

A NEWLY DESCRIBED SPECIES OF *ARCTOSTAPHYLOS* (ERICACEAE) FROM
THE CENTRAL CALIFORNIA COAST

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ABSTRACT

A newly described local endemic species, *Arctostaphylos ohloneana* M.C. Vasey and V.T. Parker, is found scattered within populations of another geographically restricted manzanita species, *Arctostaphylos glutinosa* Schreiber, from the “Lockheed Chalks” area on siliceous shale ridges, northern Ben Lomond Mountain, western Santa Cruz County. This species is found in at least four scattered occurrences within the distribution of *A. glutinosa* on private property owned by the Lockheed Martin Corporation at the end of Empire Grade Road. *Arctostaphylos ohloneana* superficially resembles *A. pungens* and *A. manzanita*, but it presents distinctive characters that separate it from these two species. Unlike the tetraploid *A. manzanita*, *A. ohloneana* is diploid, and it lacks the distinctive nascent inflorescence of *A. pungens*. Since neither *A. pungens* nor *A. manzanita* occurs in the Santa Cruz Mountains, *A. ohloneana* is all the more remarkable by virtue of its distinctiveness compared to other nearby species.

Key Words: *Arctostaphylos*, *Arctostaphylos ohloneana*, central California coast, endemism, Ohlone manzanita, Santa Cruz Mountains.

During the past 150-plus years, over 100 taxa in the shrubby genus *Arctostaphylos* have been recognized by a wide array of authors ranging from *Arctostaphylos uva-ursi* (L.) Spreng. originally described by Linnaeus in 1700 to recent descriptions of new species, *Arctostaphylos gabilanensis* V.T. Parker and M.C. Vasey (Parker and Vasey 2004) and other new taxa (Keeley et al. 2007; Parker et al. 2007). The vast majority of manzanita taxa (~93%) are situated in California (Markos et al. 1999; Wells 2000; Boykin et al. 2005) where they exhibit an array of different habits (prostrate to arborescent shrubs) and occupy a wide diversity of habitats on nutrient-limited soils that are distributed in many different geographic settings. Although *Arctostaphylos* fossils date back to the middle Miocene (Stebbins and Major 1965; Raven and Axelrod 1978; Edwards 2004), diversification within *Arctostaphylos* is hypothesized to have occurred in the relatively recent past (Stebbins 1971; Raven and Axelrod 1978), perhaps as recently as the latest Pleistocene and Holocene. Various processes have most likely interacted in driving this remarkable radiation. Recent climate fluctuations (Raven and Axelrod 1978), intensifying fire regimes, evolution of the obligate seeder life history (Wells 1969; Keeley and Zedler 1978; Parker and Kelly 1989), and hybridization

between species are likely to have played significant roles (Wells 2000). Concentrations of manzanita endemism along the summer fog-moderated California coast (Cody 1986; Keeley 1992) suggest that a favorable water-energy balance may also be important (Richerson and Lum 1980; O'Brien 1998; Francis and Currie 2003). In this paper, we recognize a local endemic *Arctostaphylos* species from a fog-influenced coastal area in the Santa Cruz Mountains.

THE OHLONE MANZANITA

In the late 1980s, Randy Morgan, a consulting biologist, discovered an undescribed manzanita while surveying a unique area of private property owned by the Lockheed Corporation called the “Lockheed Chalks” located at the end of Empire Grade Road about 3 km southwest of Eagle Rock on Ben Lomond Mountain in western Santa Cruz County (Fig. 1). The property encompasses several hundred acres of siliceous shale ridges that constitute the watershed divide between the Scott Creek, Mill Creek, and Boyer Creek drainages that lead into the nearby Pacific Ocean approximately 6 km away. Ridgecrests at the Lockheed Chalks are dominated by a knobcone pine-maritime chaparral community that grades into redwood-tan oak forest in the

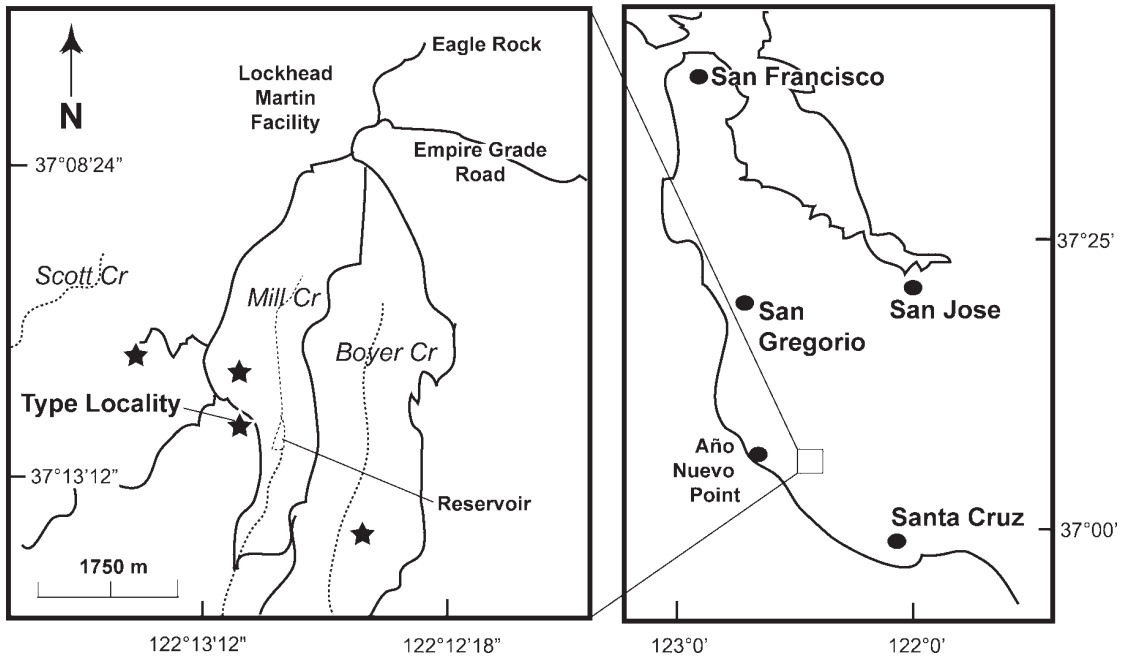


FIG. 1. Locations for four known occurrences of *Arctostaphylos ohloneana*. Total population is found within 4 km² area on private property owned by Lockheed Martin Corporation at the northern end of Ben Lomond Mountain on Monterey shale ridges that drain into the Scott Creek watershed. Populations are at an elevation of about 500 m within 6 km of the ocean.

upper arroyos (Fig. 2). The chaparral component of this area is rich in manzanita species, including *Arctostaphylos crustacea* Eastwood subsp. *crinita* (Gankin) V.T. Parker, M.C. Vasey, & J.E. Keeley, *A. andersonii* Gray, *A. sensitiva* Jepson, and the local endemic, *A. glutinosa* Schreiber. Morgan was surprised to find yet another manzanita mixed into this chaparral that is highly distinct from the other four taxa. As he continued his survey, he located two other small occurrences of the new manzanita in disjunct stands removed by several hundred meters from one another and well integrated into the local plant assemblage.

Although difficult to access, the Lockheed Chalks is well known to manzanita savants because it is the type locality of *Arctostaphylos glutinosa* Schreiber, originally described by Beryl O. Schreiber based on a visit to this site in 1939 during a Weislander Vegetation Type Map project field survey sponsored by the U.S. Forest Service (Schreiber 1940). Two original photographs of the site (#2145 and #2146) taken during this survey are available on-line at <http://www.lib.berkeley.edu/BIOS/vtm/search.html>. Although a small stand of *A. glutinosa* extends beyond the Lockheed property limits onto the Swanton Ranch west of Lockheed (Roy Buck and Jim West, personal communication), the vast majority of the population is confined to the

upland shale ridges encompassed by the Lockheed property.

Morgan contacted us to seek our interpretation of this manzanita. We were able to visit the Lockheed Chalks property on February 10, 1993. Morgan guided us to three local populations, and we examined individuals within these populations and, with the permission of Lockheed, made collections of flowering and vegetative material. Since our first visit, we have returned to this site on additional occasions to collect fruiting and nascent inflorescence material of *Arctostaphylos ohloneana*, to collect buds for chromosome analysis, to search for other populations, and to show the species to Jon Keeley, an *Arctostaphylos* expert from southern California. Keeley agreed that, despite the superficial similarity between the new manzanita and *A. pungens* Kunth., the distinctive nascent inflorescence character distinguishing *A. pungens* is absent in the new entity (Fig. 3).

Immature buds of the new manzanita were sent to Kristina Schierenbeck at California State University Chico for a chromosome determination. Schierenbeck got clear resolution for a chromosome count, which was determined to be $n = 13$, the diploid condition for *Arctostaphylos*. The diploid chromosome count further separates this entity from other similar species, such as the tetraploid *A. manzanita*, which occurs to the



FIG. 2. Habitat of *Arctostaphylos ohloneana* on siliceous-shales substrates in knobcone pine – maritime chaparral assemblage. Four other species of *Arctostaphylos* dominate this shrub matrix including *A. crustacea* subsp. *crinita*, *A. sensitiva*, *A. glutinosa*, and *A. andersonii*.

interior in the Diablo Range, and north into the North Coast Ranges, considerably distant from the *A. ohloneana* population. Further, molecular analysis demonstrates that *A. ohloneana* has a distinctive ITS sequence that puts it in the smaller of two ITS clades (Boykin et al. 2005; Wahlert 2005). We are still investigating candidate species that are likely to be the closest living relatives to *A. ohloneana*, but our preliminary view is that *A. ohloneana* most likely represents a paleoendemic species that has been able to persist in the nutrient-poor Monterey shale barrens of northern Ben Lomond Mountain.

Despite searches in the surrounding region, we have not been able to locate any other populations of *A. ohloneana* other than one additional occurrence on Lockheed Chalks property bringing the total number of occurrences to four (Fig. 1). Although relatively few in estimated number (ca. 100 individuals), *A. ohloneana* is variable in leaf size and habit, suggesting the possibility of limited hybridization with adjacent taxa. Surprisingly, Schreiber, the botanist with the Vegetation Type Map project who described *A. glutinosa*, did not notice this new manzanita while sampling this area in 1939. On the other hand, *A. glutinosa* individuals are far more abundant than the new manzanita, and it is conceivable that Schreiber would not have

discovered the much rarer new manzanita if it were roughly as abundant throughout the Lockheed Chalks property in the late 1930's as it is today (particularly since it tends to be located down slope rather on the ridge crests). Accordingly, on the basis of its distinctiveness, we are recognizing the new manzanita from the Lockheed Chalks as *Arctostaphylos ohloneana* M.C. Vasey and V.T. Parker.

TAXONOMIC TREATMENT OF *ARCTOSTAPHYLOS OHLONEANA*

Arctostaphylos ohloneana M.C. Vasey and V.T. Parker, sp. nov. – TYPE: USA, California, Santa Cruz County, northern Ben Lomond Mountain, siliceous shale ridges located on slopes above Mill Creek drainage as part of the Lockheed Martin missile test site facility; 37°07'09.65"N, 122°13'02.55" W, 515 m; February 10, 1993, *Michael Vasey and Thomas Parker 0111* (holotype CAS; isotypes UC and SFSU). Additional small populations occur at 37°06'56.50" N, 122°12'31.82" W, 500 m, 37°07'20.18" N, 122°13'06.76" W, 528 m, and 37°05'59.5" N, 122°12'05.6", 451 m. Maritime chaparral associates include *A. crustacea*, *A. sensitiva*, *Adenostoma fasciculata*, *Ceanothus cuneatus*, *Vaccinium ovatum*, *Pinus attenuata*.

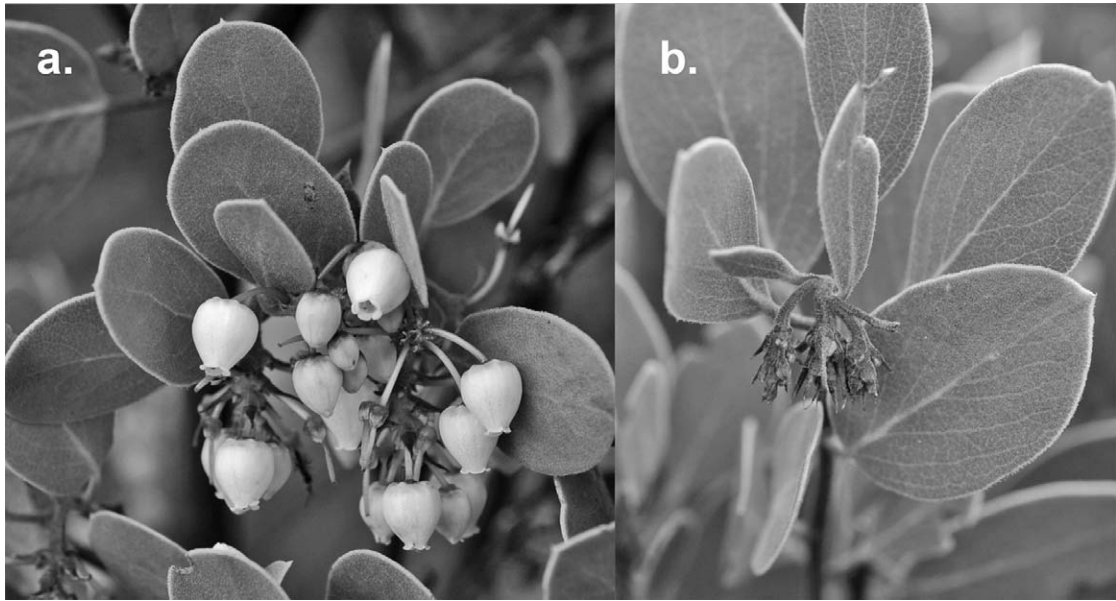


FIG. 3. *Arctostaphylos ohloneana* in flower (a.) and with immature inflorescence (b.). Note the paniculate immature inflorescence, the round-ovate leaves, glabrous pedicels, and scale-like bracts. Leaves are green with stomata equally distributed on both leaf surfaces. Not shown are occasional long gland-tipped hairs found on twigs that are otherwise covered by short, dense hairs.

Frutex erectus, 2–3 m. altus; lignotuber absens; ramorum cortex levis, ruber; ramulorum trichomata densa, brevia, et trichomatibus sparsa, longa, glanduliferis; laminis foliorum late ellipticis vel ovatus, circa 3 cm longis, 1–1.5 cm latis, viridis, stomatibus aequalibus supra et infra, apice plerumque mucronatis; inflorescentia paniculata plerumque 3–5 ramosa, laxa, pedunculus planus, bracteae deltoideae, apiculus marcescens, trichomatibus glanduliferis; pedicelli glabrescens, corolla alba vel roseo-alba; ovarium glabrum; fructus depressus-globosus, 5–8 mm diametro, glaber, aurantiaco-ferrugineus; pyrenae librae.

Erect to spreading shrub, 1–2 m high; *stems* with burl absent; bark red-brown, smooth; *twigs* covered in short, dense non-glandular hairs often with occasional long, gland-tipped hairs; *leaves* green, surfaces alike, stomata equally dense on both surfaces, leaf surfaces sparsely short pubescent; ca. 3 cm long, 1–1.5 cm wide, elliptic to round-ovate in shape, tips mucronate, base rounded; petioles prominent, ca. 5 mm long; *immature inflorescence* 3–5 branched open panicle with somewhat flattened peduncles supporting terminal clusters of buds subtended by scale-like, appressed to mildly spreading, awl-shaped, marcescent bracts 1–2 mm long; bracts sparsely ciliate with some gland-tipped hairs; *flowers* conical-urceolate, whitish-pink supported by glabrous pedicels; ovary glabrate, base of anther filaments glabrous; *fruit* depressed-globose, reddish-brown, 5–8 mm wide, pyrenes separable; n=13 (per K. Schierenbeck).

The specific epithet honors people of Native American Ohlone ancestry who occupied the Santa Cruz Mountains before European colonization. We also honor the memory of C.H. Merriam, a pioneering ecologist who defied the nomenclatural tradition of his time by naming two species of manzanitas, *A. mewukka* and *A. nissenana*, in honor of Native American people he observed during his travels in the late 1800's.

Table 1 provides a comparison of *A. ohloneana* morphology with three species to which it has been tentatively assigned in the past. Note that *A. ohloneana* is somewhat intermediate between *A. manzanita* C. Parry (a widespread arborescent shrub of the inner northern California coast range and Sierra Nevada foothills) and *A. pungens* (a widespread multi-stemmed shrub of the interior mountains of southern California, Arizona, Baja California, and mainland Mexico). It is quite different from the nearby *A. hookeri* G. Don in southern Santa Cruz and northern Monterey. Morphologically, *A. ohloneana* is more similar to *A. manzanita* than *A. pungens*, particularly in terms of its leaves, immature inflorescence and bracts. A unique character for *A. ohloneana* is the occasional long gland-tipped hairs that typically are found intermixed with short dense hairs on its twigs.

Given the richly diverse assemblage of *Arctostaphylos* taxa that occur in the Santa Cruz Mountains south of the San Gregorio watershed (central and southern region), we provide a key to the manzanitas of this subregion that includes *A.*

TABLE 1. Comparison between *Arctostaphylos ohloneana* and three representative species with similar morphology.

	<i>A. ohloneana</i>	<i>A. manzanita</i> subsp. <i>manzanita</i>	<i>A. hookeri</i> subsp. <i>hookeri</i>	<i>A. pungens</i>
Ploidy	diploid	tetraploid	diploid	diploid
Twig hairs	occasional gland-tipped hairs	no glandular hairs	no glandular hairs	no glandular hairs
Leaf Hue	green	green	bright green	green
Leaf Length	3–4 cm	3–5 cm	2–3 cm	1.5–4 cm
Leaf Shape	elliptic to round ovate	ovate to obovate	elliptic	elliptic
Immature Inflorescence	panicle 3–5 branch	panicle 5–7 branch	raceme-1 branch	raceme-1 branch
Floral Bracts	appressed to spreading, awl-tipped scales	appressed, keeled scales	spreading, awl-tipped scales	recurved, awl-tipped scales
Fruit width	8–10 mm	8–12 mm	4–6 mm	5–8 mm

ohloneana and illustrates its distinctiveness compared to other nearby *Arctostaphylos* taxa. The geographic area covered is approximately 1000 square miles (2590 km²). Note that this relatively

small area includes twelve taxa of which five are local endemics. Nomenclature follows the new treatment of *Arctostaphylos* prepared for the 2nd Edition of the Jepson Manual.

KEY TO *ARCTOSTAPHYLOS* IN THE CENTRAL AND SOUTHERN SANTA CRUZ MOUNTAINS

1. Plants with burls or woody platforms, usually resprouting after a fire.
 2. Leaves with upper and lower surfaces appearing different in color, hairiness, and stomatal distribution; twigs typically with long stiff hairs and short dense tomentum.
 3. Lower leaf surfaces glabrous or sparsely hairy *A. crustacea* Eastw. (Widespread member of chamise chaparral in the interior uplands on the east side of the range from Castle Rock Ridge to Mt. Madonna) (Thomas 1961).
 - 3' Lower leaf surfaces densely hairy, sometimes also upper leaf surfaces although less so (as on Ice Cream Grade). *A. crustacea* subsp. *crinita* V.T. Parker, M.C. Vasey, J.E. Keeley (Locally abundant in maritime chaparral on coastal uplands on west side of range from Butano Ridge south to hills near Soquel).
 - 2' Leaves with upper and lower surfaces essentially alike, similar in color and hairiness, with at least half as many stomata above as below; twigs short-hairy but lacking long stiff hairs *A. glandulosa* Eastw. subsp. *cushingiana* Eastw. (Individuals from near the summit of Loma Prieta Peak may key to this subspecies. Generally, *A. glandulosa* is not found in the Santa Cruz Mountains).
- 1' Plants lacking burls or woody platforms, not sprouting after fire.
 4. Plants with grey-hued leaves.
 5. Leaves smooth and waxy, lacking hairs on either surface; fruits spheric with pyrenes fused into a solid stone *A. glauca* Lindley (serpentine chaparral on southern and eastern interior foothills of range).
 - 5' Leaves hairy on both surfaces, often densely; fruits depressed-spheric with pyrenes separable.
 6. Leaf bases deeply lobed, apparently clasping twigs, twig and inflorescence hairs long and tipped with glands. *A. glutinosa* Schreiber (Local maritime chaparral endemic of Lockheed Chalks growing on silicious shales on northern end of Ben Lomond Mountain).
 - 6' Leaf bases rounded to cuneate, not deeply lobed, lacking long glandular hairs.
 7. Ovaries and fruits lacking hairs *A. silvicola* Jeps. and Weisl. (Local endemic of maritime chaparral on 'sand hill' Santa Margarita sandstone formation in the southern part of range from Bonnie Doon to Felton).
 - 7' Ovaries and fruits densely hairy.
 8. Hairs on pedicels and ovaries lacking glands *A. canescens* Eastw. (Southern disjunct population in chaparral along granite ridges between Loma Prieta and Mount Madonna).
 - 8' Hairs on pedicels and ovaries tipped with glands. *A. canescens* subsp. *sonomensis* (Eastw.) Wells (Several individuals of this subspecies were found intermixed with main population along Summit Road in southern range near Loma Prieta Peak).
 - 4' Plants with green-hued leaves.
 9. Leaves with distinct basal lobes, +/- clasping twigs, petioles obscure, leaves oblong in shape, ca. 4–7 cm long *A. andersonii* Gray (Tall shrub to small tree in chaparral, often at forest edges, local endemic of central and southern Santa Cruz Mountains, mostly in redwood zone).
 - 9' Leaves with truncate or rounded base, petioles obvious, leaves oblanceolate, elliptic, or oval in shape, less than 3 cm long.
 10. Leaves with upper and lower surfaces different, dark green above, light green below, stomata lacking on upper surface, flower parts (calyx and corolla) 4-merous.

- *A. sensitiva* Jeps. (In maritime chaparral on uplands near the coast in a variety of soil types, from Butano Ridge to Mount Herman).
- 10' Leaves with stomata distributed equally on both leaf surfaces, leaf-hue similar on each surface, flower parts (calyx and corolla) 5-merous.
11. Immature inflorescence generally a compact, globose raceme terminated by a cluster of acuminate, spreading bracts; leaves bright green and lustrous; twigs lacking any long, glandular hairs *A. hookeri* G. Don (A Monterey Bay maritime chaparral endemic, found in the Santa Cruz Mountains only in the southwestern coastal foothills near Soquel, ranging farther south in low hills to Carmel Bay).
- 11' Immature inflorescence a 3–5 branched open panicle with somewhat flattened peduncles supporting terminal clusters of buds subtended by scale-like, appressed, awl-shaped bracts; leaves dull green, not lustrous; twigs with occasional long gland-tipped hairs *A. ohloneana* M.C. Vasey and V. T. Parker (Local endemic of the coastal Lockheed Chalks in knobcone pine-maritime chaparral at the northern end of Ben Lomond Mountain, western Santa Cruz Mountains).

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