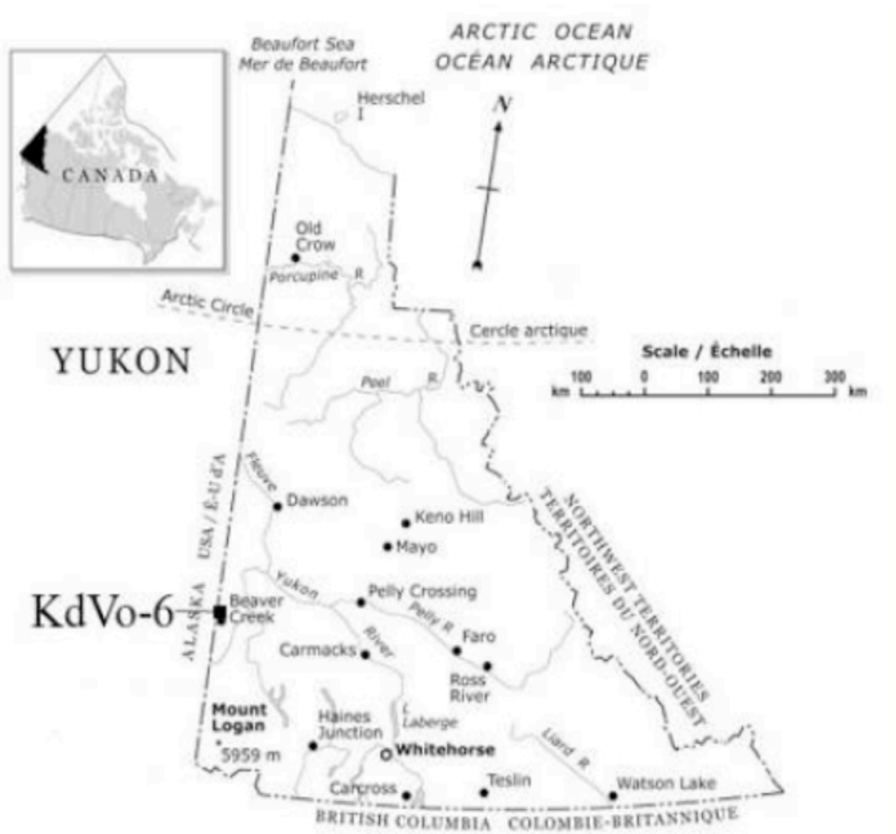


**Figure 1.1 The General Location of the Little John site (Easton 2010:44)**

The cultural occupations at KdVo-6 date to the late Pleistocene/early Holocene transition in which initial colonizers of Beringia are reflected in the site's earliest archaeological component. The site was occupied into the most recent past and continues to be of use by the local Scottie Creek Band of the White River First Nations, as a hunting camp and lookout.

Once site significance was established in 2006, and following consultation with the White River First Nation, KdVo-6 was named the Little John site (Easton et al. 2011:289). Referred to in his own language as *Klaa Dii Cheeg*, ("His Han Drops"), Little John (also, White River Johnny), along with his ancestors and descendants, have, since time immemorial, utilized this place as a hunting camp and lookout (Easton et al. 2011:289).

**Figure 1.2 Ariel View of KdVo-6 from the Southwest (Easton 2010:44)**

## 1.2. The Pleistocene Environment

The remnants of glacial activity dominate Little John's surrounding landscape. During the Pleistocene, the Nutzotin-Wrangell-St. Elias Mountain chain marked the beginnings of what is locally referred to as the McConnell Glaciation, and more universally known as the Late Wisconsin McCauly glacial advance. It terminated at the McCauley Ridge approximately 50 km to the southeast of the site (Easton et al. 2011:291; Rampton 1971:286-288). Rapid recession of this advance has been dated to c. 13,500 RCYBP (c. 16,000-16,800 cal. BP) and the region was ice free by 11,000 RCYBP (c. 12,800-13,000 cal. BP) (Easton et al. 2011:291; Rampton 1971:294).

The glacial evidence supports that Little John was located within the boundaries of the former ice-free Beringian landscape. The addition of abundant remains of Pleistocene fauna, including *Bison*, *Equus*, *Mammuthus*, and *Rangifer*, deposited as close as a mere kilometer from the site, and throughout the Scottie Creek and Mirror Creek valleys, further supports Little John's Beringian context (Easton and MacKay 2008:33).

## 1.3. Stratigraphic Context

The geologic and stratigraphic contexts of Little John are heavily influenced by both glacial and periglacial processes. The stratigraphic sequence begins with a basal regolith followed by a layer of sparse glacial till, a result of the maximum of Mirror Creek's glacial advance (Easton and MacKay 2008:35). The till, or loess sediments, vary in thickness distribution across the site, ranging from a few centimeters, to over 4.5

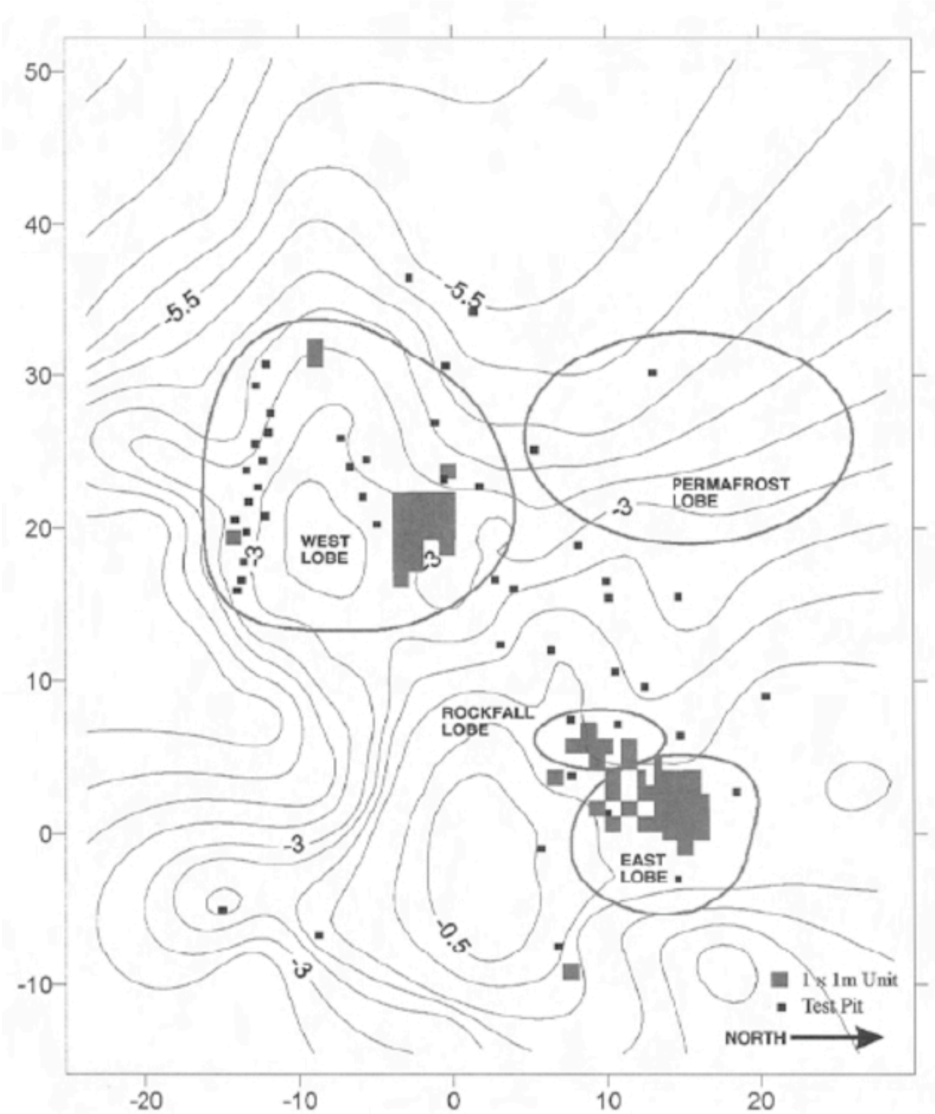


**Figure 1.3 Zonal Division of KdVo-6 (Easton & MacKay 2008:337)**

meters (Easton et al. 2011:291). Two distinct brunisol horizons follow the loess horizon (designated as B2 overlain by B1) (Easton et al. 2011:291). The B2 and B1 horizons are separated by a layer of tephra, also ranging in varying centimeters of thickness. This tephra is the result of the second White River Ash fall dated to over 12,000 years ago (Easton et al. 2011:291). Finally, an organic layer, designated as the O/A horizon, seals the Little John stratigraphic sequence.

Unfortunately, excavations at the Little John site have revealed a much less consistent stratigraphic context than the description above suggests. As a result, site interpretation has been challenging at best. The topographic context of the site ranges from deep swales to eroding cliffs, in part accounting for the discontinuous thickness of loess deposits (Easton et al. 2011:291). To further complicate the stratigraphy are multiple periglacial processes, which occurred in the distant past and continue to alter the strata. These processes include permafrost action, solifluction, colluvial deposition and a presumed mass wasting event.

Due to the undulating topography and resulting variation in sedimentary and geologic nature within the site, five distinct zones have been identified to distinguish between site locales. The West lobe occupies the southwest hillside subjacent to the Wrangell St. Elias Mountains. This zone accounts for the site's most shallow deposits (>30 cm) as well as the most abundant deposits of lithic artifacts.

Alternatively, the East lobe is a deep swale which entrains a large sedimentary package, including a loess deposit greater than 1 m thick. Below this loess deposit is a basal Paleosol complex with a spatial distribution of at least 12 $m^2$ (as exposed by the end of the 2010 field season) (Yesner et al. 2011:312). The Paleosol complex has produced a series of confident radiocarbon dates, from 8850 to 10,000 radiocarbon years before present (14C BP) (ca. 10,000-11,480 cal BP) (Yesner et al. 2011:312). The Paleosol complex has yielded an assemblage of lithic materials as well as an exceptional abundance of well preserved faunal remains.

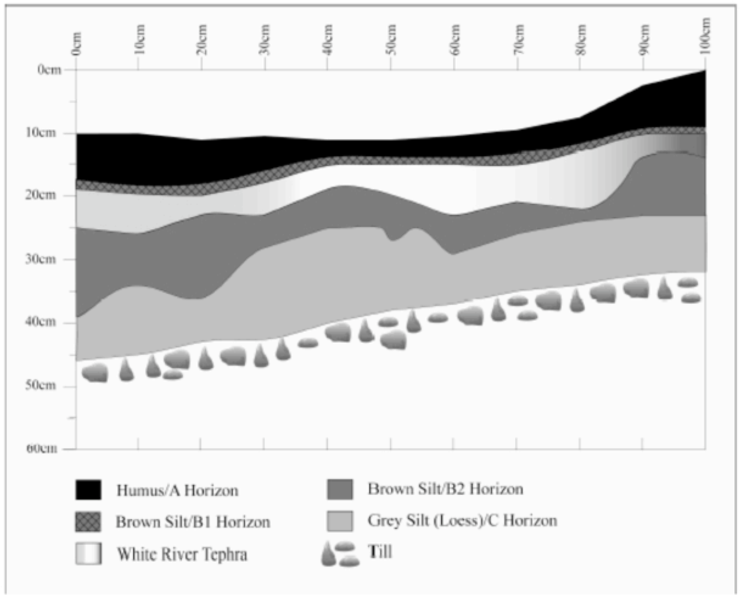


**Figure 1.4 Representative Stratigraphic Profile of the West Lobe (Easton 2009:52)**

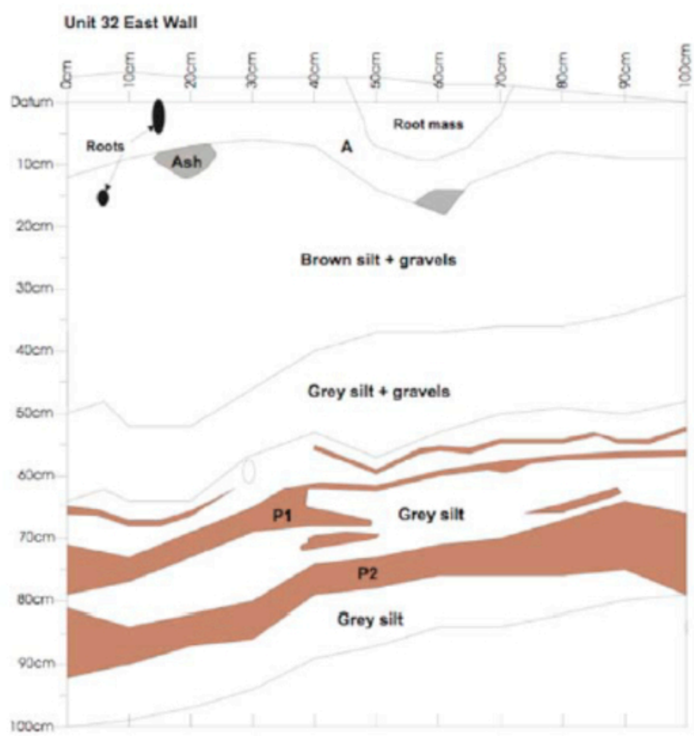


**Figure 1.5 Respresentative Stratigraphic Profile of the East Lobe (Easton 2007:46)**

The remaining three lobes have been less productive than the east and west locales. The Permafrost lobe is a slope running northwest in which frozen ground is encountered only centimeters from the surface year-round (Easton et al. 2011: 292). Central to the site is the Rockfall lobe, where large pebbles and cobbles are deposited throughout the matrix of the B horizons (Easton et al. 2011: 292). Finally, the Swale lobe, a northern extension of the East lobe, exhibits an over 4.5 m deposit of loess and has yet to produce strata of paleosol or regolith (Easton et al. 2011: 292).

## 1.4. Culture-Historical Sequence

The geographic position of Little John creates an interesting case for the designation of an archaeological culture history. The Tanana River valley sites, commonly located on the Alaskan side of the border, generally follow a framework created for Alaskan-Beringian archaeology. However, an alternative framework for the southwest Yukon is also well developed thus, creating an interesting paradox for the cultural components at the Little John site.

A cultural framework utilizing both the Alaskan and Canadian terminology has been proposed to best suit the prehistoric record at Little John. The simplified timeline for the cultural occupations, from oldest to youngest, is as follows; the Chindadn/Nenana complex of late glacial Beringia (known in the Yukon as the Northern Cordilleran Phase); the Denali complex, also a terminal Pleistocene component (or the Northwest Microblade Tradition respectively); the Little Arm Phase (a phase of Alaskan Denali complex) associated with the early Holocene; the Northern Archaic Tradition (or Taye Lake phase of the Yukon) of the mid-Holocene; this phase is interrupted by the White River volcanic eruption and deposit of ash (ca. 1,900-1,200 years BP); the Aishiak phase/Late Prehistoric (known in Alaska as the Athapaskan phase; the Bennet Lake phase/Transitional Contact Period; the Historic Period/20$^{th}$ century; the final component is the Contemporary Period (which relates to the current use of the site by members of the local Scottie Creek Band of the White River First Nations, and their relatives).

# Chapter 2. Research Questions and Study Background

## 2.1. Research Questions

Little is known on the procurement and distribution of basalt in the North American western subarctic. This research was initiated as a basalt provenance study for lithic artifacts at the Little John site to begin the exploration of these unknowns. The overarching inquiry is to assess whether or not there are distinct basalt source materials at the site, and if so, what is the potential for spatial and temporal patterning of basalt procurement and use. Other questions include; are distinct basalt source materials identifiable at the site using a visual typology; what is the potential for portable x-ray fluorescence (pXRF) technology as it pertains to the geochemical analysis of archaeological basalts; and, finally, can pXRF be utilized to asses not only the accuracy of visual classifications for basaltic materials but, also for the determination of distinct source materials.

First, a small field survey was conducted to assess if local basalt sources are present within close geographic range of the site, as well as to attain potential source materials for visual and geochemical classification. Secondly, a sample of lithic artifacts from the Little John site with basalt-like attributes was assembled. The sample assemblage was visually classified to assess to the maximum amount of distinct source materials. The accuracy of the visual typology was tested using pXRF analysis. Furthermore, these signatures were utilized to more definitively determine if there are distinct basalt source materials, if so, how many, and whether intra-site patterning is adherently recognizable.

## 2.2. Study Background:

### *2.2.1. Beringian Sourcing History*

Obsidian sourcing has, rather recently, gained extensive momentum as a productive field of archaeological research within eastern Beringia (Cook 1995; Goebel et al. 2008; Slobodina et al. 2009; and Speakman et al. 2009). Many obsidian sources utilized in archaeology sites of this region are well established and long studied. Various geochemical methods have been employed on much of the obsidian record and thus, have led to a comprehensive data set. These studies have led to inferences regarding the prehistoric movement and procurement of exotic lithic materials and those who have manufactured them.

The study of basalt artifacts, and other non-vitreous igneous stone, commonly interpreted as local raw materials, has until now received very little exploration. This research aims to assess the potential of utilizing geochemical analysis on material of this nature within the eastern Beringian context as well as expand the current understandings of local raw material use within the region.

### *2.2.2. Basalt Source Survey*

Archaeologically, basalt is an abundant lithic material, particularly in the western subarctic. It is generally recognized as being derived from nearby creek and river beds or small easily accessible outcrops (Heffner 2002:60; Easton et al. 2011:299). The Little John basalt is expected to originate from any of the multiple identified volcanic outcrops in the Tanana Valley, likely between the Chisana and Nabesna rivers, Alaska (Easton et al. 2011:299), within the boundaries of the Wrangell St. Elias National Park and Preserve. Such outcrops, as well as the many well-known obsidian sources, are the result of the extensive volcanic activity of the Wrangell volcanic field (WVF). Large expanses of the WVF are fields of thick piles of flat lying lava flows, predominantly composed of basalt, andesite and dacite (Richter et al. 1991:30).

Two main watersheds compose the drainage of the Wrangell St-Elias Mountains. The Copper River drainage flows north for release into the Gulf of Alaska and the Yukon

River drainage flowing northeast into the Bering Strait. In consideration of the Wrangell volcanic activity and the drainage pattern of the Wrangell-St. Elias Mountains, a small survey for local basalt sources (within approximately 40 km of the site) was conducted. Rivers and creeks with north to north-easterly flows were surveyed for basaltic cobbles and pebbles. These survey locales included; Sanpete Creek, the White River, Beaver Creek and Dry Creek (see Figure 2.1 and also Figures 2.2-2.5). Also surveyed was a rock quarry (within a five minute walking distance from the site), in which the geologic history is unknown and is currently used for industrially and commercial practices.

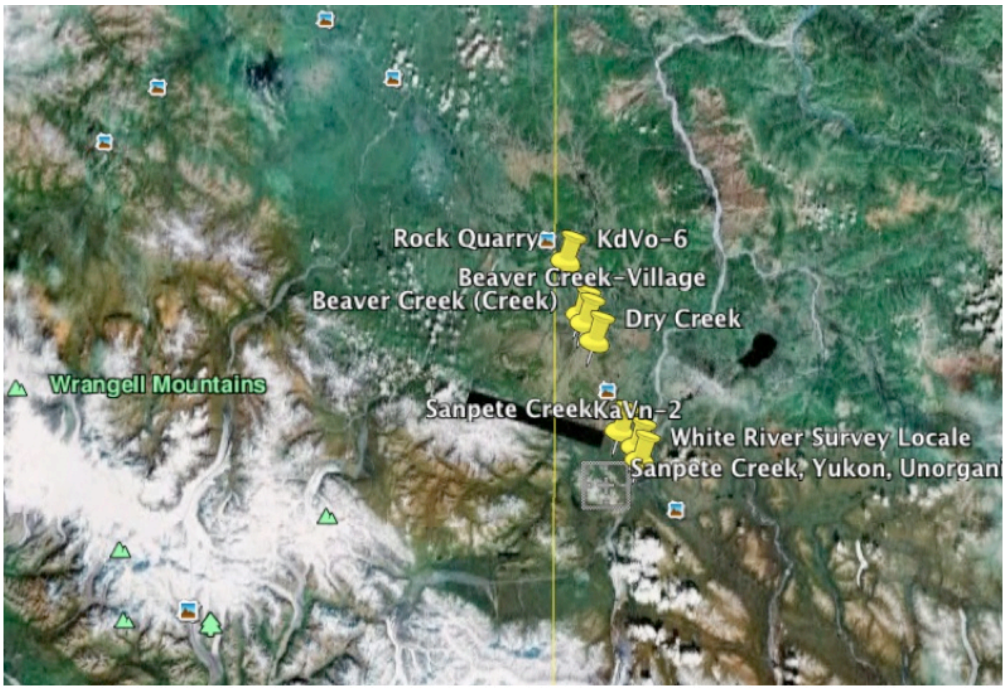


**Figure 2.1 Map of Basalt Survey Locales**

At the rock quarry locale, five igneous cobbles were recovered. However, whether materials at this site are in a primary context is highly questionable and further investigation into history and origin of this feature is necessary. Only one other potential source sample was attained, this was at the White River locale. The river was accessed using a private road which is in close proximity to the Alaska Highway. The Sanpete, Dry and Beaver Creek survey locales were all accessed similarly to the White River and again, in close range of the highway. No materials were recovered from these locations.

**Figure 2.2 Sanpete Creek Location**

**Figure 2.3 Dry Creek Location**

**Figure 2.4 White River Location**

**Figure 2.5 Beaver Creek Location**

The lack of source materials recovered from this survey may be the result of high freshwater levels from excess precipitation, in both the forms of snow and rain, for the winter and spring months of 2012 in the survey area. High water levels may therefore, account for a lack of visibility of the materials. It may be possible that the exact areas surveyed did not have a high abundance of materials and a second survey is needed to explore them further.

A future survey may include the Steele Creek-Steele Glacier area in the Yukon Territory approximately 60 km southeast of the Alaska border (Richter et al. 1991:41), the southern Alsek River (Richter et al. 1991:41), the Rocker and Sonya Creeks just west of the border (Richter et al. 1991:39), and finally, the Burwash Basin in the Yukon Territory (Cole and Ridgway 1993:153).

As the surveyed creek and river beds, presumed to have high potential for locally derived basalt materials, revealed no exclusive sources, and the locales suggested to be of significance for future survey relate to major basalt outcrops, it may be appropriate to at least entertain ideas of meaningful source areas for basaltic materials. That is, instead of basalts being exploited advantageously from nearby stream beds, perhaps more culturally-based decisions are at work behind their exploitation and use. For instance, more significant attachment or relationships to places where culturally-modified basalts are derived and where they are further manufactured could be explored (Bradley 2000:81). Future survey and subsequent geochemical analysis beyond what is included in this study, may potentially reveal more on these possibilities.

# Chapter 3. Materials and Methods

## 3.1. Little John Basalt Sample Selection

The sample prepared for visual classification and pXRF analysis consisted of 259 basalt-like artifacts from 12 1x1 meter excavation units at the Little John site. The sample was selected on a judgmental basis to ensure even coverage across the two lobes of the site, for comparison between the lobes, as well as to acquire the largest possible assemblage. A 2x2m unit and 1x2 m unit from each the East and West lobes were chosen for their high proportions of basalt materials. Other factors including, the amount of materials associated with the oldest stratigraphic layers, type artifacts for proposed cultural components, association with hearths and association with radiocarbon dates, influenced the sample selection. Added to the sample assemblage was a collection of formal, diagnostic artifacts.

## 3.2. Visual Characterization of the KdVo-6 Basalt Sample Assemblage

The primary objective of this typology was to visually determine the maximum potential amount of distinct raw material types with basaltic attributes which were exploited for the manufacture of lithic artifacts recovered at the Little John site. The three main attributes utilized to distinguish between different source materials were grain size, texture, and Munsell colour. The visual typology suggests 18 distinct source materials including various basalt, dacite and andesite types occurring within the 263 sample assemblage.

The categorization of the samples has revealed an overall larger abundance of artifacts and a consistency of lithic material quality in the West lobe in comparison to the East. Lithic artifacts are more sparse in the East lobe and a larger variety of visually distinct raw materials are found. There is an interesting paradox in fewer lithic remains with a higher variety of lithic material. The application of pXRF will potentially reveal more on these observations. The typology has not been overly conclusive in the designation of raw material type based on similarities in grain size, texture and colour. This too will be tested using the geochemical signatures resulting from pXRF analysis.

The application of pXRF spectrometry will determine if the typology proposed is accurate in distinguishing between specific raw material source groups. However, should the geochemical data not correlate with the visual classification, this will suggest that raw material and distinct source materials can only be identified via the application of trace element analysis.

## 3.3. Portable X-Ray Fluorescence and Methods

### *3.3.1. Introduction to the Technology and the Instrument*

Non-destructive x-Ray fluorescence spectrometry is a common method used in archaeological provenance studies. It has most commonly been used for obsidian sourcing studies, however, its application on other non-vitreous igneous materials is growing (Lunblad et al. 2008; Lundblad et al. 2011; Johnson 2011; Grave et al. 2012). Portable XRF instruments have also been gaining recognition with their abilities to produce accurate and reliable results (Shackley 2008; Shackley 2011; Philips and Speakman 2009). It's been proven that these instruments have the ability to produce results comparable to alternative sourcing techniques including, energy dispersive x-ray fluorescence (EDXRF) and neutron activation analysis (NAA) (Ioannis & Zacharias 2011; Glascock 2011).

There are many additional benefits to pXRF analysis including; 1) it is non-destructive, 2) it requires minimal preparation, 3) it is time efficient, 4) it is easy to use, and 5) it is cost-effective (Shackley 2011:19). However, to ensure reliability there are highly recommended protocols to consider; sample surfaces should be free of irregularities; a minimum sample size is 2.0 mm; frequent instrument maintenance and calibration; and the integration of internationally recognized standards to analyses (Shackley 2011:9).

### 3.3.2. The pXRF of Archaeological Basalts and Other Igneous Materials

While there are great benefits and immense potentiality for pXRF analysis on basalts, there are additional considerations to address. Of greatest concern is the relatively rapid chemical weathering of archaeological basalts in which the original compound of the stone is dissolved by naturally occurring acids. This process is heightened in humid and acidic environments (Lundblad et al. 2008:3). The acidic nature of boreal forests in the western subarctic is therefore, problematic to the pXRF analysis of the Little John sample assemblage. The extent of weathering on archaeological basalts in the western subarctic is not well known.

The effects of chemical weathering and leaching of basalts, however, have been assessed by XRF studies (Lundblad et al. 2008; Gauthier & Burke 2011; Potts et al. 2006). Gauthier and Burke have suggested that major elements are more affected by chemical weathering than are trace elements (2011:3). Furthermore, Lundblad et al. have suggested that Mid-Z elements are only affected by weathering in the most extreme cases (2011:77). Similar to weathering, surface patination is another concern. This process is additive verses reductive (Lundblad et al. 2011:66), having effects of similar magnitude on the geochemical signatures.

Finally, it is important to note that basalts are much more homogeneous in their major and trace element compositions than obsidians (Lundblad et al. 2011:65). Also complicating the sourcing of basalts is the lack of geographic distinctiveness due to the continuous and expansive nature of mafic volcanic eruptions (Lundblad et al. 2011:65). Considering that no geographic sources have been identified in the study area, the any lithic groups revealed in this analysis will be tentative. Furthermore, the effects of weathering and patination processes were addressed during this analysis.

### 3.3.3. Settings and Procedures

In acquiring geochemical signatures for the Little John Site basalt sample assemblage and six potential source samples, pXRF spectrometry was performed in facilities at Simon Fraser University, Burnaby, B.C. The instrument used in this study was a Bruker AXS Tracer III-V portable XRF analyzer. Variable power settings are possible with the instrument with a resolution of approximately 170eV FHWM for 5.9 keV X-rays (Reimer 2012: 128). The range of power settings allows for simultaneous detection of various elements from the periodic table from sodium (Na) to uranium (U) while counting their densities at 1000 times per second (Reimer 2012: 128).

For this analysis, the instrument was equipped with a rhodium X-Ray tube and silicon-based (SiPIN) detector. Analyses for this study utilized the instruments power setting of 40 keV and 15 UA with a 0.76 millimeter copper filter and a 0.0305 millimeter aluminum filter. Samples were emitted to the X-ray path for a 180 second live time count. Ten elements from the period table were measured and quantified; Manganese (Mn), Iron (Fe), Zinc (Zn) Gallium (Ga), Thorium (Th), Rubidium (Rb), Strontium (Sr), Yttrium (Yr), Zirconium (Zr), and Niobium (Nb). Peak intensities for these elements were calculated as ratios and converted to parts per million.

Shackley's protocols for reliable application and results were utilized (2011). Only samples larger than 2.0 mm were included and smooth flat surfaces were utilized to the greatest degree possible to minimize surface effects. Many of the samples were prepared in an ultrasonic washing machine to remove patination and residual sediment prior to application of pXRF. The standards utilized for this analysis include, basalt (BAMAP01), rhyolite (PER01), and andesite (CHA01).

## 3.4. Analytical Methods

Following the XRF analyses, spectral data was converted to parts per million (ppm) for the elements listed above. Group delineation was determined by principal component analysis (PCA) and further explored by the aid of bi-plots and scatterplot matrices.

# Chapter 4. Results

Distinct lithic groups were suggested by the PCA which assessed five trace elements Rb, Sr, Y, Zr, and Nb (Figure 4.1). Most of the assemblage variation is explained by the first three components, predominantly PC1, which contains 61.6% of the variation (Table 4.1). Eigenvectors indicate that Y, Zr, and Nb are positively correlated in this component (Table 4.1). PC2 contains 17.2 % of the total variation and it is dominated by Sr. Rb, Y, Zr, and Nb, are negatively correlated. Finally, PC3 comprises 13.3% of the remaining assemblage variation and is defined by Rb, whilst exhibiting negative correlations between Y, Zr, and Nb

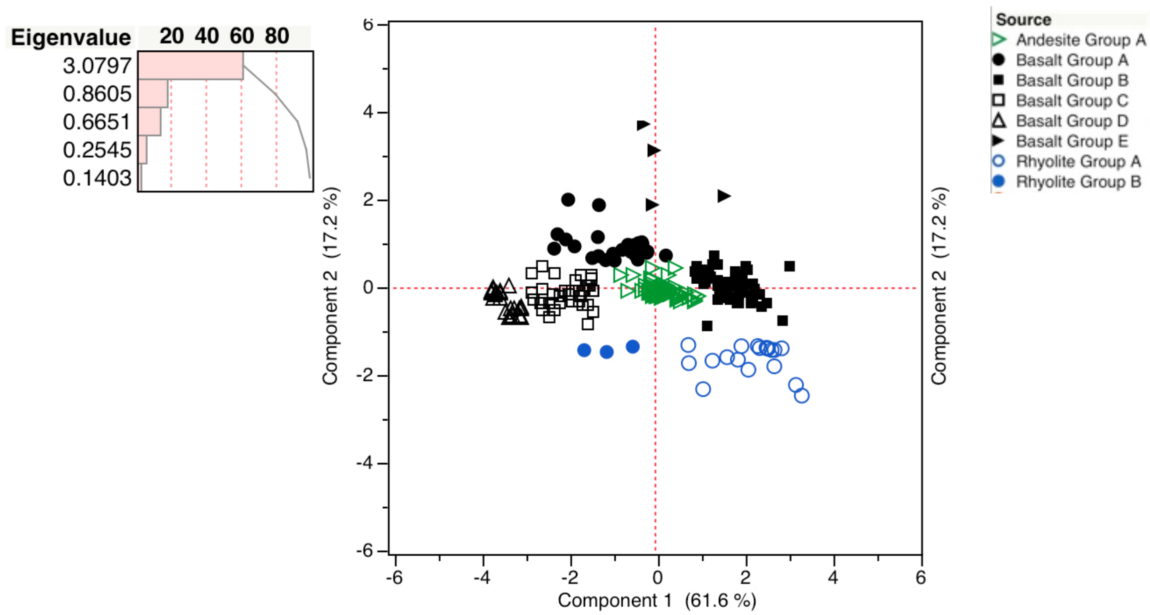


**Figure 4.1 Principal Component Analysis Exhibiting Proposed Lithic Groups**

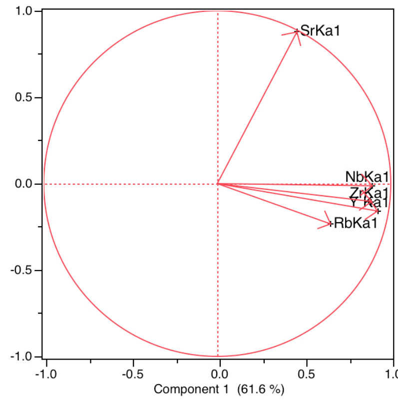


**Figure 4.2 Correlation of Elements for PC1**

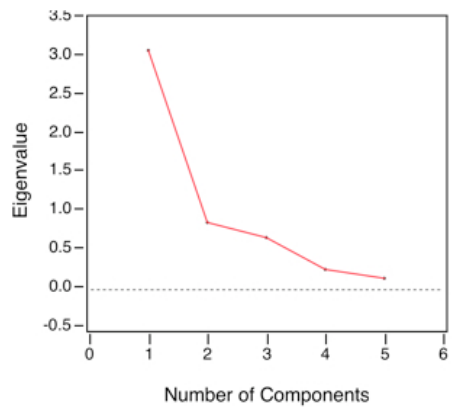


**Figure 4.3 PCA Eigenvalue Screeplot**

**Table 4.1 Principal Component Eigenvectors**

| Trace Element | PC1 | PC2 | PC3 | PC4 | PC5 |
|---|---|---|---|---|---|
| *RbKa1* | 0.37206 | -0.25164 | 0.88059 | 0.0483 | 0.14311 |
| *SrKa1* | 0.26149 | 0.94589 | 0.15788 | 0.10682 | -0.02414 |
| *Y Ka1* | 0.52632 | -0.17123 | -0.16421 | 0.29884 | -0.75987 |
| *ZrKa1* | 0.50702 | -0.11165 | -0.37273 | 0.44082 | 0.63025 |
| *NbKa1* | 0.50903 | -0.01372 | -0.1837 | -0.83823 | 0.06571 |

**Table 4.2 Principal Component Eignvalues**

| Component | Eigenvalue | % | Cumulative % | Chi-Square |
|---|---|---|---|---|
| 1 | 3.0797 | 61.593 | 61.593 | 712.181 |
| 2 | 0.8605 | 17.209 | 78.803 | 245.376 |
| 3 | 0.6651 | 13.302 | 92.104 | 158.54 |
| 4 | 0.2545 | 5.089 | 97.194 | 22.309 |
| 5 | 0.1403 | 2.806 | 100 | 0 |

While the PCA determined statistically significant lithic groups, they were further explored with the aids of bi-plots and scatterplots. Confidence in designating discrete lithic source groups as well as raw material type is challenged by the lack of geographically known sources. The following phase of this research, however, is concerned with the attempts to characterize the suggested lithic groups as well as assign raw material type, regardless of no known sources. Results fare thus, tentative.

## 4.1. Characterization of Archaeological Samples

Of the 263 artifact samples, nine distinct groups have been recognized. The validity of the visual typology was assessed and utilized to establish visual characteristics of the proposed nine groups. Assigning raw material type was difficult and it is hypothesized that the basalt and andesite groups likely represent varying related and distinct flows ranging from basalt to andesite to andesitic-basalt and so on. No evidence for dacitic groups was revealed during analysis. Alternatively, the rhyolite groups are assigned with a good degree of confidence.

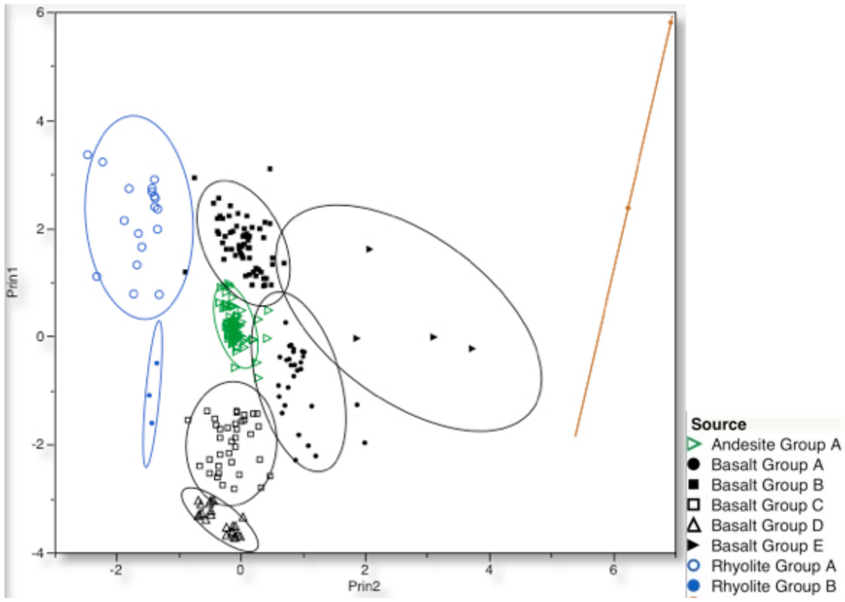


**Figure 4.4 Bi-plot Demonstrating the Relationship Between Pc1 and PC2**

### *4.1.1. Andesite Group A*

Andesite Group A is demonstrated in nearly all graph representations as a tightly clustered lithic group. Andesite Group A comprises 31% of the overall sample population (*n*=81). It is the lithic group with the most correspondence to a type proposed by the initial visual classification. It can be defined as a fine-grained black andesite containing what could be very small quartz, but more likely feldspar plagioclase, phenocrysts. This lithic group is the most visually consistent as well as distinct pXRF group. It is possible that Andesite Group A is a basalt or a basaltic-andesite, however, the standard CHA-01 suggested the former description versus the latter possibilities.

### *4.1.2. Basalt Groups A, B, C, D & E*

Basalt Group A comprises nearly 12% of the overall sample assemblage (*n*=30) and contains the highest degree of visual variation. However, it can be described as a fine-grained, dark grey-black basalt. Differences in visual characteristics are likely due to chemical weathering, a process in need of further study. This group also has potential to be an andesitic basalt or a weathered andesite. At this stage, a basaltic classification is most fitting. The repetitive graphical overlap between Andesite Group A and Basalt

Group A suggests that differing geochemical signatures may be because they are products of two volcanic flows from the same eruptive center. Alternatively, they could potentially be from the same flow but, were subject to different cooling rates and processes.

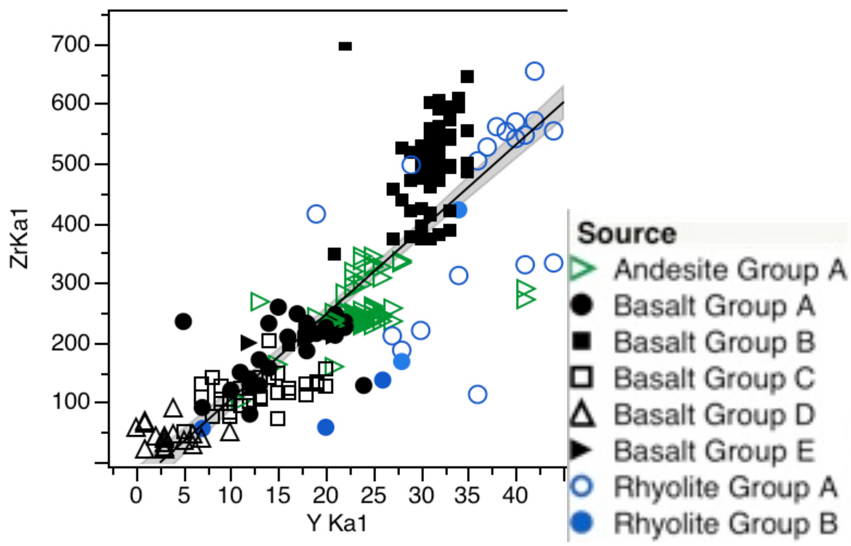


**Figure 4.5 Scatterplot Indicating Group Characterization for Zr and Y**

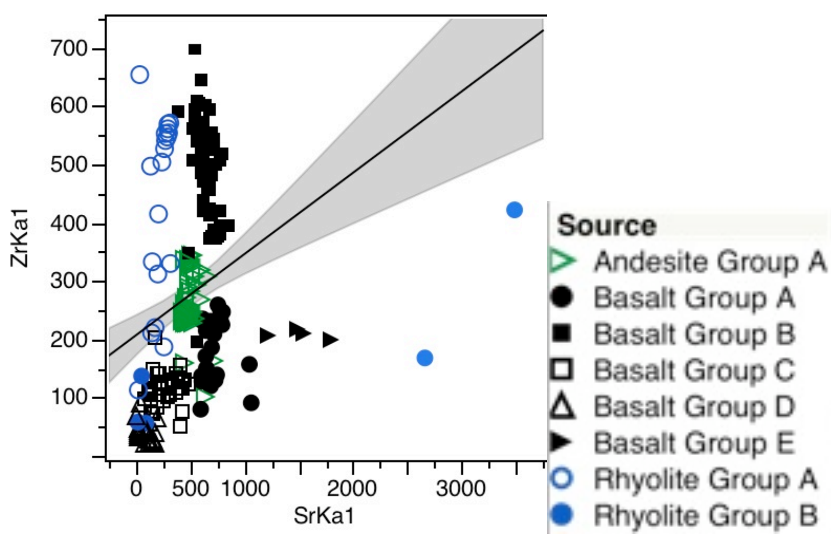


**Figure 4.6 Scatterplot Indicating Group Characterization for Zr and Sr**

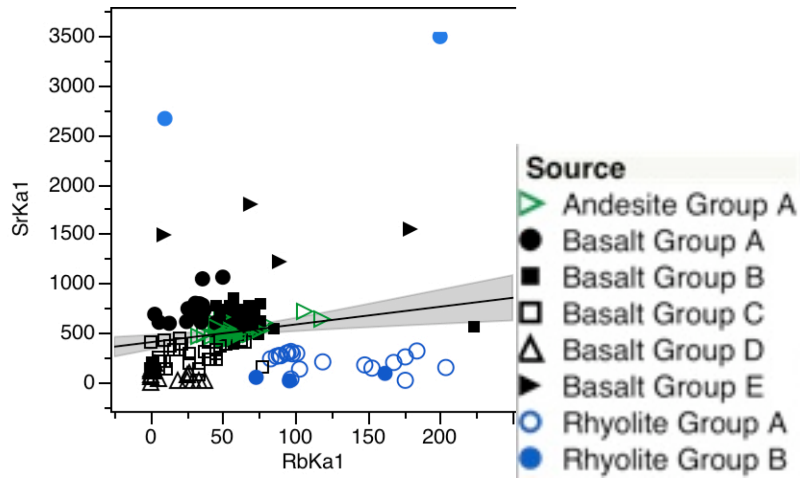


**Figure 4.7 Scatterplot Indicating Group Characterization for Sr & Rb**

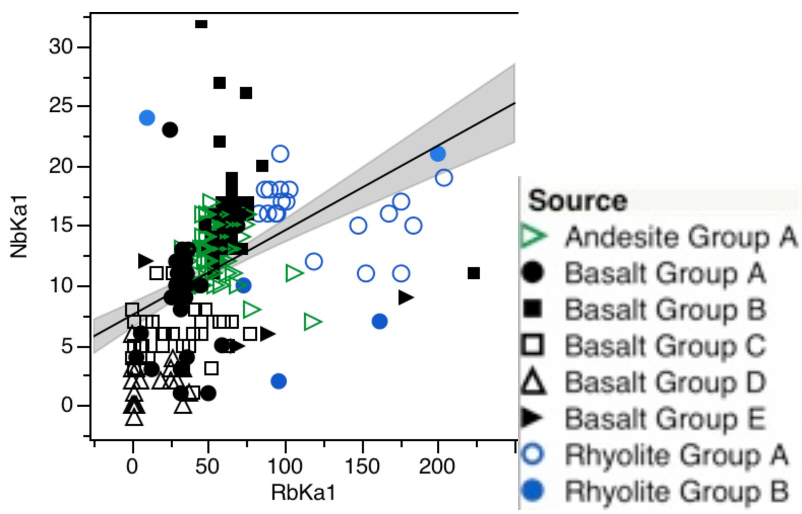


**Figure 4.8 Scatterplot Indicating Group Characterization for Nb & Rb**

Basalt Group B, described also as a dark grey-black fine-grained basalt, differs from Basalt Group A predominantly by it's exceptional visual consistency and correlation with the visual typology. Basalt Group B comprises 24 % of the assemblage (*n*=63) and is designated as a basalt with a good degree of confidence. Basalt Group C, alternatively, is a smaller lithic group, approximately 14% of the overall assemblage (*n*=36). It can be described as a dark-grey fine-grained basalt with multiple examples of olive grey samples. Thus, a high olivine content is proposed for the group.

Basalt Group D is classified as a black-dark grey, very fine-grained basalt and makes up 8% of the overall sample assemblage (*n*=21). It is visually and statistically distinct from the other proposed lithic groups. It is very fine-grained, however, there is no indication of dacitic origins for this group and thus, may be a vitreous basalt. Finally, Basalt Group E, the smallest basaltic group (*n*=4) is less confidently characterized based on the small sample size and variable visual attributes. Two samples are fine-grained black materials interpreted as basalt prior to XRF analysis. However, the third is an olive grey medium-grained, while the final sample is very fine-grained and reddish grey. This group is inconclusive.

### *4.1.3. Rhyolite Groups A & B*

Rhyolite Group A consists of 19 samples and constitutes 8% of the overall assemblage. This group is visually defined as a very-fine grained, grey-dark to grey rhyolite. Rhyolite Group B consists of only three samples and is defined as a fine-grained dark grey rhyolite. The PCA and visual characteristics for Rhyoite Groups A and B support this designation of raw material type. The low proportion of rhyolite in this assemblage is attributed to the original sample selection in which artifacts with basaltic attributes were chosen for analysis. Further geochemical analysis of rhyolitic materials from the Little John site would reveal more results regarding the two proposed rhyolite groups here.

### *4.1.4. Unknown Group*

This unknown group consists of only two artifacts with very different visual characteristics. They do, however, share a similar olive grey colour. The unknown group should be considered as outliers and may not even be igneous in nature. And comprise less than 1% of the overall sample assemblage.

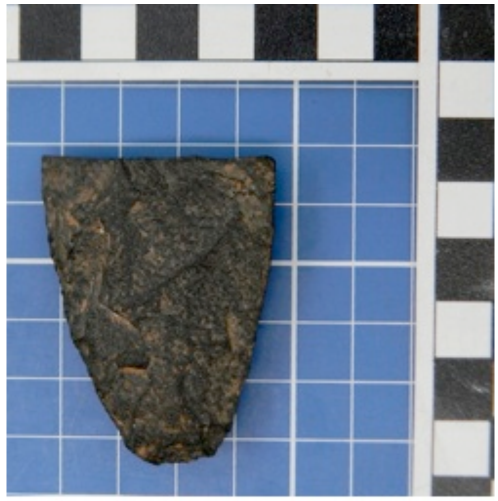

**Figure 4.9 Andesite Group A-Kdvo-6:3255 (proximal segment of a straight based lanceolate point)**

**Figure 4.10 Basalt Group B-KdVo-6:2711, 2841, 2710 (large refit scraper on blade-like flake)**

**Figure 4.11 Basalt Group B-KdVo-6:2921 (nearly complete biface; Chindadn Type 1)**

**Figure 4.12 Basalt Group C-KdVo-6:758 (bifacial preform)**

**Figure 4.13 Basalt Group D-KdVo-6:2703 (retouched blade)**

## 4.2. Source Samples Assessed

Problems regarding the Little John site's nearby 'quarry source' have been discussed, however, four of the five samples from this location appear to be consistent with Basalt Group C. This source may represent a prehistoric lithic procurement area. Alternatively, sources may be in a secondary context, the primary thus, being the true source locale. The final sample collected from the quarry site appears consistent with Basalt Group B.

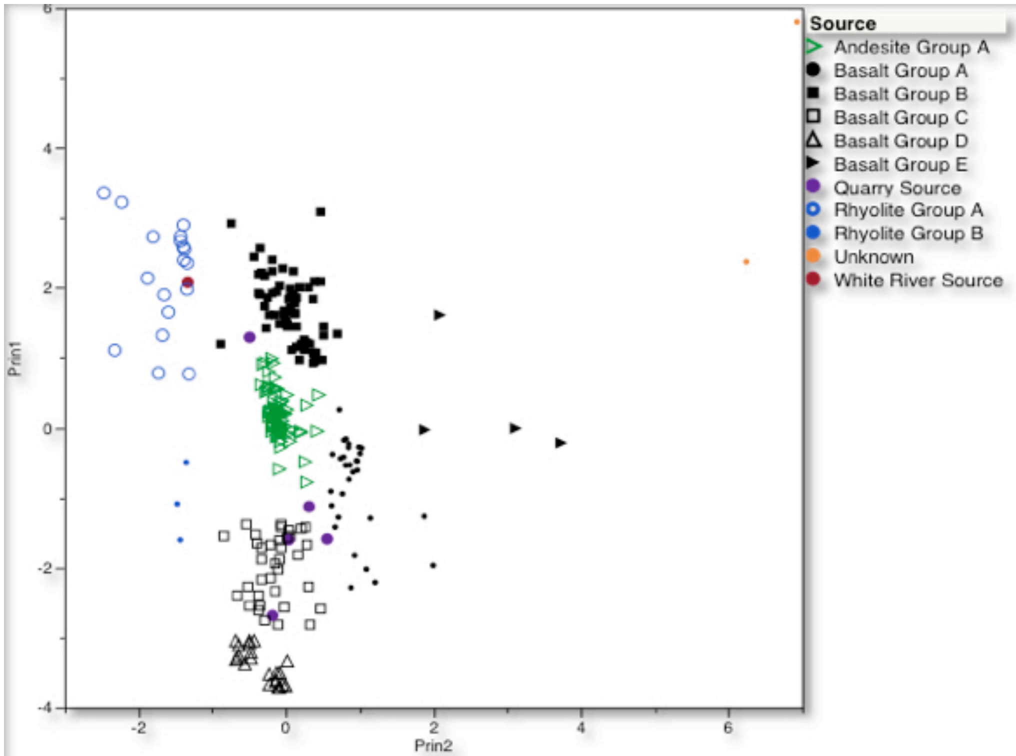


**Figure 4.14 Bi-Plot Indicating Elemental Distribution of Source Samples within the Principal Component Analysis**

The White River location is a much more probable basalt source. The one sample recovered from the White River location agrees with Rhyolite Group A. The recovery of only a single sample may be attributed to changes in raw material density over time or the high water levels of the 2012 field season. Nevertheless, a more extensive survey is necessary to assess the potentiality of this source location.

# Chapter 5. Discussion

## 5.1. Intra-Site Patterning

The preceding pXRF analysis has been successful in distinguishing between different source materials of igneous nature at the Little John site. With further refinement and the addition of sample materials, it is probable to hypothesize that increased confidence in group designations would be achieved. How these sources relate to one another, is a significant question to be answered only by the discovery of true lithic sources. Without known sources the results of this analysis remains somewhat inconclusive, however, in combination with visual classification and pXRF characterization, enough confidence has been attained to tentatively suggest the existence of discrete lithic sources.

The visual typology was not able to accurately distinguish between source material groups but, for some cases did prove to have some degree of uniformity with the groups proposed by pXRF. Visual classifications resulted in double the number of source groups in comparison to the geochemical analysis. This implies that while some characteristics, colour for instance, may suggests multiple groups, that a more homogenous elemental structure exists among the source samples. Patination and weathering may also have affected the visual group delineation as well because samples underwent ultrasonic washing following the visual classification. While, the visual classification was ultimately inaccurate, it did act as a reference for validity of the final group designations, which was stronger for some source groups than others.

PXRF analysis is determined necessary to distinguish between archaeological basalts, rhyolites and andesites. The research conducted here also suggests a great deal of potentiality for utilizing pXRF in future basaltic provenance studies. The determination of raw material type to the groups proposed was a challenge however, particularly because of the lack of known-source materials and corresponding samples.

**Table 5.1 Counts and Standardized Residuals for Source Group and Lobe**

| | | | Lobe | | |
|---|---|---|---|---|---|
| | | | *East* | *West* | **Total** |
| **Source Group** | *Andesite Group A* | *Count* | 18 | 89 | 107 |
| | | *Std. Residual* | -0.6 | 0.3 | |
| | *Basalt Group A* | *Count* | 9 | 29 | 38 |
| | | *Std. Residual* | 0.6 | -0.3 | |
| | *Basalt Group B* | *Count* | 12 | 70 | 82 |
| | | *Std. Residual* | -1 | 0.5 | |
| | *Basalt Group C* | *Count* | ***13*** | ***28*** | 41 |
| | | *Std. Residual* | ***1.8*** | ***-0.9*** | |
| | *Basalt Group D* | *Count* | ***4*** | ***17*** | 21 |
| | | *Std. Residual* | ***0*** | ***0*** | |
| | *Basalt Group E* | *Count* | 2 | 4 | 6 |
| | | *Std. Residual* | 0.8 | -0.4 | |
| | *Rhyolite Group A* | *Count* | 3 | 16 | 19 |
| | | *Std. Residual* | -0.4 | 0.2 | |
| **Total** | | **Count** | 61 | 253 | 314 |

**Table 5.2 Counts and Standardized Residuals for Source Group and Artifact Type**

| | | | Artifact Type | | |
|---|---|---|---|---|---|
| | | | *Flake* | *Formal Tool* | **Total** |
| **Source Group** | Andesite Group A | *Count* | 100 | 7 | 107 |
| | | *Std. Residual* | 0.1 | -0.4 | |
| | Basalt Group A | *Count* | 31 | 3 | 34 |
| | | *Std. Residual* | 0 | 0.2 | |
| | Basalt Group B | *Count* | 73 | 9 | 82 |
| | | *Std. Residual* | -0.3 | 1.1 | |
| | Basalt Group C | *Count* | 36 | ***0*** | 36 |
| | | *Std. Residual* | 0.5 | ***-1.7*** | |
| | Basalt Group D | *Count* | 16 | ***3*** | 19 |
| | | *Std. Residual* | -0.4 | ***1.3*** | |
| | Basalt Group E | *Count* | 4 | 0 | 4 |
| | | *Std. Residual* | 0.2 | -0.6 | |
| | Rhyolite Group A | *Count* | 17 | 1 | 18 |
| | | *Std. Residual* | 0.1 | -0.3 | |
| **Total** | | **Count** | 277 | 23 | 300 |

**Table 5.3 Counts and Standardized Residuals for Source Group and Stratigraphic Level**

| | | | Level | | | | Total |
|---|---|---|---|---|---|---|---|
| | | | *B1* | *B2* | *Loess* | *Paleosol Complex* | |
| **Source Group** | Andesite Group A | *Count* | 2 | ***78*** | ***6*** | 13 | 99 |
| | | *Std. Residual* | -1.3 | ***1.4*** | ***-2.8*** | 1.1 | |
| | Basalt Group A | *Count* | 3 | 22 | 0 | 2 | 37 |
| | | *Std. Residual* | 0.8 | -0.6 | 1.3 | -0.8 | |
| | Basalt Group B | *Count* | 3 | 63 | 11 | 3 | 80 |
| | | *Std. Residual* | -0.5 | 1.2 | -0.9 | -1.7 | |
| | Basalt Group C | *Count* | 4 | ***11*** | ***20*** | 5 | 40 |
| | | *Std. Residual* | 1.4 | ***-3.1*** | ***4.8*** | 0.6 | |
| | Basalt Group D | *Count* | 2 | 14 | 2 | 2 | 20 |
| | | *Std. Residual* | 1 | 0.1 | -0.8 | 0 | |
| | Basalt Group E | *Count* | 1 | 1 | ***3*** | 1 | 6 |
| | | *Std. Residual* | 1.3 | -1.5 | ***1.8*** | 0.6 | |
| | Rhyolite Group A | *Count* | 0 | 13 | 2 | 3 | 18 |
| | | *Std. Residual* | -0.9 | 0.3 | -0.7 | 1 | |
| **Total** | | **Count** | 15 | 202 | 54 | 29 | 300 |

It should be restated that the materials likely range from basalts to andesitic basalts to andesites and so on. It is also likely that some groups are attributed to multiple flows of a single eruptive center. Regardless, extensive inductive reasoning has led to the initial raw material designation for these proposed groups. They are open to refinement and exploration. The current designations discussed above, however, are suggested to be the most accurate and probable results achievable, at this point.

Andesite Group A, described is a black andesite with visible silicate phenocrysts. It is an exceptionally visibly distinct group adhering to substantial consistency with the initial visual typology. Black andesites are not unknown for the North American western subarctic (see Dawson 1983 & Box et al. 1993). Whether this group is in fact and andesite or andesitic basalt, it remains the most confidently assigned distinct lithic group. There is a significant increase in this material from the Loess/Paeolsol to the B2 horizon (Table 5.3). There is nothing exceptional about the ratio of formal tools to flakes. However, many of the Andesite Group A formal tools, derived from the additional “formal tool” sub-assemblage, were recovered in the Loess horizon and Paleosol complex, include multiple examples of artifacts pertaining to the Chindadn form (KdVo6:96; KdVo6:97; KdVo6:139) as well as a typical Denali form (KdVo6: 716).

**Figure 5.1 KdVo6:96-Andesite Group A: Artifact of the Chindadn Complex**


**Figure 5.2 KdVo6:97-Andesite Group A: Artifact of the Chindadn Complex**

**Figure 5.3 KdVo6:1139-Andesite Group A: Artifact of the Chindadn Complex**

Basalt groups constitute the largest percentage of the sample assemblage which is to be expected as artifacts were chosen based on basaltic attributes. Some groups are larger than others and there may be more homogeny than is indicated in the current research. Refinement of these groups will only be attainable with known source locations or alternatively, source samples collected in pebble and cobble accumulations (presumably in creek and river beds). The basalt groups have indicated differing degrees of variation between the lobes. For instance Basalt Group C is comparatively more abundant in the East lobe than the West, which is interesting in that there are far fewer lithic remains in the East (Table 5.1). Also of interest is that Basalt Group C consists of no formal tools (Table 5.2) and there is a drastic decrease of this group from the Loess/Paleosol Level to the B2 horizon (Table 5.3). This group exhibits the most dramatic temporal variation for all proposed source groups.

Alternatively, Basalt Group B has a fairly equal distribution between lobes (Table 5.1). This result may indicate some form of unity between site occupants and site activities while also providing a potential indicator of consistency in raw material use across the site. Visually, Basalt Group B is a very typical basalt material.

Also of interest is Basalt Group D, which exhibits a higher proportion of formal tools in comparison to flakes. This inference is reinforced by the visual characteristics of this group as it is a very fine grained basalt. Basalt Group D is thus, of high flaking quality and therefore was utilized, as has been demonstrated, as a prime material for the manufacture of formal and specialized tools. Such artifacts include a microblade (KdVo6:1404), a macroblade (KdVo6:2703), a biface fragment (KdVo6:2112), and a utilized flake (1803). Furthermore, Basalt Group D is equally distributed between the lobes and exhibits some consistency through time (Table 5.1 & 5.3).

Not many inferences were made regarding the rhyolitic groups. They constitute a small percentage of the overall sample population because basalts were of primary interest. However, these groups, particularly Ryolite Group A, were assigned with a fair degree of confidence and further exploration will lead to more definitive descriptions of their roles in Little John site activity and use. Also, the Unknown Group, consisting of two samples, was excluded from further analysis and interpretation.

An overarching temporal pattern was also evident in this analysis. All proposed source groups indicated either; a) positive correlations occurring for Loess and B1 and a negative correlation occurring with B2; or b) negative correlations occurring for Loess and B1 and a positive correlation occurring with B2 (Table 5.3). Basalt Group D is the only source group which does not exhibit this pattern, it perhaps may have been an exceptional source material for formal tool manufacture based on its high quality and flakability. Based on these initial explorations, it can be assumed that the pXRF method of geochemical analysis for non-vitreous igneous artifacts has great potential to not only distinguish between distinct source materials but, indicate spatial and temporal patterning.

## 5.2. Conclusion

The research presented in this thesis supports the pXRF analysis on archaeological basalts. Tentative results regarding temporal and spatial patterning and raw material use at the Little John site is evident in this exploratory study and further analysis will reveal more detailed inferences regarding the role of igneous materials in the southwestern Yukon and eastern Beringia. Furthermore, the distinct source groups suggests that while there are no known lithic sources currently, that intensified regional field survey will eventually lead to these locations in the case of at least some of the proposed lithic groups here.

Evidence suggests that some of these materials, whilst conventionally considered to be procured locally from easily accessible stream and riverbeds, may actually have been acquired from more significant source locations. There is the possibility that certain basaltic and andesitic artifacts from the Little John site are being manufactured from raw materials derived from places of meaning or prehistoric cultural significance. The data and interpretations from Andesite Group A and their relationship with Little John's Nenana/Chindadn component support these notions and call for more rigorous examination of its use at the site.

The materials pertaining to this analysis do not exhibit the same quality and attractiveness as exotic materials, such as obsidians. However, they may be able to aid the current understandings of prehistoric travel and trade which are being developed by regional obsidian sourcing studies. However, without known geographic sources, basaltic provenance studies will not gain similar momentum. There remains much to be discovered regarding the prehistoric utilization and acquisition of these materials. This research aims to initiate interest in basalt sourcing studies and support the practice of geochemical analyses on archaeological basalts in the North American western subarctic.

# References

Box, Stephen E., Elizabeth J. Moll-Stalcup, Thomas P. Frost, and John M. Murphy
1993 Preliminary Geologic Map of the Bethel and Southern Russian Mission Quadrangles, Southwestern Alaska. US Department of the Interior, US Geological Survey.

Bradley, Richard
2000 An Archaeology of Natural Places. London and New York: Routledge.

Cole, Ronald B. & Kenneth D. Ridgway
1993 The Influence of Volcanism on Fluvial Depositional Systems in a Cenozoic Strike-Slip Basin, Denali Fault System, Yukon Territory, Canada. Journal of Sedimentary Petrology.63(1):152-166.

Cook, John P.
1995 Characterization and Distribution of Obsidian in Alaska. Arctic Anthropology. 32(1):92-100.

Dawson, Garnet L.
1983 Geologic Branch Assessment Report. Geology 1:0.

Easton, Norman Alexander
2007 Archaeological Excavations at the Little John Site (KdVo6), Southwest Yukon Territory, Canada 2006. Scottie Creek Culture History Project Research Manuscript, 2011-03. Whitehorse: Northern Research Institute.

Easton, Norman Alexander and Glen R. MacKay
2008 Early Bifaces from the Little John Site (KdV0-6), Yukon Territory, Canada *In* Projectile Point Sequences in Northwestern North America. Roy L. Carlson And Martin Magne, eds. Pp. 263-282. Burnaby, B.C. Simon Fraser University Press.

Easton, Norman Alexander
2010 Archaeological Excavations at the Little John Site (KdVo6), Southwest Yukon Territory, Canada 2009. Scottie Creek Culture History Project Research Manuscript, 2011-03. Whitehorse: Northern Research Institute.

Easton, Norman Alexander, Glen R. MacKay, Patricia Bernice Young, Peter Schnurr, and David Yesner

2010 Chindadn in Canada? Emergent Evidence of the Pleistocene Transition in Southeast Beringiia as Revealed by the Little John Site, Yukon *In,* From the Yenisei to the Yukon: Interpreting Lithic Assemblage Variability in the Late Pleistocene/Early Holocene Beringia. Ted Goebel and Ian Buvit, eds. Texas A&M Press: United States.

Gauthier, Gilles and Adrian L. Burke
2011 The effects of surface weathering on the geochemical analysis of archaeological lithic samples using non-destructive polarized energy dispersive XRF. Geoarchaeology. 26(2):269-291

Glascock, Michael D.
2011 Comparison and Contrast Between XRF and NAA: Used for Characterization of Obsidian Sources in Central Mexico *In,* X-Ray Fluorescence Spectrometry (XRF) in Geoarchaeology. M. Steven Shackley, ed. Pp. 161-192. New York: Springer.

Goebel, Ted, R. J. Speakman, and J.D. Reuther
2008 Obsidian from the Late-Pleistocene Walker Road Site, central Alaska. Current Research in the Pleistocene 25, 88-90.

Grave, Peter, Val Attenbrow, Lin Sutherland, Ross Pogson, and Nicola Forster
2012 Non-destructive pXRF of mafic stone tools. Journal of Archaeological Science. 39(6):1674-1686.

Heffner, Ty Alexander
2002 KaVn-2 An Eastern Beringian Tradition Archaeological Site in West-Central Yukon Territory, Canada. Occasional Papers in Archaeology No. 10. Government of the Yukon: Heritage Branch.

Johnson, Philip R.
2011 Elemental Analysis of Fine-Grained Basalt Sources from the Samoan Island of Tutuila: Applications of Energy Dispersive X-Ray Fluorescence (EDXRF) and Instrumental Neutron Activation Analysis (INAA) Toward an Intra-Island Provenance Study. *In* X-Ray Fluorescence Spectrometry (XRF) in Geoarchaeology, M. Steven Shackley, ed. Pp. 143-160. New York: Springer.

Liritzis, Ioannis and Nikolaos Zacharias
2011 Portable XRF of Archaeological Artifcats: Current Research, Potentials and Limitations *In,* X-Ray Fluorescence Spectrometry (XRF) in Geoarchaeology. M. Steven Shackley, ed. Pp. 109-142. New York: Springer.

Lubland, S. P., P.R. Mills and K. Hon
2008 Analysing Archaeological Basalt Using Non-destructive Energy Dispersive X-Ray Fluorescence (EDXRF): Effects of Post-Depositional Chemical Weathering and Sample Size on Analytical Precision. Archaeometry 50(1):11.

Lundblad, Steven P., Peter R. Mills, Arian Drake-Raue, and Scott Kekuewa Kikiloi

2011 Non-destructive EDXRF Analyses of Archaeological Basalts *In,* X-Ray Fluorescence Spectrometry (XRF) in Geoarchaeology. M. Steven Shackley, ed. Pp. 65-80. New York: Springer.

Phillips, Colby and Robert J. Speakman
2009 Initial source evaluation of archaeological obsidian from the Kuril Islands of the Russian Far East using portable XRF. Journal of Archaeological Science. 36:1256-1236.

Potts, Philip J., Andrew T. Ellis, Peter Kregsamer, Christina Streli, Christine Vanhoof, Margaret West, and Peter Wobrauschek.
2006 Atomic spectrometry update-X-ray fluorescence. Journal of Analytical Atomic Spectrometry. 21:1076-1107.

Rampton, V.
1971 Late Pleistocene Glaciations of the Snag-Klutlan Area, Yukon Territory. Arctic*.* 24:277-300.

Reimer, Rudy
2012 The Mountains and Rocks are Forever: Lithics and Landscapes of SKWXWU7MESH UXWUMIXW. Ph.D. dissertation, Department of Anthropology, McMaster University (Paper 6735).

Richter, D.H., J.G. Smith, M.A. Lanphere, G.B. Dalrymple, B.L. Reed & Nora Shre
1991 Age and progression of volcanism, Wrangell volcanic field, Alaska. *Bulletin of* Volcanology*.* 53(1): 29-44.

Shackley, M.S.
2008 Archaeological Petrology and the Archaeometry of Lithic Materials. Archaeometry 50(2):194-215.

Shackley, M. Steven.
2011 An Introduction to X-Ray Fluorescence (XRF) Analysis in Archaeology *In,* X-Ray Fluorescence Spectrometry (XRF) in Geoarchaeology. M. Steven Shackley, ed. Pp. 7-44. New York: Springer.

Slobodina, Natalia S., Joshua D. Reuther, Jeff Rasic, John P. Cook, and Robert J. Speakman.
2009 Obsidian Procurement and Use at the Dry Creek Site (HEA-005), Interior Alaska. Current Research in the Pleistocene 26:115-117.

Speakman, Robert J., Charles E. Holmes, and Michael D. Glascock
2007 Source Determination of Obsidian Artifacts from Swan Point (XBD-156), Alaska. Current Research in the Pleistocene. 24:143-145.

Yesner, David R., Kristine J. Crossen, Norman A. Easton

2010 Geoarchaeological and Zooarchaeological Correlates of Early Beringian Artifact Assemblages: Insights from the Little John Site, Yukon *In* From the Yenisei to the Yukon: Interpreting Lithic Assemblage Variability in the Late Pleistocene/Early Holocene Beringia. Ted Goebel and Ian Buvit, eds. Pp. 308-322. Texas A&M Press: United States.

# Appendix A.

## PXRF Elemental Data

| Sample | MnKa1 | FeKa1 | ZnKa1 | GaKa1 | ThLa1 | RbKa1 | SrKa1 | YKa1 | ZrKa1 | NbKa1 |
|---|---|---|---|---|---|---|---|---|---|---|
| KdVo-6-01 | 779 | 35359 | 85 | 13 | 14 | 168 | 201 | 34 | 312 | 16 |
| KdVo-6-121 | 0 | 3816 | 12 | 13 | 8 | 73 | 51 | 26 | 137 | 10 |
| KdVo-6-125 | 993 | 32569 | 150 | 17 | 4 | 64 | 594 | 32 | 520 | 13 |
| KdVo-6-1308 | 1170 | 35684 | 106 | 14 | 5 | 65 | 628 | 33 | 571 | 14 |
| KdVo-6-1311 | 802 | 68179 | 159 | 0 | 11 | 58 | 394 | 32 | 590 | 27 |
| KdVo-6-1338 | 1177 | 32138 | 114 | 15 | 2 | 61 | 565 | 32 | 557 | 15 |
| KdVo-6-1341 | 1415 | 38485 | 140 | 15 | 3 | 65 | 657 | 33 | 547 | 18 |
| KdVo-6-1376 | 1825 | 57428 | 98 | 3 | 8 | 46 | 774 | 33 | 419 | 32 |
| KdVo-6-1378 | 675 | 14205 | 111 | 18 | 7 | 79 | 600 | 13 | 269 | 8 |
| KdVo-6-139(2) | 934 | 38494 | 111 | 13 | 3 | 48 | 455 | 25 | 234 | 13 |
| KdVo-6-1394 | 971 | 36366 | 100 | 13 | 1 | 54 | 423 | 22 | 232 | 13 |
| KdVo-6-140 | 804 | 43782 | 102 | 11 | 0 | 35 | 647 | 19 | 215 | 12 |
| KdVo-6-1404(a) | 81 | 8279 | 59 | 6 | 0 | 3 | 119 | 6 | 29 | 0 |
| KdVo-6-1404(b) | 324 | 10886 | 49 | 9 | 0 | 2 | 151 | 6 | 28 | 0 |
| KdVo-6-1411(.1) | 1082 | 35569 | 146 | 15 | 3 | 58 | 616 | 29 | 472 | 15 |
| KdVo-6-1411(.2) | 988 | 35368 | 177 | 16 | 2 | 60 | 625 | 31 | 505 | 15 |
| KdVo-6-1450(.1) | 1076 | 32017 | 90 | 14 | 5 | 59 | 595 | 31 | 487 | 14 |
| KdVo-6-1450(.2) | 801 | 37860 | 131 | 14 | 3 | 53 | 478 | 24 | 239 | 14 |
| KdVo-6-1451 | 944 | 45217 | 165 | 14 | 3 | 48 | 517 | 24 | 230 | 12 |
| KdVo-6-1452 | 1152 | 62304 | 51 | 2 | 2 | 40 | 410 | 5 | 50 | 1 |
| KdVo-6-1472 | 1198 | 36541 | 91 | 13 | 24 | 200 | 3490 | 34 | 422 | 21 |
| KdVo-6-1475 | 1714 | 45585 | 82 | 9 | 0 | 20 | 449 | 18 | 130 | 5 |
| KdVo-6-1685 | 930 | 35858 | 79 | 12 | 2 | 49 | 462 | 25 | 229 | 13 |
| KdVo-6-1700 | 1105 | 41629 | 102 | 12 | 2 | 47 | 479 | 25 | 240 | 16 |
| KdVo-6-1736 | 589 | 63264 | 129 | 6 | 6 | 60 | 482 | 24 | 297 | 15 |
| KdVo-6-1803 | 49 | 16146 | 169 | 18 | 0 | 27 | 91 | 3 | 42 | 4 |
| KdVo-6-1865 | 1017 | 31415 | 87 | 14 | 4 | 58 | 553 | 31 | 541 | 14 |
| KdVo-6-2009 | 1050 | 33663 | 94 | 14 | 6 | 57 | 612 | 31 | 473 | 15 |
| KdVo-6-2112 | 0 | 5020 | 9 | 10 | 0 | 0 | 50 | 10 | 49 | 3 |
| KdVo-6-2156 | 0 | 6586 | 7 | 14 | 18 | 176 | 21 | 36 | 113 | 11 |
| KdVo-6-2157 | 250 | 14104 | 52 | 16 | 23 | 224 | 553 | 16 | 195 | 11 |
| KdVo-6-2159 | 732 | 45754 | 90 | 10 | 8 | 63 | 454 | 28 | 336 | 12 |
| KdVo-6-2162 | 808 | 49622 | 69 | 8 | 2 | 53 | 537 | 26 | 308 | 13 |
| KdVo-6-2164 | 867 | 28435 | 60 | 11 | 0 | 1 | 199 | 10 | 84 | 3 |
| KdVo-6-2246 | 480 | 42451 | 123 | 9 | 3 | 55 | 437 | 21 | 158 | 10 |
| KdVo-6-2247 | 936 | 37923 | 77 | 11 | 3 | 51 | 472 | 24 | 240 | 12 |
| KdVo-6-2248 | 1079 | 42487 | 182 | 16 | 1 | 6 | 607 | 24 | 128 | 6 |
| KdVo-6-2260 | 733 | 54939 | 77 | 7 | 2 | 50 | 1062 | 7 | 91 | 1 |
| KdVo-6-2265 | 786 | 30440 | 105 | 15 | 6 | 57 | 779 | 32 | 380 | 22 |
| KdVo-6-2530 | 837 | 40072 | 197 | 17 | 0 | 52 | 472 | 22 | 241 | 17 |
| KdVo-6-2534 | 741 | 33028 | 108 | 15 | 2 | 50 | 432 | 24 | 236 | 14 |
| KdVo-6-2540 | 0 | 4107 | 26 | 8 | 0 | 19 | 23 | 3 | 33 | 2 |
| KdVo-6-2546 | 685 | 55093 | 134 | 9 | 2 | 69 | 755 | 15 | 259 | 15 |
| KdVo-6-2560 | 1150 | 34661 | 96 | 13 | 7 | 60 | 667 | 30 | 484 | 17 |
| KdVo-6-2561 | 245 | 71532 | 139 | 0 | 0 | 16 | 331 | 7 | 131 | 11 |

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|---|---|---|---|---|---|---|---|---|---|---|
| KdVo-6-2562 | 1112 | 37254 | 135 | 15 | 5 | 64 | 696 | 35 | 492 | 14 |
| KdVo-6-2563(.1) | 1100 | 36025 | 148 | 16 | 5 | 58 | 664 | 35 | 486 | 15 |
| KdVo-6-2564(.1) | 1152 | 37467 | 133 | 14 | 7 | 66 | 688 | 31 | 483 | 14 |
| Kdvo-6-2564(.2) | 1323 | 38419 | 127 | 14 | 4 | 64 | 730 | 35 | 501 | 15 |
| KdVo-6-2571 | 602 | 26389 | 54 | 13 | 7 | 83 | 238 | 36 | 504 | 16 |
| KdVo-6-2572 | 1254 | 33879 | 114 | 14 | 6 | 59 | 638 | 30 | 474 | 17 |
| KdVo-6-2573 | 1165 | 36581 | 103 | 13 | 10 | 54 | 679 | 30 | 425 | 14 |
| KdVo-6-2574(.1) | 1540 | 49172 | 125 | 11 | 0 | 42 | 235 | 15 | 116 | 8 |
| KdVo-6-2574(.2) | 583 | 32068 | 102 | 14 | 15 | 179 | 1547 | 21 | 209 | 9 |
| KdVo-6-2577 | 934 | 61259 | 111 | 6 | 0 | 46 | 328 | 9 | 128 | 6 |
| KdVo-6-2578(.1) | 601 | 43083 | 81 | 9 | 7 | 97 | 34 | 42 | 654 | 21 |
| KdVo-6-2578(.2) | 1443 | 52544 | 102 | 8 | 1 | 40 | 241 | 16 | 124 | 6 |
| KdVo-6-2578(.3) | 930 | 62366 | 132 | 6 | 0 | 48 | 368 | 13 | 141 | 8 |
| KdVo-6-2578(.4) | 1124 | 45132 | 129 | 12 | 0 | 45 | 229 | 20 | 127 | 6 |
| KdVo-6-2579 | 964 | 35016 | 89 | 13 | 2 | 56 | 463 | 24 | 238 | 14 |
| KdVo-6-2580(.1) | 1085 | 37563 | 148 | 14 | 2 | 66 | 679 | 33 | 496 | 15 |
| KdVo-6-2580(.2) | 1024 | 40162 | 170 | 16 | 3 | 55 | 772 | 30 | 396 | 16 |
| KdVo-6-2580(.3) | 1401 | 43700 | 270 | 20 | 7 | 70 | 766 | 31 | 510 | 16 |
| KdVo-6-2581 | 1043 | 38983 | 73 | 11 | 0 | 27 | 287 | 12 | 100 | 6 |
| KdVo-6-2591 | 1122 | 32348 | 92 | 13 | 4 | 63 | 546 | 34 | 596 | 16 |
| KdVo-6-2619 | 0 | 6387 | 112 | 13 | 0 | 1 | 122 | 3 | 20 | 1 |
| KdVo-6-2621 | 868 | 37151 | 131 | 15 | 3 | 49 | 437 | 23 | 242 | 16 |
| KdVo-6-2622 | 948 | 35235 | 150 | 16 | 3 | 55 | 461 | 24 | 236 | 12 |
| KdVo-6-2623 | 720 | 30569 | 158 | 17 | 2 | 87 | 263 | 37 | 527 | 18 |
| KdVo-6-2624 | 131 | 5385 | 61 | 12 | 0 | 2 | 162 | 3 | 25 | 0 |
| KdVo-6-2625 | 1283 | 39545 | 186 | 17 | 3 | 61 | 682 | 33 | 494 | 16 |
| KdVo-6-2626 | 606 | 33180 | 166 | 18 | 6 | 90 | 269 | 39 | 553 | 18 |
| KdVo-6-2627 | 0 | 3959 | 81 | 6 | 0 | 1 | 137 | 3 | 21 | 0 |
| KdVo-6-2628(.1) | 581 | 34115 | 183 | 18 | 7 | 98 | 288 | 41 | 547 | 17 |
| KdVo-6-2628(.2) | 1307 | 39579 | 134 | 14 | 9 | 71 | 718 | 32 | 544 | 13 |
| KdVo-6-2629(.1) | 0 | 5880 | 117 | 11 | 0 | 1 | 171 | 3 | 20 | 0 |
| KdVo-6-2629(.2) | 854 | 67811 | 236 | 8 | 0 | 77 | 153 | 15 | 73 | 6 |
| KdVo-6-2637 | 638 | 30501 | 161 | 18 | 5 | 89 | 272 | 40 | 541 | 16 |
| KdVo-6-2638 | 775 | 40702 | 89 | 11 | 0 | 32 | 681 | 13 | 128 | 3 |
| KdVo-6-2643 | 903 | 34073 | 85 | 13 | 4 | 53 | 444 | 27 | 237 | 13 |
| KdVo-6-2644 | 0 | 3409 | 41 | 9 | 0 | 0 | 143 | 3 | 22 | 0 |
| KdVo-6-2645 | 1054 | 35292 | 137 | 15 | 3 | 60 | 621 | 30 | 530 | 14 |
| KdVo-6-2646 | 863 | 36344 | 103 | 13 | 2 | 52 | 727 | 27 | 373 | 14 |
| KdVo-6-2647 | 899 | 36818 | 151 | 16 | 3 | 51 | 438 | 21 | 230 | 15 |
| KdVo-6-2652 | 508 | 32618 | 181 | 19 | 7 | 101 | 293 | 38 | 561 | 17 |
| KdVo-6-2655 | 892 | 45415 | 256 | 19 | 5 | 55 | 469 | 21 | 238 | 15 |
| KdVo-6-2657 | 886 | 32880 | 87 | 13 | 0 | 50 | 427 | 24 | 245 | 13 |
| KdVo-6-2658(.1) | 933 | 37731 | 107 | 13 | 5 | 57 | 441 | 25 | 260 | 16 |

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|---|---|---|---|---|---|---|---|---|---|---|
| KdVo-6-2658(.2) | 1152 | 40795 | 239 | 19 | 2 | 72 | 668 | 33 | 594 | 13 |
| KdVo-6-2658(.3) | 1005 | 41803 | 221 | 18 | 1 | 58 | 487 | 25 | 245 | 12 |
| KdVo-6-2661 | 1023 | 33579 | 96 | 13 | 3 | 52 | 419 | 23 | 247 | 15 |
| KdVo-6-2665 | 896 | 35012 | 97 | 13 | 1 | 50 | 430 | 21 | 233 | 13 |
| KdVo-6-2666(.1) | 230 | 23990 | 122 | 13 | 0 | 34 | 136 | 10 | 76 | 3 |
| KdVo-6-2668 | 1056 | 34677 | 146 | 16 | 2 | 53 | 629 | 29 | 421 | 14 |
| KdVo-6-2669 | 920 | 38985 | 199 | 18 | 3 | 55 | 488 | 24 | 242 | 13 |
| KdVo-6-2670 | 1252 | 44543 | 283 | 20 | 5 | 76 | 626 | 31 | 600 | 16 |
| KdVo-6-2671 | 1047 | 42768 | 136 | 13 | 0 | 34 | 458 | 41 | 271 | 13 |
| KdVo-6-2674 | 1092 | 44490 | 247 | 18 | 9 | 58 | 847 | 30 | 396 | 14 |
| KdVo-6-2675 | 791 | 35414 | 135 | 15 | 4 | 54 | 461 | 21 | 237 | 16 |
| KdVo-6-2678 | 1045 | 35360 | 152 | 16 | 4 | 54 | 655 | 30 | 425 | 11 |
| KdVo-6-2682 | 326 | 25079 | 79 | 12 | 0 | 0 | 134 | 13 | 107 | 4 |
| KdVo-6-2683(.1) | 450 | 25749 | 79 | 9 | 0 | 0 | 143 | 15 | 116 | 4 |
| KdVo-6-2683(.2) | 540 | 35129 | 39 | 10 | 0 | 2 | 165 | 15 | 148 | 5 |
| KdVo-6-2684 | 1250 | 66393 | 127 | 2 | 5 | 59 | 648 | 11 | 150 | 5 |
| KdVo-6-2687(.1) | 906 | 39187 | 233 | 19 | 1 | 57 | 472 | 22 | 252 | 14 |
| KdVo-6-2687(.2) | 1412 | 42265 | 234 | 19 | 2 | 49 | 666 | 23 | 309 | 14 |
| KdVo-6-2688 | 175 | 18665 | 96 | 12 | 0 | 25 | 82 | 6 | 46 | 2 |
| KdVo-6-2689(.1) | 1035 | 42089 | 220 | 18 | 6 | 59 | 480 | 24 | 232 | 13 |
| KdVo-6-2689(.2) | 1334 | 40506 | 279 | 22 | 9 | 68 | 710 | 33 | 540 | 17 |
| KdVo-6-2689(.3) | 1154 | 40222 | 186 | 17 | 6 | 64 | 682 | 28 | 525 | 17 |
| KdVo-6-2703 | 0 | 15969 | 5 | 8 | 0 | 0 | 2 | 1 | 69 | 6 |
| KdVo-6-2704 | 919 | 38564 | 101 | 13 | 1 | 54 | 483 | 25 | 253 | 14 |
| KdVo-6-2710(2) | 823 | 36154 | 102 | 13 | 1 | 29 | 697 | 18 | 186 | 10 |
| KdVo-6-2711(2) | 827 | 44404 | 109 | 11 | 1 | 31 | 714 | 18 | 211 | 11 |
| KdVo-6-2724 | 484 | 7754 | 123 | 20 | 7 | 162 | 91 | 7 | 56 | 7 |
| KdVo-6-2731(.1) | 7 | 8395 | 47 | 10 | 0 | 34 | 29 | 4 | 46 | 3 |
| KdVo-6-2731(.2) | 1043 | 33512 | 141 | 16 | 1 | 56 | 670 | 27 | 457 | 13 |
| KdVo-6-2731(.3) | 1442 | 48897 | 268 | 17 | 15 | 68 | 776 | 30 | 508 | 15 |
| KdVo-6-2740 | 1119 | 37872 | 167 | 16 | 5 | 55 | 463 | 22 | 239 | 13 |
| KdVo-6-2744 | 822 | 65153 | 207 | 8 | 0 | 45 | 298 | 12 | 122 | 7 |
| Kdvo-6-2746 | 237 | 38199 | 75 | 11 | 3 | 9 | 1480 | 19 | 217 | 12 |
| KdVo-6-2750 | 1029 | 40055 | 221 | 18 | 0 | 63 | 497 | 22 | 250 | 13 |
| KdVo-6-2752 | 903 | 50078 | 119 | 10 | 0 | 36 | 748 | 22 | 227 | 10 |
| KdVo-6-2776 | 749 | 67786 | 94 | 0 | 5 | 10 | 2663 | 28 | 168 | 24 |
| KdVo-6-2778 | 1047 | 36065 | 104 | 13 | 1 | 45 | 603 | 23 | 320 | 13 |
| KdVo-6-2779 | 8 | 21217 | 139 | 17 | 6 | 119 | 207 | 19 | 415 | 12 |
| KdVo-6-2781 | 870 | 37985 | 181 | 17 | 0 | 55 | 763 | 29 | 377 | 16 |
| KdVo-6-2784 | 1101 | 37537 | 99 | 13 | 4 | 54 | 728 | 33 | 388 | 11 |
| KdVo-6-2785(.1) | 1346 | 37164 | 205 | 18 | 4 | 67 | 630 | 34 | 603 | 17 |
| KdVo-6-2785(.2) | 46 | 9413 | 149 | 14 | 0 | 34 | 23 | 4 | 47 | 0 |
| KdVo-6- | 1324 | 46575 | 251 | 18 | 8 | 76 | 803 | 29 | 517 | 17 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 2787(.1) | | | | | | | | | | |
| KdVo-6-2787(.2) | 903 | 37702 | 158 | 15 | 2 | 51 | 466 | 23 | 242 | 13 |
| KdVo-6-2789 | 1009 | 31207 | 94 | 14 | 0 | 45 | 564 | 23 | 294 | 10 |
| KdVo-6-2790 | 772 | 31454 | 77 | 13 | 7 | 95 | 300 | 44 | 554 | 16 |
| KdVo-6-2793 | 866 | 41722 | 220 | 18 | 3 | 54 | 484 | 25 | 245 | 13 |
| KdVo-6-2802(.1) | 968 | 36137 | 226 | 20 | 0 | 32 | 778 | 22 | 234 | 8 |
| KdVo-6-2802(.2) | 1016 | 30597 | 174 | 19 | 0 | 35 | 764 | 18 | 232 | 10 |
| KdVo-6-2802(.3) | 705 | 50802 | 203 | 14 | 1 | 34 | 760 | 18 | 227 | 9 |
| KdVo-6-2805(.1) | 544 | 51800 | 88 | 8 | 0 | 63 | 426 | 12 | 125 | 5 |
| KdVo-6-2805(.2) | 474 | 56557 | 99 | 7 | 2 | 58 | 423 | 12 | 117 | 7 |
| Kdvo-6-2806 | 607 | 47151 | 108 | 11 | 4 | 37 | 728 | 18 | 223 | 13 |
| KdVo-6-2807(.1) | 931 | 31870 | 169 | 18 | 4 | 55 | 526 | 32 | 508 | 13 |
| KdVo-6-2807(.2) | 898 | 30271 | 145 | 17 | 0 | 29 | 683 | 18 | 231 | 12 |
| KdVo-6-2807(.3) | 769 | 45709 | 95 | 10 | 0 | 33 | 715 | 21 | 212 | 9 |
| KdVo-6-2809(.1) | 1058 | 38429 | 302 | 24 | 0 | 31 | 798 | 21 | 247 | 10 |
| KdVo-6-2809(.2) | 847 | 33510 | 184 | 18 | 0 | 36 | 779 | 17 | 248 | 11 |
| KdVo-6-2813 | 454 | 59120 | 113 | 7 | 5 | 60 | 479 | 11 | 122 | 7 |
| KdVo-6-2816 | 1114 | 35735 | 89 | 12 | 3 | 58 | 670 | 32 | 471 | 15 |
| KdVo-6-2817 | 112 | 72799 | 250 | 0 | 9 | 25 | 614 | 5 | 235 | 23 |
| KdVo-6-2819 | 939 | 35160 | 88 | 13 | 3 | 55 | 669 | 31 | 413 | 13 |
| KdVo-6-2820 | 1156 | 37122 | 82 | 12 | 7 | 53 | 725 | 30 | 386 | 13 |
| KdVo-6-2822 | 988 | 33027 | 153 | 17 | 7 | 61 | 584 | 31 | 558 | 16 |
| KdVo-6-2823 | 958 | 37867 | 148 | 15 | 2 | 56 | 473 | 24 | 253 | 14 |
| KdVo-6-2824 | 1210 | 43173 | 258 | 20 | 2 | 59 | 484 | 22 | 242 | 10 |
| KdVo-6-2825(.1) | 988 | 45555 | 223 | 16 | 5 | 63 | 500 | 27 | 256 | 11 |
| KdVo-6-2825(.2) | 1214 | 41500 | 239 | 19 | 4 | 57 | 498 | 23 | 243 | 14 |
| KdVo-6-2826(.1) | 868 | 38495 | 158 | 16 | 1 | 53 | 481 | 25 | 258 | 11 |
| KdVo-6-2826(.2) | 1025 | 41655 | 190 | 16 | 2 | 57 | 464 | 19 | 242 | 14 |
| KdVo-6-2827(.1) | 935 | 37663 | 158 | 16 | 1 | 59 | 454 | 23 | 251 | 13 |
| KdVo-6-2827(.2) | 937 | 37748 | 200 | 18 | 3 | 57 | 477 | 25 | 253 | 12 |
| KdVo-6-2827(.3) | 0 | 7096 | 178 | 17 | 0 | 0 | 81 | 1 | 23 | 2 |
| KdVo-6-2829 | 897 | 35402 | 147 | 16 | 4 | 55 | 448 | 23 | 240 | 14 |
| KdVo-6-2830 | 1094 | 32912 | 96 | 14 | 5 | 59 | 619 | 28 | 438 | 13 |
| KdVo-6-2831 | 1250 | 35675 | 95 | 13 | 3 | 48 | 685 | 31 | 372 | 15 |
| KdVo-6-2834(.1) | 1102 | 32698 | 84 | 13 | 5 | 66 | 568 | 34 | 610 | 19 |
| KdVo-6-2834(.2) | 964 | 39305 | 192 | 17 | 2 | 57 | 470 | 26 | 247 | 14 |
| KdVo-6-2834(.3) | 944 | 38855 | 186 | 17 | 5 | 56 | 475 | 22 | 242 | 12 |
| KdVo-6-2834(.4) | 1117 | 44501 | 251 | 19 | 1 | 66 | 509 | 25 | 254 | 15 |

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|---|---|---|---|---|---|---|---|---|---|---|
| KdVo-6-2837(.1) | 980 | 32676 | 139 | 16 | 4 | 56 | 628 | 31 | 520 | 13 |
| KdVo-6-2837(.2) | 1134 | 46819 | 224 | 17 | 2 | 38 | 489 | 41 | 289 | 12 |
| KdVo-6-2837(.3) | 778 | 36586 | 154 | 15 | 0 | 50 | 426 | 26 | 244 | 13 |
| KdVo-6-2837(.4) | 857 | 36676 | 188 | 18 | 2 | 54 | 441 | 24 | 247 | 12 |
| KdVo-6-2837(.5) | 1667 | 61949 | 220 | 10 | 0 | 13 | 368 | 7 | 108 | 7 |
| KdVo-6-2838 | 740 | 26777 | 59 | 13 | 0 | 33 | 77 | 9 | 99 | 5 |
| KdVo-6-2839(.1) | 822 | 36814 | 107 | 13 | 4 | 54 | 446 | 22 | 233 | 12 |
| KdVo-6-2839(.2) | 760 | 40672 | 112 | 13 | 1 | 47 | 492 | 25 | 235 | 14 |
| KdVo-6-2840(.1) | 928 | 38168 | 143 | 15 | 2 | 54 | 469 | 22 | 249 | 15 |
| KdVo-6-2840(.2) | 900 | 38074 | 130 | 14 | 2 | 54 | 463 | 19 | 241 | 15 |
| KdVo-6-2840(.3) | 1027 | 37920 | 89 | 12 | 5 | 54 | 475 | 21 | 249 | 14 |
| KdVo-6-2840(.4) | 879 | 39192 | 156 | 15 | 0 | 50 | 492 | 21 | 230 | 13 |
| KdVo-6-2841(2) | 618 | 43141 | 112 | 12 | 0 | 32 | 719 | 16 | 209 | 11 |
| KdVo-6-2843 | 646 | 40070 | 302 | 24 | 18 | 184 | 317 | 41 | 330 | 15 |
| KdVo-6-2846 | 779 | 34625 | 201 | 19 | 6 | 94 | 294 | 40 | 569 | 16 |
| KdVo-6-2848 | 447 | 27823 | 174 | 20 | 14 | 204 | 150 | 44 | 333 | 19 |
| KdVo-6-2849 | 1044 | 36383 | 153 | 16 | 6 | 64 | 650 | 32 | 489 | 14 |
| KdVo-6-2853 | 899 | 40983 | 107 | 12 | 3 | 49 | 485 | 23 | 237 | 13 |
| KdVo-6-2854 | 828 | 37029 | 141 | 13 | 0 | 5 | 246 | 11 | 93 | 4 |
| KdVo-6-2856(.1) | 758 | 47294 | 89 | 10 | 0 | 33 | 707 | 20 | 225 | 13 |
| KdVo-6-2856(.2) | 1132 | 40994 | 259 | 19 | 8 | 68 | 577 | 32 | 606 | 16 |
| KdVo-6-2857 | 219 | 47250 | 187 | 12 | 0 | 38 | 30 | 2 | 43 | 1 |
| KdVo-6-2859(.1) | 773 | 39422 | 94 | 12 | 0 | 20 | 321 | 19 | 129 | 6 |
| KdVo-6-2859(.2) | 871 | 46121 | 124 | 11 | 5 | 22 | 381 | 19 | 133 | 6 |
| KdVo-6-2861 | 1055 | 33020 | 125 | 15 | 1 | 54 | 603 | 30 | 511 | 16 |
| KdVo-6-2862 | 634 | 33806 | 120 | 15 | 24 | 153 | 144 | 27 | 211 | 11 |
| KdVo-6-2863 | 1082 | 36461 | 96 | 13 | 4 | 50 | 701 | 29 | 377 | 13 |
| KdVo-6-2865 | 1084 | 35760 | 105 | 13 | 4 | 53 | 704 | 30 | 374 | 12 |
| KdVo-6-2867 | 1838 | 42487 | 75 | 10 | 0 | 52 | 389 | 16 | 117 | 3 |
| KdVo-6-2868 | 625 | 41073 | 130 | 11 | 2 | 118 | 648 | 11 | 100 | 7 |
| KdVo-6-2916 | 737 | 43846 | 157 | 14 | 0 | 32 | 730 | 12 | 130 | 1 |
| KdVo-6-2917 | 836 | 32961 | 158 | 17 | 4 | 56 | 439 | 22 | 238 | 13 |
| KdVo-6-2918 | 0 | 4845 | 74 | 10 | 0 | 26 | 27 | 5 | 37 | 3 |
| KdVo-6-2919 | 1077 | 32613 | 83 | 12 | 6 | 67 | 705 | 35 | 554 | 13 |
| KdVo-6-2921 | 1123 | 35977 | 95 | 12 | 5 | 55 | 700 | 31 | 417 | 13 |
| KdVo-6-2922 | 0 | 7107 | 43 | 11 | -5 | 29 | 25 | 3 | 40 | 2 |
| KdVo-6-2988 | 793 | 52991 | 208 | 13 | 7 | 72 | 503 | 25 | 345 | 14 |
| KdVo-6-2995(2) | 860 | 45625 | 166 | 13 | 24 | 176 | 257 | 28 | 187 | 17 |
| KdVo-6-2997 | 666 | 45333 | 148 | 13 | 0 | 34 | 793 | 22 | 225 | 10 |
| KdVo-6-2998 | 696 | 54386 | 230 | 15 | 7 | 76 | 519 | 24 | 343 | 16 |
| KdVo-6-2999 | 1055 | 37256 | 200 | 18 | 9 | 71 | 598 | 35 | 644 | 13 |
| KdVo-6-3001 | 666 | 34710 | 123 | 13 | 18 | 148 | 176 | 30 | 220 | 15 |
| KdVo-6-3004 | 1186 | 35104 | 102 | 14 | 5 | 56 | 664 | 31 | 461 | 14 |

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|---|---|---|---|---|---|---|---|---|---|---|
| KdVo-6-3032 | 598 | 52247 | 97 | 9 | 5 | 49 | 548 | 21 | 234 | 13 |
| KdVo-6-3034 | 752 | 43177 | 99 | 11 | 10 | 107 | 719 | 15 | 164 | 11 |
| KdVo-6-3035 | 804 | 58100 | 65 | 4 | 0 | 27 | 193 | 8 | 142 | 11 |
| KdVo-6-3036 | 845 | 37606 | 97 | 11 | 2 | 48 | 458 | 24 | 239 | 13 |
| KdVo-6-3037 | 884 | 49362 | 140 | 11 | 5 | 67 | 501 | 28 | 333 | 11 |
| KdVo-6-3065 | 826 | 51118 | 228 | 16 | 0 | 37 | 302 | 13 | 104 | 5 |
| KdVo-6-3066 | 0 | 9884 | 134 | 21 | 1 | 96 | 16 | 20 | 58 | 2 |
| KdVo-6-3070 | 598 | 66030 | 81 | 2 | 0 | 5 | 37 | 4 | 91 | 2 |
| KdVo-6-3071 | 578 | 54371 | 89 | 7 | 0 | 13 | 596 | 12 | 80 | 3 |
| KdVo-6-3082 | 535 | 70140 | 115 | 0 | 0 | 1 | 175 | 14 | 202 | 7 |
| KdVo-6-3084(2) | 2010 | 65658 | 174 | 0 | 4 | 75 | 475 | 21 | 347 | 26 |
| KdVo-6-3086 | 831 | 68199 | 119 | 0 | 0 | 9 | 205 | 9 | 106 | 7 |
| KdVo-6-3088 | 947 | 69057 | 173 | 0 | 1 | 35 | 609 | 14 | 232 | 9 |
| KdVo-6-3096 | 845 | 57226 | 122 | 8 | 3 | 45 | 603 | 12 | 137 | 10 |
| KdVo-6-3104(.1) | 1264 | 39450 | 72 | 11 | 3 | 36 | 1045 | 14 | 157 | 4 |
| KdVo-6-3104(.2) | 706 | 45952 | 55 | 8 | 4 | 89 | 1221 | 18 | 206 | 6 |
| KdVo-6-3104(.3) | 673 | 30182 | 92 | 14 | 0 | 0 | 109 | 18 | 114 | 4 |
| KdVo-6-3104(.4) | 659 | 46346 | 45 | 8 | 0 | 11 | 134 | 10 | 105 | 4 |
| KdVo-6-3106 | -599 | 57940 | 162 | 0 | 0 | 0 | 119 | 0 | 57 | 2 |
| KdVo-6-3107 | 917 | 37971 | 83 | 12 | 1 | 26 | 744 | 12 | 139 | 9 |
| KdVo-6-3108 | 1203 | 53322 | 75 | 7 | 3 | 34 | 643 | 13 | 171 | 11 |
| KdVo-6-3109 | 758 | 39920 | 102 | 12 | 4 | 69 | 1800 | 12 | 201 | 5 |
| KdVo-6-3110 | 826 | 30290 | 100 | 15 | 9 | 103 | 134 | 29 | 497 | 18 |
| KdVo-6-3113 | 1123 | 46467 | 233 | 17 | 3 | 54 | 516 | 24 | 245 | 14 |
| KdVo-6-3115 | 755 | 48918 | 130 | 11 | 5 | 69 | 490 | 28 | 337 | 10 |
| KdVo-6-3116 | 699 | 48139 | 133 | 12 | 8 | 66 | 478 | 25 | 326 | 13 |
| KdVo-6-3117 | 758 | 50611 | 179 | 13 | 3 | 64 | 504 | 25 | 330 | 13 |
| KdVo-6-3118 | 763 | 52896 | 212 | 14 | 5 | 74 | 530 | 26 | 327 | 15 |
| KdVo-6-3119 | 800 | 50771 | 202 | 14 | 7 | 63 | 505 | 24 | 337 | 15 |
| KdVo-6-3120 | 1245 | 42125 | 77 | 10 | 6 | 65 | 399 | 12 | 115 | 7 |
| KdVo-6-3123 | 506 | 27861 | 48 | 11 | 0 | 0 | 416 | 20 | 157 | 8 |
| KdVo-6-3133 | 700 | 70956 | 83 | 0 | 0 | 7 | 221 | 14 | 140 | 5 |
| KdVo-6-3136 | 773 | 62184 | 88 | 2 | 0 | 3 | 687 | 10 | 120 | 4 |
| KdVo-6-3137 | 1130 | 53269 | 78 | 7 | 0 | 9 | 428 | 10 | 76 | 3 |
| KdVo-6-3138 | 572 | 44084 | 118 | 10 | 8 | 85 | 535 | 22 | 698 | 20 |
| KdVo-6-3139 | 956 | 38568 | 79 | 11 | 0 | 49 | 459 | 25 | 240 | 11 |
| KdVo-6-3140 | -68 | 69100 | 98 | 0 | 3 | 3 | 190 | 1 | 65 | 3 |
| KdVo-6-3144 | 788 | 39111 | 241 | 19 | 11 | 97 | 312 | 42 | 571 | 18 |
| KdVo-6-3146 | 966 | 36858 | 145 | 15 | 0 | 56 | 459 | 22 | 240 | 13 |
| KdVo-6-3255 | 906 | 38846 | 97 | 12 | 1 | 47 | 460 | 24 | 228 | 10 |
| KdVo-6-3680 | 970 | 27715 | 80 | 14 | 4 | 61 | 519 | 32 | 562 | 16 |
| KdVo-6-3681 | 836 | 35511 | 88 | 13 | 3 | 49 | 430 | 24 | 241 | 15 |
| KdVo-6-530 | 1203 | 32028 | 99 | 14 | 7 | 65 | 548 | 33 | 573 | 14 |
| KdVo-6-531 | 710 | 44560 | 95 | 11 | 3 | 30 | 679 | 20 | 218 | 11 |
| KdVo-6-621 | 636 | 71196 | 118 | 0 | 0 | 1 | 173 | 7 | 41 | -1 |
| KdVo-6-716 | 689 | 48877 | 91 | 9 | 3 | 47 | 501 | 22 | 281 | 10 |
| KdVo-6-758 | 904 | 64070 | 118 | 5 | 0 | 5 | 132 | 8 | 77 | 5 |
| KdVo-6-96 | 840 | 37486 | 94 | 13 | 4 | 43 | 460 | 26 | 237 | 11 |
| KdVo-6-97 | 960 | 36248 | 82 | 12 | 2 | 51 | 460 | 24 | 236 | 15 |
| KdVo-6-q1 | 1118 | 54859 | 153 | 10 | 1 | 1 | 498 | 17 | 132 | 8 |
| KdVo-6-q2 | 546 | 33960 | 29 | 7 | 0 | 0 | 176 | 11 | 87 | 4 |
| KdVo-6-q3 | 768 | 43964 | 92 | 11 | 3 | 84 | 596 | 14 | 121 | 5 |
| KdVo-6-q5 | 2030 | 14562 | 34 | 10 | 1 | 7 | 415 | 36 | 43 | 0 |
| KdVo-6-wr1 | 2557 | 21032 | 88 | 16 | 7 | 80 | 216 | 31 | 547 | 19 |
| KdVo-q4 | 762 | 64503 | 159 | 6 | 9 | 86 | 461 | 29 | 306 | 17 |