Journal of Archaeological Science: Reports 18 (2018) 499–508

Contents lists available at ScienceDirect

Journal of Archaeological Science: Reports

journal homepage: www.elsevier.com/locate/jasrep

The Watts Point dacite source and its geological and archaeological occurrence along the shores of the Salish Sea, British Columbia Canada

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A R T I C L E   I N F O

Keywords:
Salish Sea archaeology
Fine Grained Volcanic Rock (FGV)
X-ray fluorescence (XRF)
Lithic raw material procurement
Settlement patterns
Lithic technological organization

A B S T R A C T

The archaeological record of the Salish Sea of the Southern Northwest Coast of North America is dominated the use of Fine-Grained Volcanic rocks (FGV). To date no formal study of the geochemistry of an FGV source in this region exists, despite several studies that have attempted to address the nature of lithic sources and their cultural use over the past 25 years. These studies suffer from a lack of systematic investigation of a primary FGV source in the region. To date, researchers in this area do not have a complete set of reference materials for any FGV source, including samples from proximal glacial/beach deposits, for full and meaningful comparisons. This research will address some fundamental questions but also present research questions regarding lithic provenance. This research documents a full analysis of a known source of FGV in the area and offers initial observations about its use over the past 9700 years.

1. Introduction

Globally recognized as an ecologically unique region, the Salish Sea is on the southern Northwest Coast of North America. For example, the region's archaeological record has evidence of continuous occupation spanning the past 12,000+ years, evidence for long standing adaptations to the marine environment, and a rich ethnographic record that can aid in the interpretation of the archaeological record (Moss, 2011; Reimer, 2012). In this article, I use the term Fine Grained Volcanic Rock (FGV) but crystalline volcanic rock and fine grained glassy volcanic rocks are also used by other researchers. Over the past 12,000+ years, fine-grained volcanic rocks (FGV) dominate chipped stone tool assemblages (Bakewell, 1991, 1993, 1998; Close, 2006; Kwarsick, 2008, 2010; Osiensky, 2014; Reimer, 2012; Rorabaugh and McNabb, 2015). Frequently labeled as “basalt” in regional archaeological literature, the extensive suite of these materials falls under the calc-alkaline range of fine-grained igneous rocks (Bakewell, 2005; Close, 2006; Kwarsick, 2010). They include basalt, andesite, dacite and rhyolite that are suitable for fashioning a broad range of tool types including bifaces, projectile points, scrapers, and blades. However, macroscopic identification of these materials is problematic as they share many visual and physical attributes (Table 1) and to date, geochemical analysis of FGV sources has received little attention in these discussions (Bakewell, 1991, 1993, 1998; Kwarsick, 2010; Taylor, 2012). Currently, there is no published elemental data set for FGV source materials in the Salish Sea region. Some previous research about FGV has only used a few source samples with the assumption that the source has geochemical homogeneity. The lack of larger scale analysis of source materials is negative in these cases (Kwarsick, 2008, 2010; Osiensky, 2014). Others successfully attempted to link materials in secondary source deposit such as beaches and riverbanks to nearby outcrops (Rorabaugh and McNabb, 2015; Shackley, 1998; Taylor, 2012). All these studies attempt to “source” materials without proper consideration of the full range of variability within a source(s), thus failing to fully address the provenance postulate (Weigand et al., 1977:24; Neff, 2000:107–108: Glascock and Neff, 2003). A way to clarify this situation is to directly access the full range of materials available at a primary source. Therefore, the purposes of this study are to use portable X-ray fluorescence (pXRF) to first examine in detail the extent of geochemical variation of an FGV source known as Watts Point in southwestern British Columbia and how it compares to two other sources in the region (Fig. 1). Second is to determine the availability and size of Watts Point materials that occur in secondary glacial beach deposits directly south of the Watts Point source. The third goal is to identify the occurrence of material from these three sources (derived from either primary or secondary deposits) and possibly other unknown sources in the archaeological record at sites south of this source. Fourth is to find out if there are any changes in the use of these materials from these sources over time. Elsewhere the interest in FGV sources and their distribution is growing as these materials play important roles in understanding land and resource use (Bostwick and Burton, 1993; Coffman and Rasic, 2015; Dillian, 2014; Grave et al., 2012; Jones et al., 1997; Latham et al., 1992; Lundblad et al., 2011; Mintmier et al., 2012; Seelenfreund et al., 2009; Shackley, 2010, 2011).

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https://doi.org/10.1016/j.jasrep.2018.02.003
Received 27 June 2017; Received in revised form 31 January 2018; Accepted 5 February 2018
Available online 20 February 2018

Table 1
Physical and visual characteristics of primary source materials included in this study.

Property	Watts Point	Turbid Creek	Arrowstone Hills
Color	10 YR 2/1 to 3/1	10 YR 2/1	10 YR 2/1
Crystal structure	Fine to medium	Fine	Fine
Cleavage	Little to tabular	Little	Little
Fracture	Conchoidal	Conchoidal	Conchoidal
Hardness	6	6	6
Lusture	Glassy	Glassy	Glassy
Size at source	5–45 cm	10–40 cm	10–55 cm
Size away from source	0.4–25.6 cm	0.5–15 cm	0.4–8 cm

2. Geological, archaeological and cultural background of the Watts Point source

Geologically, most lithic materials in the region are the result of plate tectonics and volcanoes that are part of the Pacific Ring of Fire (Green et al., 1988; Monger, 1994). Under the Salish Sea, the Juan de Fuca Plate is sandwiched between the Pacific and North American Plates. Convergent plate subduction pressure leads to the melting of crust material, producing abundant magma and pressure, feeding volcanoes and causing numerous eruptions (Monger, 1994). The Watts Point lava flow is an FGV source 10 km south of the modern town of Squamish, British Columbia, Canada and is the southernmost flow in the Garibaldi volcanic belt (Fig. 1). Created by volcanic eruptions underneath glacial ice approximately 130,000–90,000 years ago, the Watts Point source extends from modern day sea level to 240 m above sea level and currently covers an area of 0.4 km^2 (Bye et al., 2000). The Watts Point source was free of glacial ice from 50,000–25,000 years ago but was then covered again by massive glacial ice until approximately 10,000 years ago (Bye et al., 2000; Reimer, 2012).

Material from the Watts Point source could have been accessed directly from the primary source or secondary glacial till deposits as far south as the San Juan Islands, Olympic Peninsula and Puget Sound since the early Holocene (Bakewell, 1998; Kwarsick, 2010; Osiensky, 2014; Taylor, 2012) (Fig. 1). However, the size and frequency of secondary source material (glacial beach deposits) of Watts Point material vary (Kwarsick, 2008, 2010; Osiensky, 2014; Reimer, 2012; Reimer and Hamilton, 2015; Rorabaugh and McNabb, 2015; Taylor, 2012). This study uses definitions provided by Glascock et al. (1998:16) and Shackley (2011) who consider both the physical and geochemical nature of lithic sources. Physically, a lithic source can occur as primary and secondary deposits. A primary deposit is a lava flow/outcrop or major pyroclastic field surrounding a volcanic cone. Secondary sources are the result of erosion activity of glaciers, streams, gravity, or other geological processes that transport material away from a primary zone (Brooks and Hickin, 1991; Evans and Brooks, 1991; Reimer, 2012).

The Watts Point source is in the heart of Squamish Nation territory, who are one of many Coast Salish groups in the region (Suttles, 1990). Lexwlúxwls is the place name that Squamish Nation applies to the place also known as Watts Point (Bouchard and Kennedy, 1986). It is the name for their northern neighbors the Mount Currie or Lil'wat people (Ignace, 1998). The name derives from oral historical events of a time of Transformation when the territory of the Squamish Nation was made inhabitable by powerful beings sent by the creator, known as the Transformers. The Transformers found a group of Lil'wat people here who were behaving in strange ways and turned them into stone,

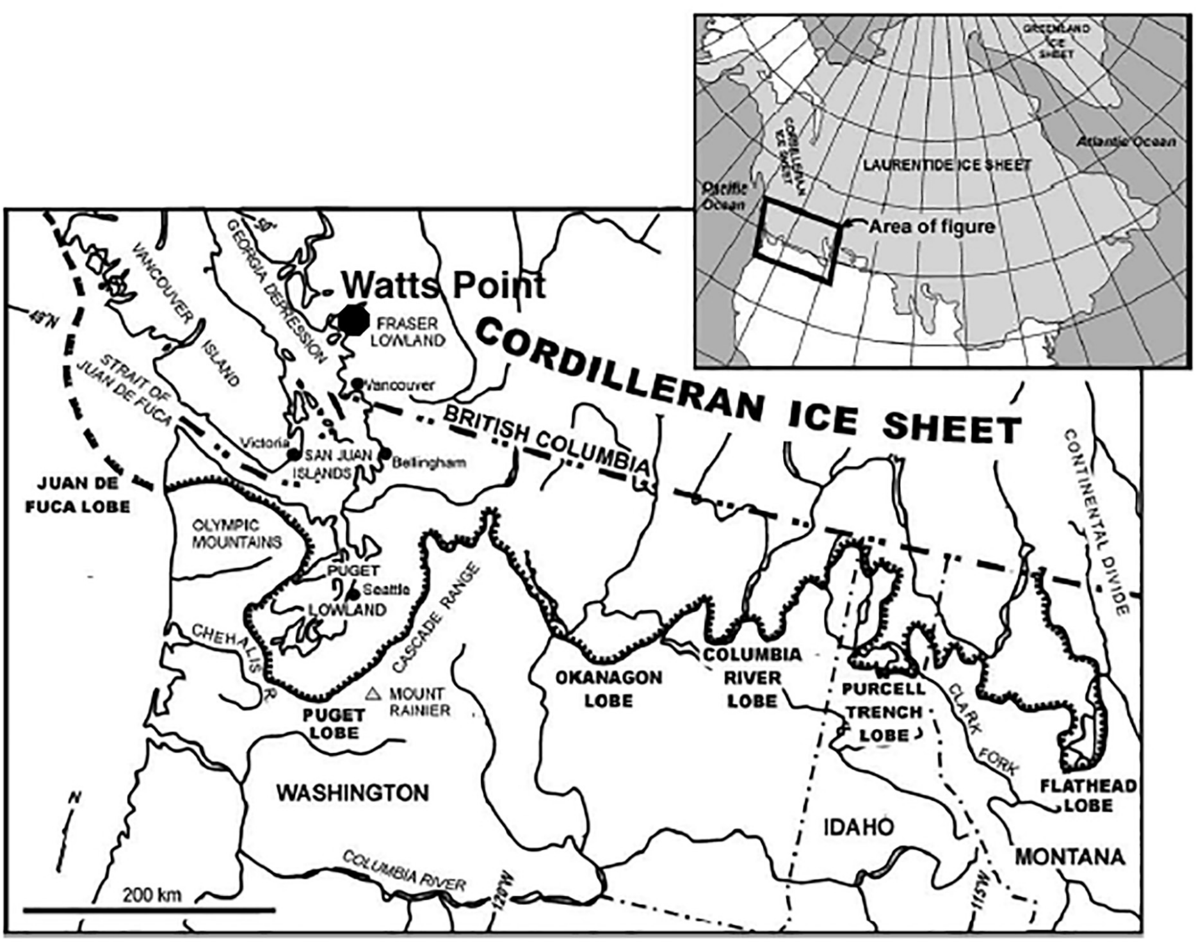

Fig. 1. Extent of the Cordilleran Ice Sheet and the location of Watts Point (from Booth et al., 2003).