CHAPTER 10. RAW MATERIAL IDENTIFICATION AND SOURCING

For over 7,500 years, Alutiiq ancestors harvested Kodiak's natural resources for food and raw material. The plants, animals, and stone they selected and the ways they used these resources sheds light on the organization and evolution of Alutiiq societies. Patterns of land use, travel, trade, and social organization are preserved in the spatial distribution of the raw materials represented in tools and manufacturing debris. To aid in identifying these patterns, museum archaeologists developed a system for classifying the types and origins of raw materials found in Kodiak's archaeological assemblages.

This section of the Alutiiq Technological Inventory shares our system and the information on which it rests. It provides a summary of Kodiak's natural history, highlighting the biological and geological facts that provide a structure for identifying raw materials. It also summarizes raw materials studies completed to date, and then provides a detailed description of known materials and their likely sources.

At the outset, it is important to characterize this effort. First, our system is intended to provide an informed, general picture of raw material use in the Kodiak Archipelago. While our approach offers a model for others, it is designed specifically to provide a structure for identifying materials tied to Kodiak's unique natural history and location in the central Gulf of Alaska.

Second, the purpose of our raw material studies is to support archaeological research. We are interested in how the use of raw materials reflects human behavior. We are not attempting to characterize the natural history of Kodiak, but to use information from that history to better understand the structure and evolution of Alutiiq societies.

Third, this work focuses on the study of artifacts, cultural objects rich in information. In many cases, robust identification of the materials used to make artifacts requires destructive sampling—thin sectioning or DNA analysis for example. While very valuable, such techniques are not often appropriate or practical. They are costly, time-consuming, disfiguring, and can result in the destruction of other types of information. Our research is informed by such scientific analyses, as described below, but it relies heavily on patterning and proxy information (e.g., the regional distribution of land mammals or the stone associated with a well described geological terrane). As such, our aim is to develop a broad picture of raw material use, not to definitively match objects with an exact source. As such, we lump similar materials (e.g., a variety of visually variable tuffs, antler that could be moose or caribou) and provide only a general provenience data (e.g., the west coast of Kodiak).

Finally, although careful constructed, our system represents a preliminary set of material identifications and their likely sources. There is a great deal of research that could be done to refine the insights offered here. This inventory was created to evolve. We fully anticipate the need to update the observations and information presented here as knowledge of Kodiak's natural and cultural histories advances.

Raw Materials and Kodiak's Natural History

The Kodiak Archipelago's rugged topography reflects intensive Pleistocene glaciation. For more than 100,000 years, streams of ice from Cook Inlet, the Alaska Peninsula, and Kodiak's own mountain glaciers carved the precipitous mountains and dramatic fjords that typify the island today (Capps 1937, Karlstrom 1969:29). Glaciation of the region included three periods of ice advance and retreat, culminating with deglaciation of the archipelago between about 14,000 and 17,000 years ago (Peteet and Mann 1994; Misarti et al. 2012). As the ice melted, rising ocean waters filled deeply carved coastal valleys creating the region's complex coastline. Today, Kodiak has more than 4,000 km of coastline, and no place on the island is more than 24 km from the water (Capps 1937:120). For ancient foragers, glaciation shaped the land in economically significant ways. Ice exposed bedrock throughout the region and carried exotic rocks from the mainland to the southwestern shore of Kodiak Island, providing access to stone for tool production. It also created an abundance of protected coastal habitat for plants, fish, and animals.

Biologists believe that plants and then mammals colonized Kodiak's ice-free landscape soon after deglaciation. Pollen studies indicate that a variety of herbs were the first plants to arrive, followed by ferns (Peteet and Mann 1994), alder and birch at least 7,000 years ago, and a succession of modern plants (Heusser 1960:183). Sitka spruce trees, which now cover about a third of the region, were a late arrival. They colonized the archipelago after about 800 years ago (Griggs 1914). Similarly, biologists believe that Kodiak's first mammals—brown bear, fox, river otter, and weasel—reached the archipelago by swimming or traveling over sea ice (Rausch 1969:230). Ground squirrels, perhaps introduced by people, arrived by at least 4,500 years ago based on archaeological finds (Clark 2010, Saltonstall personal communication 2021), although their distribution was limited to a few islands. For other species, like moose and caribou, water and ice were barriers to colonization. People were the island's final settlers, arriving about 7,500 years ago, thousands of years after indigenous animals.

Today, a rich marine environment with a wealth of sea mammals, birds, fish, and shellfish surrounds Kodiak's terrestrial environments. These marine resources also reflect the region's glacial history and climate. Tongues of ice carved a complex coastline and created an abundance of protected nearshore habitat. Warm oceanic currents and large diurnal tides deliver nutrients to these waters. Frequent storms keep these nutrients suspended in the water column, where they enter the food chain and feed numerous biological communities (Sambrotto and Lorenzen 1986:263-264).

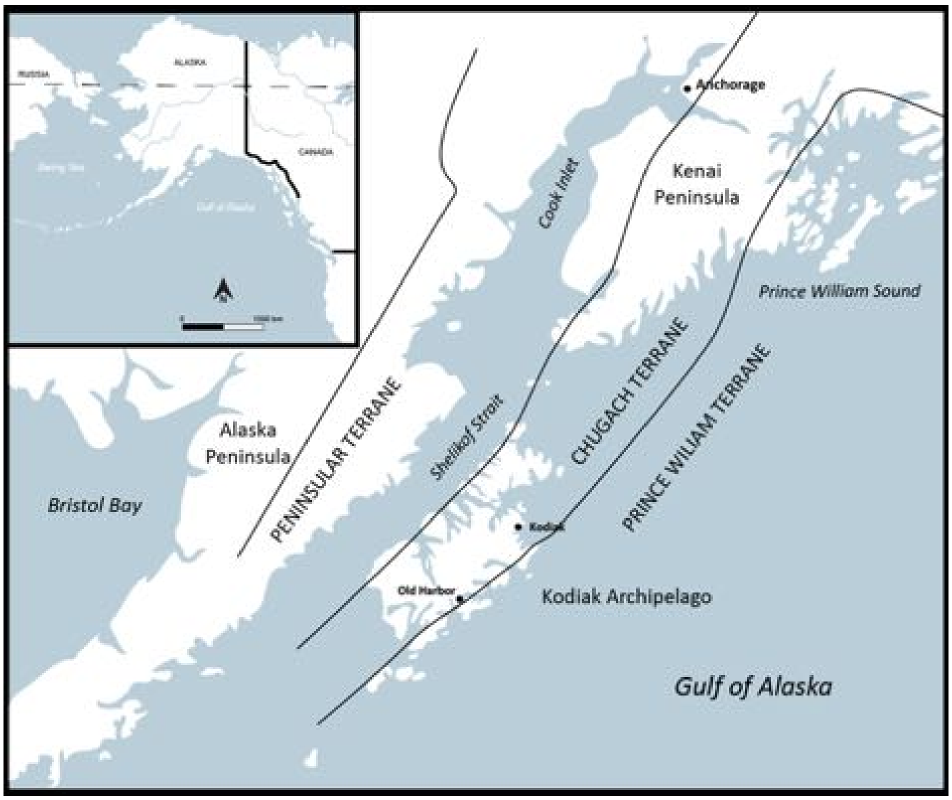
Geological studies suggest that deglaciation began on the western coast of Kodiak Island, and that areas along the northeastern coast of the archipelago were covered in ice for a longer period. This pattern reflects local topography. The mountainous spine of the archipelago follows Kodiak Island's long axis, trending northeast to southwest. The tallest peaks, with summit altitudes over 1,280 m, lie near the center of the island overlooking its eastern shore. Glacial ice flowed out of these peaks and small mountain glaciers are present here today.

The Kodiak Mountains are part of the Chugach Range (Capps 1937:114), the southern extension of the massif that forms the Kenai Peninsula on Alaska's mainland to the north. The Chugach Range is made up of bands of northeast / southwest trending geological terranes, each with a distinct array of bedrock formations. All these rocks have their origins in tectonic processes (Peterson 1980:11).

The Kenai Peninsula and the Kodiak Archipelago lie at the eastern edge of the North American plate, a relatively stationary part of the Earth's crust. As the adjacent Pacific Oceanic plate slides westward, it collides and slides beneath the North American plate generating earthquakes and new bedrock. Kodiak is composed largely of sedimentary and metamorphic rocks, material scraped off the Pacific Oceanic plate as it slides beneath the North American plate. These materials accrete to the edge of the North American plate (Plafker et al. 1994).

Kodiak's bedrock is an extension of the three geological terranes found in the Chugach Range (Figure 10.1), and each is bounded by major tectonic fault. These terranes trend northeast / southwest, running roughly parallel to the Pacific Oceanic plate's subduction trench and the long axis of the Kodiak Archipelago (Silberling et al. 1994).

Figure 10.1. Geological terranes of the Central Gulf of Alaska (after Silberling et al. 1994).



The Peninsular Terrane is confined to the coast of the Alaska Peninsula and the extreme western margin of the Kodiak Archipelago. This portion of the formation on Kodiak holds a variety of heavily weathered volcanic materials whose suitability for tool manufacture is unknown. These rocks need to be examined by an archaeologist as a possible source of the stone used in tool manufacture. Limestone may occur in the Shuyak Formation, a portion of the Peninsular Terrance that outcrops on western Shuyak Island and Afognak Island.

The center of the Kodiak Archipelago is formed from the Chugach Terrane. This wide terrane covers a large area, outcropping on mountain peaks and along the deeply fjorded coast (Silberling 1994). On Kodiak there are two distinct formations in this terrane. To the northwest lies the Uyak Formation, Cretaceous rocks that include greenstones and radiolarian cherts (Connelly 1978; Vallier et al. 1994). Outcrops of red, green, and grey cherts provide some of the best materials for flint knapping on Kodiak. These materials occur in the Uyak complex, a band of rocks accessible around bay mouths from Uyak Bay to Afognak Island. To the southeast lies the

Late Cretaceous flysch (turbidites) of the Kodiak Formation (Vallier et al 1994; Plafker et al. 1994). This formation underlies most of Kodiak and is composed of shales, slates, and greywackes. The Kodiak formation is the source of the region's abundant, widely available slates and greywackes, materials used by toolmakers throughout history.

The Kodiak Batholith, a set of intrusive igneous rock of Paleocene age outcrops in the Chugach terrane. The granitic rocks of the batholith are particularly prevalent around Kodiak's highest mountain peaks but can be found around the region as outcrops and cobbles transported by glaciers. These silica rich granites often appear as light-colored dikes in local slates and greywackes and were a source of material for cobble tools like lamps and sinkers.

The Prince William Terrane follows the far eastern shore of the region, underlying Cape Chiniak, the mouth of Ugak and Kiliuda Bays, Sitkalidak Island to the west of Old Harbor, and the Aliulik Peninsula. This terrane holds an array of metamorphic and sedimentary rocks that include gritty sandstones, tuffs, and siltstones as well as some flakable cherts (Fitzhugh and Trusler 2009).

Raw Material Identification

Organic Materials

— For inorganic raw materials, many of our identifications are based on comparisons with known samples in the museum's collections as well as recognized characteristics of bone, antler, ivory, shell, baleen, spruce root, grass, and other organic materials. Except in rare cases, where we have an identifiable species or elements and an expert to confirm, we do not identify beyond the material type. For example, we recognize that an item is made of sea mammal bone but do not suggest that it is made from a seal rib. This level of detail would be very valuable and could be determined for a variety of the organic objects in the museum's care. However, it represents a step beyond the current analysis.

Our identification of organic materials has been aided significantly by two sources. A paper by Joan Dale, Craig Gerlach, and Gray Salinger (1989) provided helpful information on differentiating between bone, ivory, and antler. Similarly, Amy Margaris' study of the use of animal skeletal elements in Alutiiq manufacturing (Margaris 2006), describes the qualities of different animal tissues and shows how Alutiiq people purposefully selected certain types of material and even certain skeletal elements in making tools. For example, harpoon heads are often made of antler and resilient types of bone, as these materials are good at absorbing the impacts of use. Margaris' review of museum collections illustrated the widespread presence of antler and helped us to better identify and describe organic materials. Her observations informed the organic material descriptions presented below.

Although we are rarely able to identify the type of wood represent in an artifact, studies of wood charcoal by Jenny Deo Shaw (2008) and David Tennessen (2010) shed light on ancestral patterns of wood harvesting and use.

For sourcing organic raw materials, we rely on Kodiak's natural history, recognizing the species that were locally available and those that were not. Although some species have been introduced to Kodiak over the last century (Tennessen 2010), our framework focuses on the distribution of species available before the Western conquest of Kodiak. For some organic materials, identifying a broad origin (on island vs. off island) is a relatively easy process. Antler, ivory, marmot tooth, abalone, and dentalium are examples of materials that come from animals not found in the Kodiak region. They can always be assumed to have been imported. However, materials like a fragment of sea mammal bone may or may not be from Kodiak. We assume that all materials are from their closest source (on island) unless there is definitive evidence of a non-local species (off island). For example, a fragment of land animal bone is considered local.

Inorganic Materials — Major differences in the suite of rocks available in each geologic terrane allow archaeologists to classify the type and origin of raw materials found in archaeological sites, assigning them to different regions of the Kodiak Archipelago. For example, red cherts are typically from the west coast of the archipelago, while sandstones are from its eastern coast.

The processes that formed Kodiak's bedrock, also contributed to the formation of distinct rock formations on the Alaska Peninsula. As the Pacific Plate subducts, crustal rocks melt into the Earth's underlying asthenosphere. The resulting magma rises toward the Earth's surface through volcanoes (Peterson 1980:12). In many areas where the Pacific Plate dives beneath the North American Plate, volcanoes pierce the Alaska Peninsula (Jacob 1986:150). Here, igneous rocks, including basalts, rhyolites, obsidians, and scoriae are common. As the rocks formed by volcanism are distinct from those formed by plate convergence, they can be readily distinguished. Generally, volcanic rocks suitable for tool production come from the Alaska Peninsula. Volcanic rocks are found in Peninsular Terrane that outcrops on the west coast of Kodiak, but these rocks are very different than those on the Alaska Peninsula. Kodiak's volcanic rocks are very old and altered. They do not contain basalt, obsidian, or rhyolite suitable for flintknapping.

Although there is a strong relationship between terranes, landforms, and the distribution of raw materials, there are complicating factors. First, the Kenai Peninsula shares the three geological terranes found on Kodiak (Figure 10.1). As such, rocks from the Chugach and Prince William terranes found on Kodiak are not easily distinguishable from those of the same terrane found on the Kenai Peninsula. For the purposes of this study, we assume that locally available slates, greywackes, and granites were the sources of artifacts made for these materials. Our assumption is that Kodiak people used materials commonly available on Kodiak rather than importing such materials from adjacent areas of the mainland.

Second, due to repeated episodes of glaciation, some non-local rocks have been transported to the archipelago from the mainland. The beaches at the southwestern end of Kodiak Island, between Cape Ikolik and Cape Alitak for example, are formed of glacial end moraines containing rocks from the Alaska Peninsula (Capps 1937:164). However, during the more recent episode of glaciation, Kodiak glaciers scoured the landscape, erasing much of the earlier glacial record (Capps 1937:164). Thus, although present, non-local glacial imports are uncommon.

Third, this is a simplified summary of Kodiak's geology and our interpretations of the stone use by Alutiiq people remains a work in progress. Geologists not archaeologists examined the rocks when the various formations were described and mapped. As archaeologists we have interpreted their descriptions and correlated them with rocks found in archaeological sites. Sometimes this is easy. We can correlate an archaeological sample with stone found in situ in a particular formation. Archaeologists have directly correlated red chert, greywacke, slate, tonalite, hornfels, sandstone, and Tanginak chert with outcrops found on the landscape. At other times we do not know the source of a material but suspect a general location based on a review of the geological literature. For example, it is likely that indurated tuffs were created along the contact of tuffs and the intrusive batholith on the eastern shores of the archipelago.

Archaeological data also helps us assign rock types to a general area. For instance, we know that high-quality tuffs are common in archaeological assemblages from sites on the eastern coasts of the archipelago, but rare in assemblages from the region's west side. Based on the hypothesis that people will first use the materials locally available to them, rather than importing quantities of stone, we infer that this tuff comes from somewhere in the Prince William Terrane. Our knowledge of the geological literature pinpoints some likely localities. Eventually the rocks found at those localities must be checked to test our hypothesis.

Two rock formations remain little known to archaeologists. The Ghost Rocks (Prince William Terrane) and Shuyak formation (Peninsular Terrane) are both located in remote parts of the archipelago and have not been carefully examined as sources of workable stone. As the rocks in these formations are examined by archaeologists, they may eventually be better correlated with the materials used to make artifacts found in site assemblages.

Inorganic Material Identification Studies — The inorganic raw material descriptions and sourcing work reported here began with our study of the Blisky Site (Steffian et al. 1998). Until that study, we based all raw material identifications on visual examination made with a 50x binocular microscope. Much of the sourcing was also based on an understanding of the geologic literature (Barker 1994, Burk 1965, Capps 1937, Connelly 1978, Connelly and Moore 1979, Farris 2010, Keller and Reiser 1959, Nilsen and Moore 1979, Plafker et al. 1994, Silberling et al 1994, Vallier et al 1994). Since then, we have obtained thin sections of a few materials which facilitated more accurate petrological descriptions (May and Carver 1998).

In October of 1998, Wade May, an undergraduate student at Humboldt State University worked with geologist Dr. Gary Carver to complete petrographic analyses of ten artifact samples from two archaeological sites in the Kodiak region.

As this analysis required thin sectioning, a destructive technique, only pieces of debitage were selected for study. These artifacts included seven flakes from the Blisky site (KOD-210) a multi-component site from Near Island in Chiniak Bay with both Ocean Bay and Early Kachemak tradition levels (Steffian et al. 1998). In addition, the team studied three pieces of debitage from the Settlement Point site (AFG-015), an early Koniag tradition village on the shore of Afognak Bay (Saltonstall 1997). Saltonstall and Steffian choose the samples to represent some of the most common inorganic materials available in the Kodiak region as a baseline for non-invasive, visual identification of other artifacts.

After preparing each sample for study through the thin sectioning process, the geologists recorded details of mineralogy, texture, and general description using a standard binocular scope and a petrographic microscope. The results of their unpublished analysis are on file at the Alutiiq Museum (May and Carver 1998) and summarized here (Table 10.1).

This investigation confirmed most of our original designations, but several geologic categories were refined. We reworked our original siltstone and metatuff categories. The descriptions provided below (see Table 10.4), reflect these improvements. Importantly, however, none of our broad regional designations changed because of this refinement.

Table 10.1. Artifacts studied by thin section

Site	Cat #	Artifact	AMAR ID	Geologist ID
Blisky (KOD-210)	AM199:623	Flake	T1	Siltstone
Blisky (KOD-210)	AM199:1716	Flake	MT1	Tuff
Blisky (KOD-210)	AM199:1717	Flake	T2	Tuff
Blisky (KOD-210)	AM199:2104	Flake	MT4	Silicified Tuff / Chert
Blisky (KOD-210)	AM199:2311	Flake	T2	Silicified Tuff
Blisky (KOD-210)	AM199:3135	Flake	MT1	Tuff
Blisky (KOD-210)	AM199:3409	Flake	Red Chert	Radiolarian Chert
Settlement Point (AFG-015)	AM33:1814	Debitage	Grey Slate / MT2	Slate
Settlement Point (AFG-015)	AM33:2708	Debitage	MTI, Greenstone	Diagenetically Altered Tuff
Settlement Point (AFG-015)	AM33:2786	Debitage	G2, Tonalite	Altered Rhyolite Flow

Table Note: The Afognak Native Corporation provide permission for the analysis of Settlement Point site artifacts. Permission to study the Blisky site artifacts came from the University of Alaska Fairbanks. The artifacts and thin section plates were returned to the Alutiiq Museum following analysis where they are currently stored.

Other studies have also added to our knowledge of inorganic raw material sources. Steffian (1992a) looked at the possible sources of coal used to make jewelry and ornaments found at the Uyak (KOD-145) and Old Karluk (KAR-031) sites (Table 10.2). Working with PD Rao, a coal scientist at the University of Alaska Fairbanks, she studied eight pieces of coal debitage through vitrinite reflectance testing, a process that determines the rank—or degree of metamorphosis—of a coal sample. The results indicate that the samples come from at least two sources of high volatile bituminous coal, class C. Comparison of the artifact reflectance values with those from samples of known sources indicates that the samples are most likely from the Alaska Peninsula Province, one of three major coal fields in the central Gulf of Alaska.

Experiments conducted by Saltonstall suggest that both the composition and depositional history of coal affect its workability. He notes that coals with high liptinite values are more easily shaped into artifacts than more brittle coals high in vitrinite. In essence, not all high ranked coals are suitable for working. He notes that cannel coal, a type of coal formed in water, is the best material for use in manufacturing and that coal of this type outcrops in Kinak Bay, on the eastern coast of the Alaska Peninsula. Saltonstall visited this area in 1994 and confirmed that the coal outcropping along the shore is very similar to coal found in Kodiak sites. Similarly, a 2021 trip to Sitkinak Island (Saltonstall and Steffian in prep.), where coal outcrops at tidewater in the Kodiak Archipelago (Figure 10.2), illustrated that this coal is very brittle and not suitable for making objects. Although pieces of this material were seen eroding from the remains of an historic Alutiiq sod house, based on their size and condition it appears they were collected for fuel and not manufacturing. Although more research is needed, the available studies suggest that the coal found in ancestral Alutiiq sites is likely from sources on the Alaska Peninsula.

Additionally, Jeff Rasic, of the University of Alaska Museum of the North completed a study of 17 obsidian artifacts from the Alutiiq Museum's collections (Rasic 2011). The objects come from eight sites broadly representing Kodiak Island and the span of Alutiiq history (Table 10.3). Many of the objects are fragmentary tools, likely discarded because they broke. Although there are a few flakes of obsidian there is no substantial evidence of obsidian working in the current Kodiak collections.

Table 10.2. Results of vitrinite reflectance testing on coal samples from the Uyak and Old Karluk sites (from Steffian 1992a).

Site	Cat #	Artifact	Ro mx%	Rank
Uyak Site (KOD-145)	UA88.78.428	Debitage	0.454 ± 0.028	High volatile bituminous class C
Uyak Site (KOD-145)	AM199:1716	Debitage	0.472 ± 0.030	High volatile bituminous class C
Uyak Site (KOD-145)	AM199:1717	Debitage	0.592 ± 0.035	High volatile bituminous class C
Uyak Site (KOD-145)	AM199:2104	Debitage	0.568 ± 0.053	High volatile bituminous class C
Uyak Site (KOD-145)	AM199:2311	Debitage	0.442 ± 0.032	High volatile bituminous class C
Uyak Site (KOD-145)	AM199:3135	Debitage	0.566 ± 0.045	High volatile bituminous class C
Uyak Site (KOD-145)	AM199:3409	Debitage	0.478 ± 0.045	High volatile bituminous class C
Old Karluk (KOD-031)	UA85.209.7957-2	Debitage	0.414 ± 0.035	High volatile bituminous class C

Figure 10.2. Coal deposits eroding from the shore of Sitkinak Lagoon, 2021.

Table 10.3. Results of XRF analysis of obsidian artifacts in Alutiiq Museum collections (from Rasic 2011:13)

Site	Cat #	Artifact	Tradition	Obsidian Source
Karluk One (KAR-001)	AM38:2571	Flake Fragment	Koniag	Okmok, Aleutian Islands
Malina Creek (AFG-005)	AM24.2975	Flake Tool		Okmok, Aleutian Islands
Malina Creek (AFG-005)	AM24.2975	Modified Flake		Okmok, Aleutian Islands
Malina Creek (AFG-005)	AM24.3135	Flake Tool		Okmok, Aleutian Islands
Malina Creek (AFG-005)	AM24.93.6774	Projectile Point		Okmok, Aleutian Islands
Malina Creek (AFG-005)	AM24.9750	Projectile Point		Okmok, Aleutian Islands
Nunakakhnak (KAR-037)	UA84-195-1990	Projectile Point	Historic	Okmok, Aleutian Islands
Old Karluk (KAR-031)	UA83.209.335	Flake Fragment	Ocean Bay	Okmok, Aleutian Islands
Old Karluk (KAR-031)	UA86-209-3748	Flake Tool		Okmok, Aleutian Islands
Old Karluk (KAR-031)	UA86-209-5611	Projectile Point		Okmok, Aleutian Islands
Old Karluk (KAR-031)	UA86-209-8146	Projectile Point		Okmok, Aleutian Islands
Outlet (KOD-562)	AM327:8271	Projectile Point		Okmok, Aleutian Islands
Rice Ridge (KOD-393)	AM363-89-4-70-213	Biface – Knife	Ocean Bay	Okmok, Aleutian Islands
Three Saints Bay (KOD-083)	AM591:1389	Flake Tool		Okmok, Aleutian Islands
Uyak (KOD-145)	UA88-78-3413	Flake	Late Kachemak	Group D, Aleutian Islands
Uyak (KOD-145)	UA88-78-3680	Biface Fragment	Late Kachemak	Batza Tena, Koyukon River

Using data acquired with an XRF analyzer, Rasic measured ten elements and compared the composite readings with those of samples from known sources and from artifacts in other museum collections. The results indicate that most of the obsidian, 15 of the 17 specimens, come from the Okmok obsidian source on Umnak Island in the Aleutian Island chain. One sample is related to an unidentified obsidian source (Rasic's Group D), likely from the Unalaska region, also in the Aleutian Islands. The final piece, a biface fragment, is made of from the Batza Tena source. This material is from in the Koyukuk River drainage of interior Alaska, more than 500 miles north of the Kodiak region. Rasic reports that this specimen is one of the furthest transported pieces of Batza Tena obsidian found in his research. Together the results illustrate that the obsidian used on Kodiak represents long distance travel and trade and comes predominantly from the Aleutian Islands.

Classification Framework Review

Patrick Saltonstall, an archaeologist with training in geology, created the original raw material classification framework for Kodiak archaeological collections in 1998 (Steffian et al. 1998:Appendix B) with help from Gary Carver and Wade May. Although this framework has been updated over the years, it had not been reviewed by a geologist since its creation. As part of the Alutiiq Technological Inventory project, the museum hired professional geologist Tom Corbett to complete the review. Corbett was an ideal selection. He is a senior geologist with Pathfinder Mineral Services, who has spent his career studying Alaskan geology. Moreover, he is married to an archaeologist. As such, he understands the nature of archaeological collections and analyses. Archaeologists can't typically thin section every item in a collection and are often interested in a general source locale rather than identifying the specific outcrop from which a stone originated.

Corbett visited the museum for three days in November 2020. He prepared by reviewing geological literature of Kodiak, including the most recent bedrock geology map (Wilson 2013). AMAR also supplied a copy of the working raw material framework. In Kodiak, Saltonstall and Corbett examined the raw material boxes created for the project with samples of common materials. Then they reviewed geological literature and discussed Saltonstall's use of this information to create the classification framework. The next step was a review of the museum's collection. Together, Saltonstall and Corbett examined a variety of archaeological collections with examples of artifacts made from different inorganic raw materials.

Following his visit, Corbett summarized his finds and recommendations in a short, written report (see Appendices). Generally, Corbett felt that the classification system functioned well and was grounded in a good understanding of Kodiak geology. He suggested some terminological changes (e.g., differentiating between slate and hornfels based on degree of fissility and thermal alteration), and not using the term greenstone. He recommended the museum purchase a stereomicroscope and a light source to aide in future material studies since thin sectioning is seldom possible or practical. Finally, he encouraged Saltonstall to study rock formations and collect stone samples as his archeological fieldwork extended to new areas.

Based on Corbett's input, Saltonstall revised the raw material classification system. The major change was moving stones thought originally to be metatuffs from the Uyak formation to the tuff group found in the Prince William Terrane (MT3, MT4, and MT5). Corbett suggested that these indurated materials were likely the result of exposure to dike rock. Namely, he suggested that as molten granitic dikes formed, they thermally altered immediately adjacent rocks to create chippable indurated tuffs. While this hypothesis requires additional study, particularly field sampling, it is a good working hypothesis for the origins of a set of materials consistently found in the archaeological record.

Raw Material Descriptions

The following section describes each of the raw materials identified in the museum's collections, based on the framework developed by Saltonstall and refined during the Alutiiq Technological Inventory project. The descriptions are grouped by class (organic or inorganic) and presented in alphabetical order. The likely sources of each material appear in Table 10.4. Examples of the materials are also available in our raw material example kit (Figure 10.3, Table 10.5)

As the great majority of our material identifications were based on visual examination, all affiliations should be considered provisional. As with our artifact classification, our raw material identifications are broad categories informed by environmental knowledge. There are many ways these categories could be refined. They are offered as a framework for understanding the broad geographic affiliation of the raw materials used in ancestral Alutiiq manufacturing.

Figure 10.3. Raw material kit in the Alutiiq Museum laboratory

Table 10.4. Likely sources of raw materials found in Kodiak's archaeological sites

	LOCAL: On-Island	INTRODUCED: On-Island	NON-LOCAL: Off-Island	UNKNOWN
ORGANIC	**HARVEST** Baleen Bird Bone Fish Bone (halibut vertebrae) Grasses & Herbs (rye grass, fern, etc.) Kelp (marine algae) Land Mammal Bone (brown bear, ermine, fox, ground squirrel, land otter) Sea Mammal Bone (harbor seal, porpoise, sea lion, sea otter, whale) Shell (chiton, clam, mussel, whelk, etc.) Spruce Root Tooth (bear, seal, sea lion, salmon, etc.) Wood & Bark (alder, cottonwood, spruce, willow)	**DRIFT** Driftwood (birch, cedar, hemlock, pacific yew) Seed pods	**HARVEST / TRADE** Amber Antler (caribou, moose) Birch Bark Exotic Shell (dentalium, abalone) Horn (goat, sheep) Ivory (walrus, fossilized ivory) Land mammal bone (black bear, caribou, moose, etc.) Tooth (beaver, marmot, porcupine incisors)	**MISCELLANEOUS** Coral
INORGANIC	**INTRUSIVE (throughout archipelago)** Bog iron Granites G3 Granite (from Batholith) G2 Tonalite (Dike Rock) Iron Ore Iron Oxide (Red Ochre) Quartz **KODIAK FORMATION (central archipelago)** Slate Hornfels Greywacke **UYAK FORMATION (western archipelago)** Meta Tuffs MT1 Greenstone MT2 Gray slate MT3 Silicified Tuff with metallic inclusions MT4 Spotted Chert—silicified meta tuff Radiolarian Chert (red, gray, green) Schists (green & blue facies) **PRINCE WILLIAM TERRANE (eastern archipelago)** Conglomerate Cherts TC Tanginak gray chert BC Banded chert Sedimentary S1 Sandstone (some with molluscan fossils) S2 Siltstone Tuffs T1 Straight Tuff (grainy and soft) T2 Indurated Tuff (spotted with feldspars, not silicified or distorted	**GLACIAL TRANSPORT** Pebbles (banded chert) **DRIFT** Metal from shipwrecks, etc. Pumice	**VOLCANIC (Alaska Peninsula)** Basalt (fine grained mafic) B1 with phenocrysts B2 without phenocrysts B3 olivine rich Obsidian Pumice (Silicic, floats) Rhyolite (fine grained silicic) Scoria (Mafic, does not float) **EXOTIC CHERT** Various colors (bright red, mustard yellow, etc.) **MISCELLANEOUS** Canel coal (bituminous, high in liptonite) Chalcedony Copper/ copper oxide Limestone Red Shale	**MISCELLANEOUS** Graphite Jadeite Molybdenite Quartz crystal

Table 10.5. Raw material kit inventory

Object AM#	Collection	Coll. Type	Object	Original Location	Material Kit Location
AM33.2786	Settlement pt.	ARCH	G2 Granite Flake	M,8	Box 1, Sq. 26
AM33.2786	Settlement pt.	ARCH	Thin section of	M,8	Box 1, Sq. 26
AM199:3409	Near Is. Blisky site	ARCH	Red Chert Flake	M,8	Box 1, Sq. 21
AM199:3409	Near Is. Blisky site	ARCH	Thin section of	M,8	Box 1, Sq. 21
AM33.1814	Settlement pt.	ARCH	MT2 silicified slate	M,8	Box 1, Sq. 22
AM33.1814	Settlement pt.	ARCH	Thin section of	M,8	Box 1, Sq. 22
AM33.2708	Settlement pt.	ARCH	MT1 Greenstone Flake	M,8	Box 1, Sq. 27
AM33.2708	Settlement pt.	ARCH	Thin section of	M,8	Box 1, Sq. 27
AM199:2311	Near Is. Blisky site	ARCH	T2 Spotted chert Flake	M,8	Box 1, Sq. 17
AM199:2311	Near Is. Blisky site	ARCH	Thin section of	M,8	Box 1, Sq. 17
AM199:1717	Near Is. Blisky site	ARCH	T2 spotted chert Flake	M,8	Box 1, Sq. 17
AM199:1717	Near Is. Blisky site	ARCH	Thin section of	M,8	Box 1, Sq. 17
AM199:2104	Near Is. Blisky site	ARCH	MT4 spotted chert flake	M,8	Box 1, Sq. 28
AM199:2104	Near Is. Blisky site	ARCH	Thin section of	M,8	Box 1, Sq. 28
AM110:41	Teaching Collection	TEACH	Chalcedony flake	W,8	Box 1, Sq. 19
AM110:61	Teaching Collection	TEACH	Basalt chipped point	W,8	Box 1, Sq.13
AM699:17	Teaching Collection	TEACH	Obsidian flake	W,14	Box 1, Sq. 8
AM126:1	Malina Chert Collection	NHIS	Exotic Chert bright red	N,9	Box 1, Sq. 16
AM129:1	Aleutian Limestone/calcite (2 pieces)	NHIS	Limestone	N,9	Box 1, Sq. 23
AM129:2	Aleutian Limestone/calcite (2 pieces)	NHIS	Limestone	N,9	Box 1, Sq. 23
AM108	Homer siltstone collection	NHIS	Red Shale (3 pieces)	L,2	Box 1, Sq. 11
AM145:24	Chignik Lake Collection	ARCH	Basalt with phenocrysts	L,2	Box 1, Sq. 14
AM582:1	Daniel Boone Reed	TEACH	Coal Labret	X,4	Box 1, Sq. 9
AM110:266	Teaching Collection	TEACH	Dentalium shells	W,4	Box 2, Sq. 35
AM110:313	Teaching Collection	TEACH	Canine Tooth	W,4	Box 2, Sq. 17
AM110:325	Teaching Collection	TEACH	Bone	W,2	Box 2, Sq. 18
AM110:237	Teaching Collection	TEACH	Sea mammal bone	W,2	Box 2, Sq. 23
AM535:2842	Salonie Mound	ARCH	Siltstone	D,4,1	Box 1, Sq.1
AM535:4326	Salonie Mound	ARCH	Sandstone	D,4,3	Box 1, Sq. 2
AM535:6154	Salonie Mound	ARCH	OB "Chert"	D,4,3	Box 1, Sq. 17
AM535:6580	Salonie Mound	ARCH	MT3 Tuff	D,4,4	Box 1, Sq. 29
AM535:5208	Salonie Mound	ARCH	G1 Big Grain Granite	D,4,4	Box 1, Sq. 25
AM535:4288	Salonie Mound	ARCH	Scoria	D,4,3	Box 1, Sq. 15

Alutiiq Terms for Raw Materials

Elders recall only a few of the Alutiiq names for traditionally used stone. Many of the materials below are simply identified as *yaamaq* (rock) (Table 10.6). More specific terms, if they existed, have faded from living memory. In part, this may be because stone chipping became much less common in the late prehistoric era, reducing the variety of materials craftspeople used. Additionally, the rapid conquest of Kodiak and the introduction of new technologies and languages, likely contributed to the loss of terms for traditionally used manufacturing materials.

Table 10.6 Alutiiq terms for inorganic raw materials

English	Alutiiq	Note
Banded Chert	Yaamaq[m]	
Basalt	Yaamaq[m]	
Chalcedony	Yaamaq[m]	
Chert	Yaamaq[m]	generally - any color
Clay	Qikuq[h]	Leer (1978)
Coal	Qetek[m]	
Copper	Kanuyaq[h]	Leer (1978)
Fossil	Nenret yaamanek canamasqat[c]	"bones made from stone"
Granite	Yaamaq[m]	
Graphite	Yaamaq[m]	
Greenstone	Yaamaq[m]	
Greywacke	Yaamaq[m]	
Iron	Cawik	bog iron, naturally occurring
Limestone	Yaamaq[m]	calcite
Metal	Cawik	e.g., historic metal, or flotsam metal
Metatuff	Yaamaq[m]	
Obsidian	Yaamaq[m]	
Ochre	Qetaq* / Uiteraq*	iron oxide
Pumice	Qapuk / Utakinem yaamaa*	utakineq = volcano
Quartz	Quglaq[c]	"a type of white rock"
Quartz Crystal	Quglam cikutaa[c]	
Red Chert	Yaamaq[m]	Kodiak's red chert
Red Shale	Saliriq[m]	shale generally
Rhyolite	Yaamaq[m]	
Sandstone	Yaamaq[m]	
Schist	Yaamaq[m]	
Scoria	Yaamaq[m]	like pumice, but dark and doesn't float
Siltstone	Yaamaq[m]	
Slate	Ipegyaq[m]	
Tuff	Yaamaq[m]	

m = term in modern usage, h = historic term, c = term created by Elder Alutiiq speakers
* = suggested term needing additional review

Organic raw materials are better known to Alutiiq speakers (Table 10.7). The list below includes some materials, like feathers, that are almost never found in archaeological sites.

However, these materials are common components of ethnographic collections and were included here for that reason. A next step in enhancing the Alutiiq Technological Inventory is to expand the materials list to include those represented in 18th and 19th century collections, e.g., bird skin, seal skin, sinew, caribou hair, puffin beak, cotton thread, etc. (cf. Korsun 2010).

Table 10.7. Alutiiq terms for organic raw materials

English	Alutiiq	Notes
Abalone Shell	Quiraq[m]	"mother of pearl"
Amber	Amaq[h]	
Antler	Ciruneq	moose or caribou (horn)
Baleen	Kagit'ruaq	
Birch Bark	Qasrulek / Qasruq[c]	paper birch / birch bark (combined dictionary, needs approval)
Bird Bone	Saqullkanam nenea[m]	Animal name + neneq
Charcoal	Kianiq[m]	wood charcoal from household fires
Clam Shell	Salaq[m]	
Claw	Stuk[m]	fingernail too (combined dictionary)
Clay	Qikuq	
Coal	Qetek[m]	
Coral	Yaamaruaq naut'staaq[c]	
Cottonwood Bark	Ciquq[m]	
Dentalium Shell	Aimhnaq[h]	
Driftwood	Pukilaaq[m]	Leer (1978)
Feather	Culuk[m]	
Fur	Amiq[m]	Skin or fur
Grass	Weg'et[m]	
Halibut Vertebrae	Saagim iiwaa	
Horn	Ciruneq[m]	Sheep or goat
Human Hair	Nuyat[m]	Might be another word for hair no longer on head.
Ivory	Tuluq	Term adopted from Central Yup'ik
Kelp	Nasqulut[m]	
Land Mammal Bone	Specific animal (but ending m) +	e.g., bear bone; taqukaram nenraa (bear's bone)
Mussel Shell	Qapilaq[m]	
Puffin Beak	Tunngam cug'a[m]	
Sea Mammal Bone	Specific animal (but ending m) +	e.g., arwam nenraa (whale's bone)
Spruce Root	Napam acillqua*	acillquq = base and/or main root complex of tree
Tooth	Guuteq[m]	bear, sea lion, etc. (not ivory)
Wood – Alder	Uqgwik[m]	
Wood – Bark	Qelltek[m]	
Wood – Cottonwood	Ciquq[m]	from Nadia
Wood – Elderberry	Qaruckaq[m]	
Wood – Mountain Cedar	Allciq[m]	
Wood – Red Cedar	Qar'uciq[m]	
Wood – Spruce tree	Napaq[m]	
Wood – Tree Root – any	Nukek[m]	tendon historically
Wood – Willow	Nimruyaq[m]	
Wood – Yellow Cedar	Teptuliq[m]	

m = term in modern usage, h = historic term, c = term created by Elder Alutiiq speakers
* = suggested term needing additional review