Tuqan Chert: A "Mainland" Monterey Chert Source on San Miguel Island, California

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Abstract

In this paper, we report the discovery of a geological source of Monterey chert on San Miguel Island. Previously, Monterey chert artifacts found in terminal Pleistocene and Early Holocene strata at Daisy Cave—and other San Miguel Island sites spanning the Holocene—were generally assumed to have come from mainland sources on the western Santa Barbara Coast or the Vandenberg area. Rounded cobbles of 'Tuqan' Monterey chert eroding from raised beach deposits on eastern San Miguel Island produce artifacts macroscopically similar to mainland Monterey cherts, except for a ~1 to 2 millimeter thick, white cortex found on most cobbles. This distinctive weathering rind appears to result from a long encasement of the cobbles in beach sediments rich in $CaCO_3$. Extensive lithic scatters in the vicinity of the raised beach deposits have produced chipped stone crescents and Channel Island Barbed points, suggesting that people mined Tuqan chert cobbles for more than 10,000 years. Because the adjacent shoreline contains cliffs composed of bedded shales of the Monterey Formation, additional marine cobble deposits and intact chert outcrops could potentially exist offshore, where they may have been accessible during periods of lower sea level, or on the west end of Santa Rosa Island where similar terrace deposits appear to be present.

Introduction

The Chumash Indians of southern California are renowned for their economic and sociopolitical complexity, including well-developed craft specialization and trade that was locally intensive and regionally extensive (Arnold 2001; Kennett 2005; King 1990; Landberg 1965). There has been a great deal of scholarly discussion about Chumash exchange, a dialog that spans many decades (e.g., Arnold 1987, 1992, 2001; Johnson 2000; Landberg 1965; Kennett and Conlee 2002; King 1971; Rick 2007). Given the antiquity of *Olivella* shell beads found deep in the interior of California and artifacts of Sierra Nevada obsidians found in coastal areas, long-distance trade in southern California has a history of at least 9,000 to 10,000 years (Erlandson 1994; Fitzgerald, Jones, and Schroth 2005).
From these and many other studies, California archaeologists know a great deal about ancient trade and interaction in southern California, especially in the Chumash area.

Despite over a century of archaeological studies and nearly 50 years of scientific archaeology, however, there is still much to be learned about the geographic distribution of mineral resources used by the Chumash and their neighbors—including cherts, fused shales, pigments, asphaltum, soapstone, and other materials. Wilcoxon and Moriarty demonstrated this with their discovery of a tool-quality fused shale source in the Santa Ynez Valley in the 1980s, after archaeologists for decades considered the Grimes Canyon locality in Ventura County to be the only source for the many fused shale artifacts recovered in southern California.
It was illustrated again in the 1990s, when

Erlandson and Kennett documented the presence of a widely used chalcedony (Cico chert) source on northeastern San Miguel Island (Erlandson et al. 1997). Arnold (2001:15; Arnold and Bernard 2005:118) also stated that no source of high-grade asphaltum was available on the Northern Channel Islands, when a major tar seep has long been known to exist off the northwest coast of San Miguel Island (Braje, Erlandson, and Timbrook 2005:209; Heye 1921:20; Roberts 1991:14; Weaver 1969:2). Recently, Erlandson (2005; Erlandson et al. 2005), Pletka (2001), Rick (2004), and others have argued that artifacts of 'mainland' Monterey chert types also represent evidence for trade or transport across the Santa Barbara Channel, a conclusion we have questioned in the past (Erlandson et al. 1997) and take issue with here.

Clearly basic research is needed on the geographic distribution of major mineral commodities such as high-quality Monterey cherts used by the Chumash and their ancestors in the Santa Barbara Channel region for millennia. This research need is especially true in a coastal area occupied by people for at least 13,000 years—a period in which sea levels have risen approximately 50 meters—where extensive lowland landscapes once accessible to humans now lie submerged off the coast. This includes the Northern Channel Islands, where coastal plain habitats several kilometers wide have been submerged since the end of the last glacial period, and a Cico chert outcrop was reported off the northeast coast of San Miguel Island (Erlandson et al. 1997:125).

We have identified numerous Early Holocene sites on San Miguel, many of which have produced artifacts made from Monterey cherts or siliceous shales similar to mainland sources found along the coastlines of western Santa Barbara County (e.g., Erlandson 2005; Erlandson et al. 1997, Erlandson et al. 2005). The presence of these Monterey chert and siliceous shale artifacts has been interpreted as evidence for early trade between distinct island and mainland populations, or as evidence that the islands were periodically visited by mainland peoples who carried chert artifacts and cobbles with them. The abundance of Monterey chert and siliceous shale artifacts, some of them made from relatively low-quality materials that seemed unlikely to be transported across the Santa Barbara Channel, also led Erlandson et al. (1997:128) to speculate that a local source for such materials might exist on San Miguel or western Santa Rosa Island. Despite multiple searches over the last decade, however, we were unable to identify tool-quality sources of Monterey chert or siliceous shale on these islands until recently.

In 2005, we finally identified a geological source of Monterey chert at Cardwell Bluffs on eastern San Miguel Island, with outcrops that produce cherts that strongly resemble artifacts made from mainland Monterey chert varieties. In this paper, we describe the geological setting of this new chert source, which we call 'Tuqan' Monterey chert after a Chumash name for San Miguel Island. We also briefly describe three large lithic scatters recently recorded at Cardwell Bluffs that have produced extensive evidence for biface and projectile point production, including crescents and Channel Island Barbed points (a.k.a. Punta Arena or Arena points; Erlandson and Braje 2008a; Justice 2002) that indicate a heavy use of the Tuqan outcrops by Early Holocene peoples. Finally, we discuss the implications of the discovery of the Tuqan Monterey chert source for understanding the nature of early maritime settlement on San Miguel Island, the use of lithic resources by Channel Islanders, and the archaeological study of exchange between the Island Chumash and their mainland neighbors.

Geological Background

San Miguel, the northwesternmost of California's Channel Islands, is located about 42 kilometers off the western Santa Barbara Coast (Fig. 1). Roughly 14 kilometers long and 7 kilometers wide, with a total land area of approximately 37 square kilometers, the San Miguel landscape consists of two low hills surrounded by extensive tablelands, with a series of raised marine terraces separated by steep escarpments that mark ancient shorelines and sea cliffs. The island is covered by extensive sand dunes, both ancient and modern, that obscure much of the bedrock geology, except where it is exposed in sea cliffs, canyon walls, and other escarpments.

During the last glacial maximum, when sea levels were roughly 120 meters lower than today, San Miguel was connected to the other Northern Channel Islands as part of a larger island known as Santarosae (Orr 1968; Wenner and Johnson 1980). Postglacial sea level rise has flooded large expanses of coastal lowlands that once surrounded San Miguel and the other Channel Islands. These submerged landscapes may have contained outcrops of high-quality cherts and other mineral resources not available on the islands today. Traces of such offshore geology can sometimes be identified in raised beach deposits on island marine terraces, where rounded cobbles of diverse rock types can be found. Such cobbles can be transported considerable distances by wave action and lateral shoreline movements associated with marine transgressions.

Initially, our search for a geological source of Monterey chert on San Miguel Island focused on the far southeastern coast, where geologists have mapped a localized area of Miocene Monterey Formation rocks (Erlandson et al. 1997; Weaver and

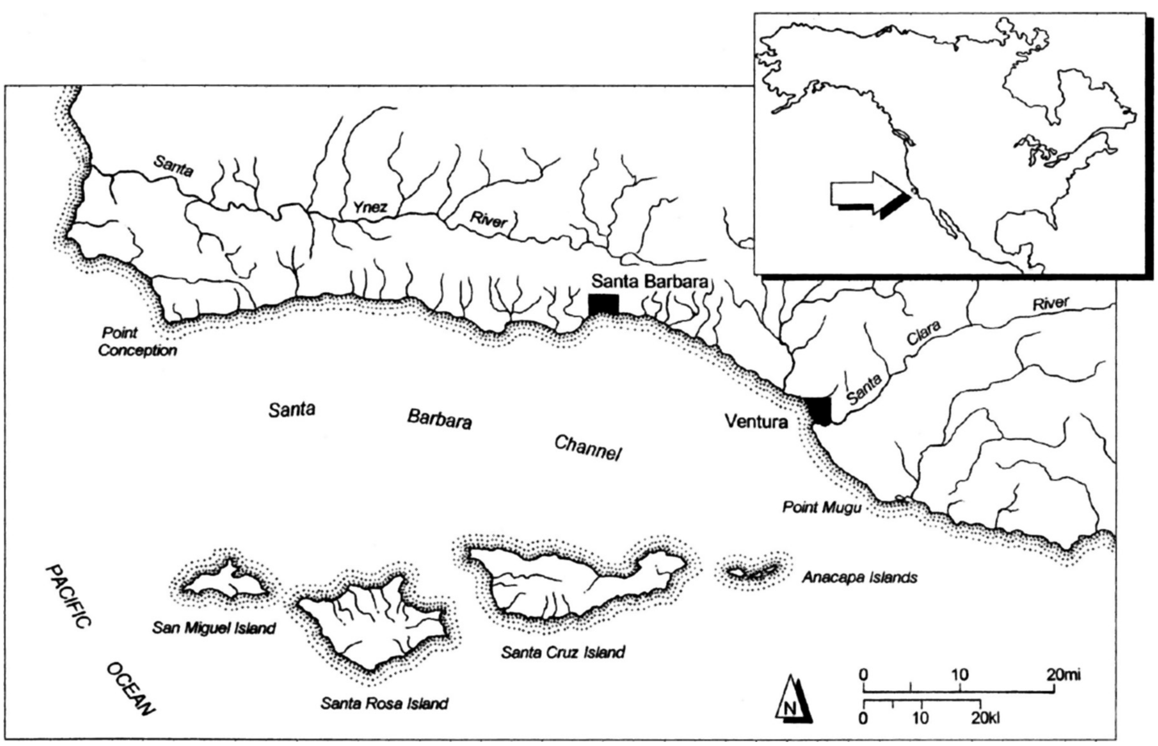

Fig. 1. Map of the Santa Barbara Channel region and the Northern Channel Islands (adapted from Kennett 2005).

Doerner 1969). Geoarchaeological reconnaissance of beaches and sea cliffs in the area revealed the bedded calcareous shales typical of the Monterey Formation, but no sign of the chert or siliceous shale outcrops often mined by the Chumash and their ancestors to make stone tools. Beaches in the area were largely covered with sand, and no cobbles of Monterey chert were noted in the area. However, a few large cobbles of Cico chert were found on the beach just north and west of Cardwell Point.

Over the years, we identified a few rounded pebbles or small cobbles of high-quality Monterey chert in a large lithic scatter (CA-SMI-678) exposed in a heavily eroded area on the bluffs overlooking Cardwell Point. A National Park Service hiking trail follows an old U.S. Navy or ranch road graded through this site, which has many chipped stone tools and tool-making debris made from Monterey cherts. Erlandson et al. (1997:128) suggested that this locality might be a source of Monterey chert cobbles used by San Miguel islanders. Despite multiple visits to the site, however, we never found any unbroken chert cobbles in a primary geological context, leaving open the possibility that they were carried to San Miguel from mainland sources and later flaked by people on the island.

In 2005, however, Erlandson finally identified cobbles of high-quality Monterey chert eroding from a caliche-encrusted cobble and gravel deposit exposed by erosion on the slopes of the escarpment below CA-SMI-678. Here, we identified what appears to be an ancient beach deposit containing unbroken cobbles of Monterey cherts that are very similar macroscopically to banded or mottled Monterey cherts found along the mainland coast in western Santa Barbara County. Also noted in

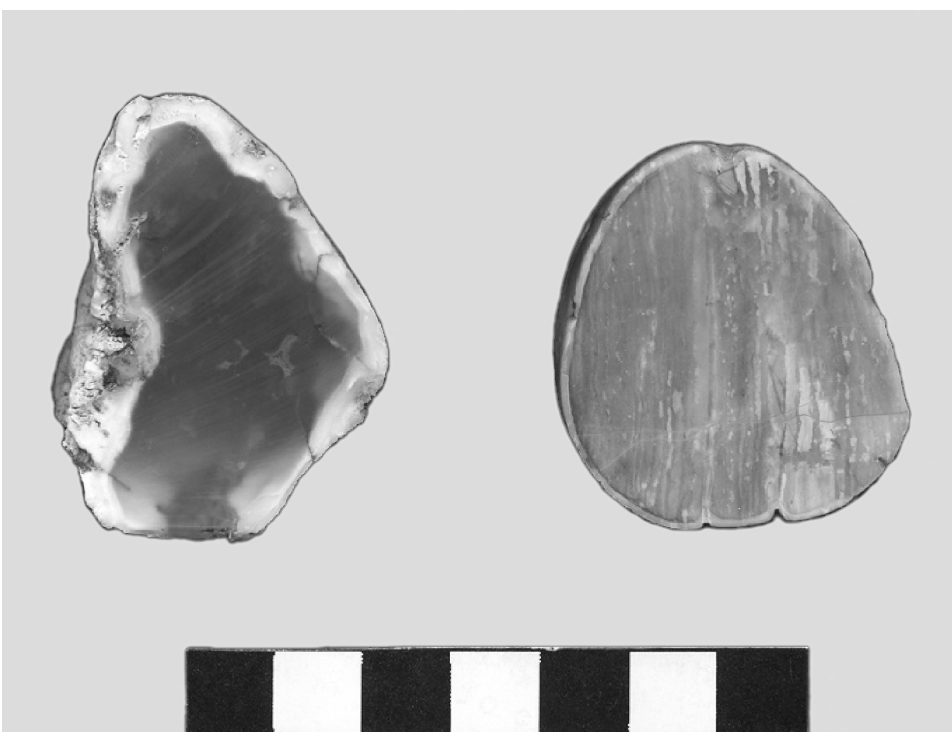

Fig. 2. Photo of distinctive cortex found on most Cico chert (left) and Tuqan chert (right) cobbles at Cardwell Bluffs on San Miguel Island. Scale shows centimeters. Photo taken by J. M. Erlandson.

the beach deposits were occasional Cico chert, quartzite, and metavolcanic cobbles that were also used by the Island Chumash and their predecessors to make stone tools.

The beach deposit in which these cobbles are embedded appears to have been heavily altered over tens of thousands of years. More recently, large portions of the Cardwell Bluffs area have been stripped of soil and scoured to a rugged and cemented caliche surface that formed beneath ancient dunes by the slow dissolution of calcareous sands and the gradual accumulation of calcium carbonates in the underlying geological formations. Fortuitously, at Cardwell Bluffs the ancient cobble beach deposit appears to have been completely infused with a soft, calcareous caliche that provides the means to distinguish many Tuqan cherts from similar mainland Monterey cherts.

A Preliminary Description of Tuqan Monterey Chert

Although the precise age of the chalky beach deposit that contains the rounded Monterey chert cobbles from the Tuqan source, is not known, it is clearly more than 200,000 years old. The exterior of most Tuqan chert cobbles, embedded in this calichified beach deposit, is a continuous, completely opaque, and relatively thick (~1 to 2 millimeters) cortex that appears to be a weathering rind. This rind appears related to the long encasement of the cobbles in a matrix rich in calcium carbonate ($CaCO_3$). This distinctive white or buff cortex often completely hides the cobble interior (Fig. 2), making it difficult to recognize whole cobbles as chert. Once broken, however, the interiors of the Tuqan cobbles strongly resemble many of the mainland varieties of Monterey chert found in western Santa Barbara County, from the Gaviota area to Vandenberg Air Force Base. We still have a relatively small sample of unmodified cobbles with which to document the variability inherent in the color, texture, and other characteristics of Tuqan cherts in the Cardwell beach deposits. The geological specimens from the Cardwell area consist of dark banded or mottled cherts varying in color from brown, to black, and various shades of gray. The maximum diameter of whole pebbles or cobbles observed ranges from about 3 to 15 centimeters.

Since recognizing the distinctive nature of Tuqan Monterey chert cobbles, we have identified cores and cortical flakes of Tuqan cherts in archaeological sites across San Miguel Island. These include sites of Early, Middle, and Late Holocene age. Although dark brown, gray, and black varieties seem to dominate this larger sample, artifacts made from Tuqan cherts also appear to encompass a broader range of mainland chert varieties, with tan or buff examples, as well as laminated varieties containing both chert and siliceous shale bands. Examination of these artifacts also makes it clear that many Tuqan chert cobbles are of very high-quality chert. In part, this may be due to the greater resistance to erosion of highly competent siliceous rocks. Subjecting chert clasts to the high energy wave action of California beaches tends to destroy those cobbles containing numerous internal fractures, resulting in beach cobbles that are relatively pure, with well-developed conchoidal fracture.

Remarkably, after describing our long search for Tuqan chert to an artist who shared the San Miguel Island bunkhouse with us, she returned the next day with several small cobbles of siliceous shale that contained thin bands of Monterey chert. These cobbles, reportedly found on the beach in Cuyler Harbor on the north coast of San Miguel, are similar to several cobble cores found in Early Holocene midden deposits at Daisy Cave in the 1990s—cores that first convinced us there must be a local source of Monterey chert on San Miguel

Island. We recently identified similar siliceous shale cobbles on the beach near the west end of Cuyler Harbor, where their existence suggests that there may be additional sources of tool-quality Monterey chert and siliceous shales yet to be discovered on San Miguel Island—and possibly Santa Rosa Island (Erlandson 1997).

Preliminary Description of the Cardwell Bluff Lithic Sites

Near the rim of the bluffs overlooking Cardwell Point, in the immediate vicinity of the primary Tuqan chert source, we recently recorded three large lithic scatters that are remarkable for the large numbers of bifaces found on their surfaces. Situated between Cactus Canyon on the south and Fish Ridge to the north, these Cardwell Bluff sites (CA-SMI-678, CA-SMI-679, and CA-SMI-680) are exposed on three heavily eroded blowouts between the outcrops of Tuqan chert and Cico chalcedonic chert (Fig. 3). Although not yet quantified, the abundance of bifaces made from these local cherts seems to vary with proximity to the sources, with tools made from Tuqan chert (Fig. 4) dominating the southern sites (CA-SMI-678 and -679) and roughly equal proportions of Cico and Tuqan cherts in the northern site (CA-SMI-680). The dominance of Tuqan chert artifacts at CA-SMI-678 and CA-SMI-679—despite the presence of Cico chert and other malleable rock types—suggests that quarrying and stone-working at these sites was focused primarily on the exploitation of high-quality Tuqan chert cobbles.

Along with ready access to siliceous rocks used to make stone tools, the Cardwell Bluffs area provides a commanding view from the east end of San Miguel to western Santa Rosa Island. A plateau known as the Gangplank (Johnson 1972) rises gradually to the west, providing some protection to the Cardwell Bluffs area from the strong northwesterly winds that buffet San Miguel much of the year. Fresh water may have been available intermittently in Cactus Canyon, but more permanent water sources were probably located

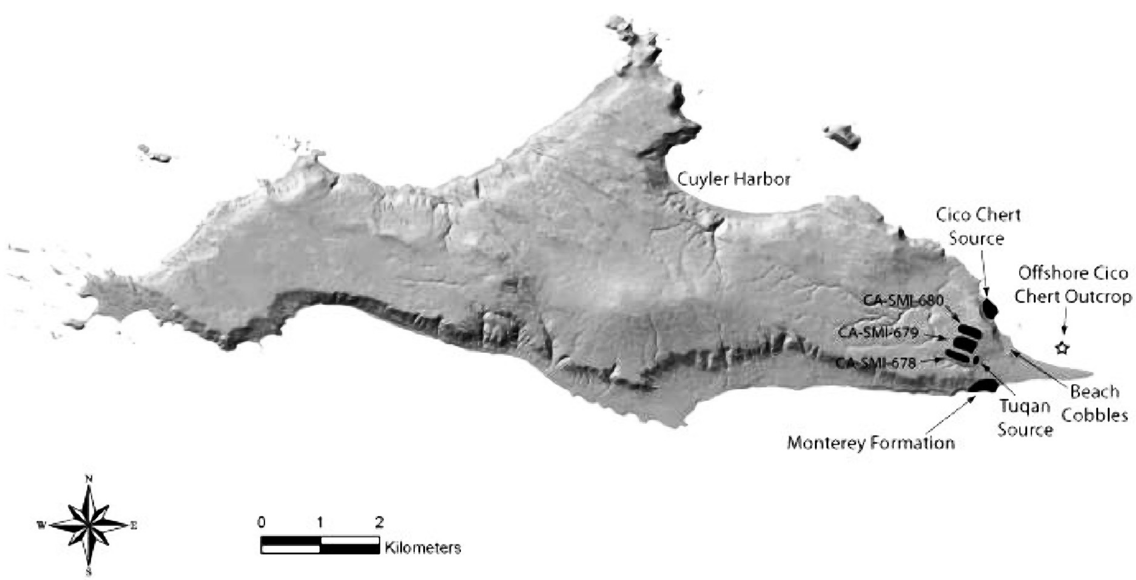

Fig. 3. San Miguel Island, showing the location of Cardwell Bluffs area, Tuqan and Cico chert sources, and other geographic features discussed in the text.

about a kilometer to the northwest in Willow Canyon. Judging from the contents of nearby shell middens, the coastline adjacent to Cardwell Point also provided a wealth of shellfish and other resources from rocky intertidal, kelp forest, and other nearshore habitats. During the Early Holocene, with sea levels ranging between roughly 50 and 20 meters below present, a much broader plain would have extended eastward towards Santa Rosa Island, but coastal habitats would never have been more than about a kilometer distant to the south.

After the discovery of the Tuqan chert source in 2005, we first carefully examined these three lithic sites. They are remarkable, in part, because of the large number of biface fragments found on their eroded surfaces. This is similar to some sites of the western Santa Barbara Coast (especially the Vandenberg area), where local sources of Monterey chert are also available. At Cardwell Bluffs, the bifaces (most of them broken) range from crude preforms to finished projectile points, the latter including several crescents (Erlandson and Braje 2008b; Erlandson, Braje, and Snitker 2008), as well as small stemmed and barbed Arena points. These

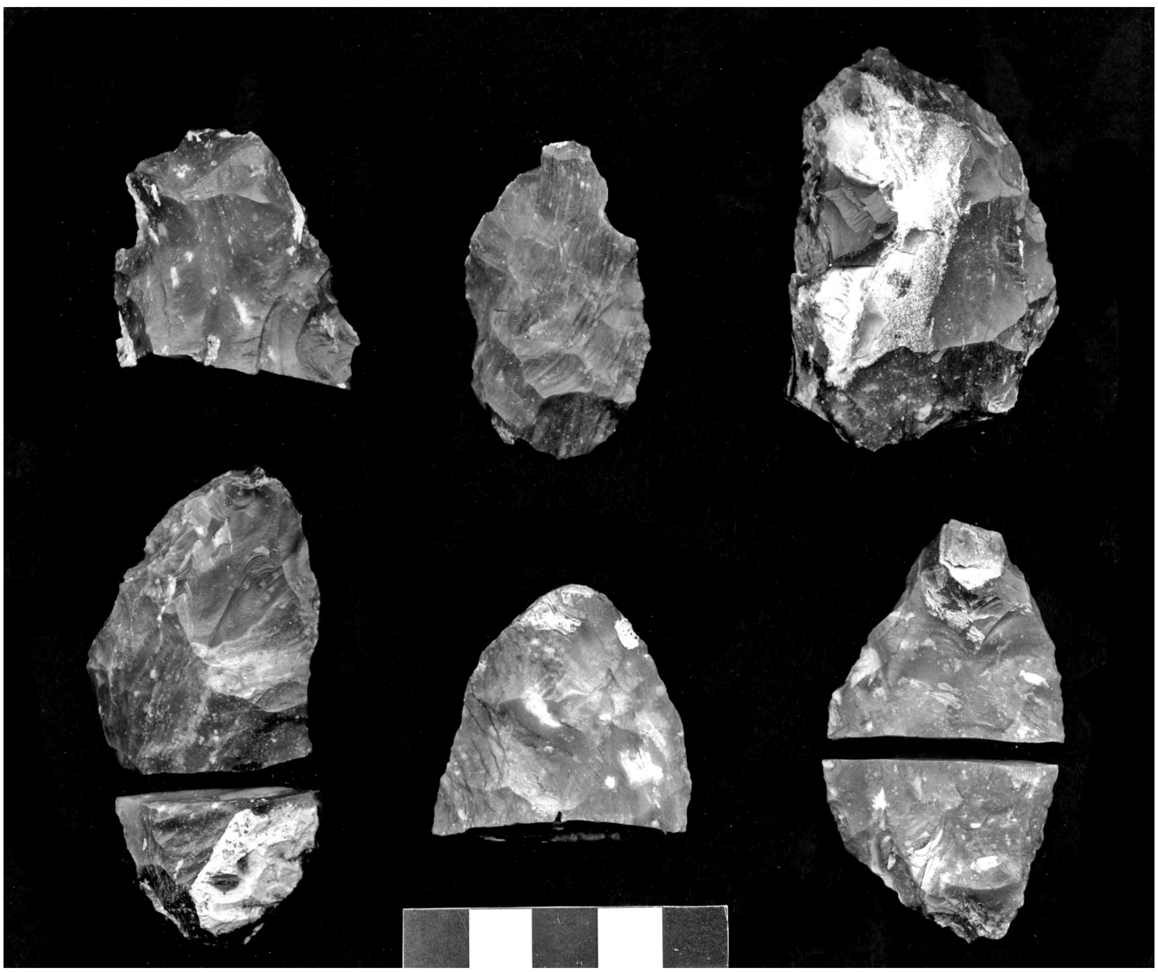

Fig. 4. Chipped stone bifaces from CA-SMI-679 made from Tuqan Monterey chert, including two refitted specimens (lower left and lower right). Scale shows centimeters. Photo taken by J. M. Erlandson.

two artifact types both appear to be diagnostic of Early Holocene assemblages. The debitage at the sites consists primarily of large flake debris, biface reduction flakes, and the products of cobble core reduction. The cortical flakes observed have the distinctive cortex typical of Tuqan Monterey chert cobbles.

The Cardwell Bluff lithic sites are also distinctive in containing very little marine shell, although where present, the shell tends to be relatively well-preserved. So far, they have produced no ground stone tools, no burned rock, and very few drills, reamers, or other flake tools more typical of large residential sites. The finished projectile points that have been found are almost all broken, including many basal fragments that appear to have been broken during use, and later replaced on site during routine maintenance and retooling activities. These characteristics, along with a lack of clear indicators of later site use, suggest that the Cardwell Bluff lithic sites were used primarily by Early Holocene peoples during quarry/workshop activities associated with the production of stone tools and the retooling of spent projectile points. A recently obtained radiocarbon date for a red abalone shell embedded in one loci at CA-SMI-678 suggests that the use of Tuqan chert may extend back to the terminal Pleistocene, as much as 11,600 calendar years ago.

The presence of what appears to be an early biface industry on San Miguel Island, along with knowledge that high-quality sources of Monterey chert were locally available to early Channel Islanders, may alter notions of the permanence of early human occupation of the island. It helps explain the dominance of Monterey chert in the Early Holocene levels of Daisy Cave, no longer requiring regular cross-channel trade or travel by the Paleocoastal peoples who occupied the site. This increases the chance that the numerous Early Holocene (~10,000 to 8,000 years old) sites identified on San Miguel Island were occupied by a permanent residential population rather than transient groups visiting the island occasionally from their homes on the mainland or the larger Channel Islands (Kennett 2005:128).

Summary and Conclusions

At Cardwell Bluffs on eastern San Miguel Island, our documentation of a geological source of high-quality Monterey chert cobbles provides important new data on the availability of economically and technologically important mineral resources on the Northern Channel Islands. Artifacts made from Tuqan chert cobbles have now been recognized in San Miguel archaeological sites dating to throughout the Holocene—and possibly the terminal Pleistocene—suggesting that such chert was widely and intensively used by island residents for millennia. As is nearly always the case, however, our discovery raises new questions that have yet to be resolved. Are there additional geological outcrops of Tuqan chert elsewhere on San Miguel, Santa Rosa, or the other Channel Islands? If not, how widely are artifacts made from Tuqan cherts distributed on the islands? Were bifaces or other artifacts made from such cherts traded to other island or mainland groups? If so, when did such trade take place and what role (if any) did it play in the development of intensive Chumash exchange and craft specialization in the Santa Barbara Channel area during the Late Holocene?

Answering such questions is complicated by the fact that the macroscopic appearance of many artifacts made from Tuqan cherts is similar or identical to mainland Monterey chert varieties generally identified by archaeologists as coming from western Santa Barbara County (e.g., the Vandenberg area). Further study is needed to determine whether these similar island and mainland varieties of Monterey chert can be distinguished macroscopically, microscopically, or geochemically—especially when cobble cortex is not present. Until such studies can be completed, the visual overlap between many artifacts made from mainland and Tuqan Monterey cherts, as well as some Cico and Santa Cruz Island cherts, suggests that archaeologists working on the Channel Islands and in the larger Santa Barbara Channel area need to be cautious in identifying the sources of many chert artifacts and in reconstructing ancient exchange and travel patterns.

If we can no longer assume that Channel Island artifacts made from ‘mainland’ Monterey chert types originated from mainland sources, we also cannot conclude that all such artifacts came from the Tuqan source at Cardwell Bluffs. There are similar bluffs and raised marine terraces on the west end of Santa Rosa Island that may contain similar cobbles, for instance, especially given the fact that the predominant wind and wave patterns in the area are from northwest to southeast.

Despite the presence of local Monterey cherts on San Miguel Island, it also seems likely that some Monterey chert artifacts found on San Miguel and the other Northern Channel Islands were made from mainland cherts—just as artifacts made from obsidian, fused shale, and Franciscan chert are found on the islands. This is true for CA-SMI-87 a Late Holocene site in Cuyler Harbor. This site contains numerous bifaces made from Monterey chert, some of which contain the thin cortex found on Tuqan chert cobbles, while others may have been obtained from mainland or other sources (Rick 2007). Some artifacts made from Tuqan chert undoubtedly made it to the mainland, as well, just as a few tools made from distinctive Cico chert were identified in Tecolote Canyon assemblages from the western Santa Barbara Coast (Erlandson, Rick, and Vellanoweth 2008). These data also demonstrate the importance of searching for additional raw material sources on the islands, and remaining conservative in our determination of raw material origins until more detailed surveys are conducted. This is particularly true since cursory studies have identified a chalcedony source at Frenchys Cove on Anacapa Island (Rick 2006:70), and other chert sources have recently been identified on Santa Rosa Island.

As archaeological models of resource use, manufacturing processes, exchange, and cultural complexity become increasingly sophisticated, knowledge about the spatial distribution of raw material sources must keep pace. Without such detailed geological data for the broader Santa Barbara Channel region, we cannot hope to understand the full complexity of economic and sociopolitical relationships among the Chumash and their neighbors. That we still don’t fully understand the natural distribution of important raw materials within Chumash territory—one of the more intensively studied areas along the Pacific Coast of North America—suggests that such cautionary tales apply to the entire Pacific Coast region and adjacent interior regions as well.

In coastal areas, we must also give some consideration to the potential distribution of mineral and other resources on the lowland landscapes submerged by rising postglacial sea levels. Before we can translate such knowledge into a deeper and more detailed understanding of resource procurement, production, and exchange patterns in the past, we also need to develop more effective protocols to differentiate artifacts made from similar materials but separate sources, including those made from Tuqan and mainland Monterey chert varieties.

Acknowledgements

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