

## *Caloplaca obamae*, a new species from Santa Rosa Island, California

KERRY KNUDSEN<sup>1</sup>

**ABSTRACT.** – *Caloplaca obamae*, a sterile terricolous species is described. The species has a well developed hypothallus of rhizohyphae and discreet patches of orange granules mostly 30–50 µm in diameter, usually coalesced and adhering to one another. It appears to be endemic to the Pleistocene marine terraces on the north side of Santa Rosa Island in California.

**KEYWORDS.** – Biological crusts, Channel Islands, Channel Islands National Park, grazing, Obama, restoration.

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### INTRODUCTION

The north Channel Islands of California (Anacapa, Santa Cruz, San Miguel, and Santa Rosa) support a diverse lichen biota of over four hundred species (Knudsen, unpublished data). The genus *Caloplaca* is represented by at least 27 taxa (Wetmore 2007) of which 24 have been collected on Santa Rosa Island (Knudsen, unpublished data). During a continuing floristic survey of Santa Rosa Island a new *Caloplaca* species was collected on soil, growing alone or in biological crusts at seven sites on Pleistocene marine terraces. This taxon is described here as *Caloplaca obamae*. The species is of particular ecological interest in the context of the management and restoration of Santa Rosa Island because it belongs to a community of organisms that has suffered significant degradation on the Channel Islands as a result of the introduction of non-native animals, particularly cattle, deer and elk.

### METHODS

Specimens were studied using hand sections with standard light microscopy. Measurements of anatomical characters are based on water mounts prior to the application of (10% KOH, or I for structural study). Brilliant cresyl blue (Bcr) was used to stain structures. Several specimens were studied dry using a Baush & Lomb StereoZoom 7 dissecting microscope and images were captured using a Nikon CoolPix990 digital camera. Illustrations were prepared using Adobe Photoshop.

### THE NEW SPECIES

#### *Caloplaca obamae* K. Knudsen sp. nov.

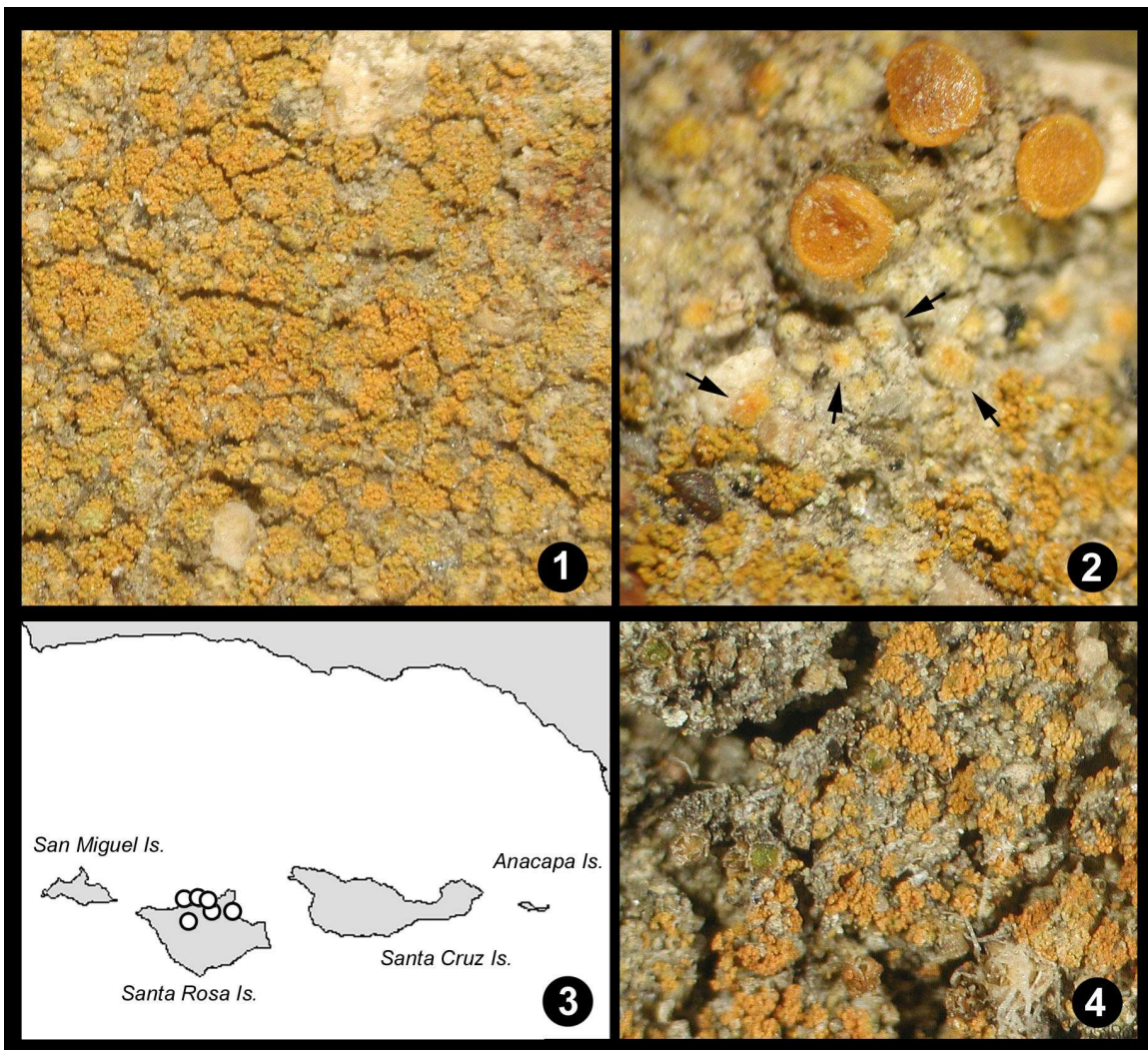
MYCOBANK #512895.

Thallus terricola, granulis aurantiacis, 30–50 µm latis compositis.

**TYPE: U.S.A. CALIFORNIA.** SANTA BARBARA CO.: Santa Rosa Island, Channel Islands National Park, on alluvial bench just above bottom of Soledad Canyon, near crossing of Smith Highway, 33°59'12"N, 120°08'20"W, 96 m, on soil with *Leprocaulon microscopium* and probably *Caloplaca ludificans*, 23.x.2008, K. Knudsen 10545 w/ S. Chaney & K. Niessen (UCR, holotype; PRM, isotype).

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<sup>1</sup>KERRY KNUDSEN – The Herbarium, Dept. of Botany and Plant Sciences, University of California at Riverside, Riverside, CA, 92521-0124, U.S.A. – e-mail: kk999@msn.com



**Plate 1.** *Caloplaca obamae*. Figure 1, aspect of thallus on loosely consolidated soil (*Knudsen 10572*, NY, x10). Figure 2, detail of apothecia and apothecia initials (arrows), probably of *C. ludificans*, rarely found intermixed with *C. obamae* (*Knudsen 10547*, NY, x15). Figure 3, known geographic distribution of *C. obamae*. Figure 4, aspect of thallus on well consolidated soil (*Knudsen 10568*, NY, x10).

**DESCRIPTION.** – *Thallus* thin chasmolithic crust, often unapparent, verruculose, with thin whitish to hyaline phenocortex, not forming areoles or squamules, with abundant discreet patches of orange granules, 0.2–1 mm in diam., covering areas up to 6–7 cm, sometimes intermixed with other terricolous lichens and bryophytes in biological soil crusts. *Granules* orange, mostly 30–50  $\mu\text{m}$  in diam., usually coalesced and adhering to one another, K+ purple, C–, paraplectenchymatous cortex around an algal core, 1–4 layers thick, cells mostly 2–3  $\mu\text{m}$  in diam., without any projecting hyphae. *Algal layer* a discontinuous thin stratum, usually 50–100  $\mu\text{m}$  thick, well-developed beneath patches of granules, but usually lacking between the patches of granules. *Hypothallus* stabilizing the substrate with a rhizohyphal weft, with hyaline rhizohyphae 1–2  $\mu\text{m}$  thick, apparently with a few longer hyaline rhizines 3–4.5  $\mu\text{m}$  thick, mixed with soil fungi and bacteria and becoming gelatinized.

Among the sterile thalli of *C. obamae* small patches of apothecia and pycnidia are rarely found. These are described below but not included in the diagnosis (above). They may belong to *C. obamae*, but probably belong to *C. ludificans* Arup, which is common on Santa Rosa Island and can grow on soil.

*Apothecia* 0.2–0.4 mm in diam., lacking a thalline margin. *Proper margin* orange, slightly elevated above the disc, epruinose, of radiating thin-walled, short-celled hyphae, 50–70  $\mu\text{m}$  wide, K+ purple, C–. *Disc* orange, usually slightly paler than margin, rough, epruinose, K+ purple, C–. *Epihymenium* yellow–orange, granular interspersed; *hymenium* hyaline, 50–100  $\mu\text{m}$  thick; *paraphyses* mostly 2  $\mu\text{m}$  thick, no branching observed, apices expanded to up to 4  $\mu\text{m}$  wide; *hypothecium* 20–30  $\mu\text{m}$  wide. *Asci* 40–50 x 10–17  $\mu\text{m}$ . *Ascospores* (14.1)–14.9–(15.6) x (4.9)–5.4–(5.9)  $\mu\text{m}$  ( $n=14$ , average  $\pm$  SD), septum 2–4  $\mu\text{m}$  wide. *Pycnidia* rare, immersed, orange; *conidia* bacilliform to narrowly ellipsoid, 2.0–3.5 x 1.0–1.5  $\mu\text{m}$ .

ETYMOLOGY. – The species is named in honor of Barack Obama, President of the United States. The final collections of this species were made during the suspenseful final weeks of Obama’s campaign for president and this paper was written during the international jubilation over his election. The final draft was completed on the day of his inauguration. He is honored for his support of science and scientific education.

ECOLOGY AND DISTRIBUTION. – *Caloplaca obamae* occurs on soil on Pleistocene marine terraces and benches in associated canyons on the north side of the Santa Rosa Fault, from the bluffs of Vail Ranch on Beecher Bay to Soledad Canyon, except in the stabilized dune fields of Carrington Point. This whole area has been heavily grazed for over a hundred years and supports mostly disturbed grassland. *Caloplaca obamae* is easily disturbed if stepped on, but its asexual propagules of small granules as well as hypothallus can probably readily reestablish the species. Cattle grazing only ceased in 1998 on Santa Rosa Island. Game deer and elk still roam the island grazing and will not be removed until 2011. It is expected that *C. obamae* will make a vigorous comeback in the next fifty years on the marine terraces of Santa Rosa Island with the end of grazing and reestablishment of the native vascular flora. Though generally collected alone, one biological crust examined on Brockway Point suggests that *C. obamae* and *Endocarpon pusillum* Hedw. would be important and vigorous components in the natural restoration of biological crusts.

*Caloplaca obamae* has not yet been collected on the mainland of California or on the other Channel Islands. Like many terricolous crusts in southern California it may be rare because of human development of suitable habitats, as well as habitat degradation from invasive weeds and regular soil disturbance by human usage or animals.

DISCUSSION. – Lacking an areolate crust and forming granules, *Caloplaca obamae* differs from two sorediate species that occur on soil in western North America and Europe, *C. citrina* (Hoffm.) H. Olivier and *C. tominii* (Savicz) Ahlner (Arup 1993, 2006; Wetmore 2001). Neither species has been reported on soil from the Channel Islands. *Caloplaca citrina* is common on wood, bark and rock, and may include several taxa, but is rarely found on soil in western North America (Arup 1993, Wetmore 2007). *Caloplaca tominii* has not yet been collected in southern California and occurs exclusively on soil (Wetmore 2007). Both species differ from *C. obamae* in having corticate areoles, rather than a chasmolithic non–areolate thallus with a well–developed hypothallus of rhizohyphae, and in producing soredia rather than having granules.

Though rock was abundant at several sites where *C. obamae* occurs, it was not found on rock. Considering that the current populations are probably relictual, rock would have been a perfect substrate to persist on during the disturbance of soil habitats by grazing as some terricolous lichens are known to do such as *Aspicilia glaucopsina* (Nyl. ex Hasse) Hue and *Acarospora obpallens* (Nyl. ex Hasse) Zahlbr. that can occur on sandstone. But like *A. schleicheri* (Ach.) A. Massal. and *A. terricola* H. Magn., *C. obamae* does not appear to be adapted to rock substrates and produces an abundant hypothallus of rhizohyphae and rhizines as do other terricolous species of genera such as *Endocarpon* Hedw. and *Placidium* A. Massal. Though *C. obamae* grew in one specimen on some partially buried vegetative detritus, it was not found on the bark or wood of any coastal sage shrubs which occur at most of sites where *C. obamae* was collected.

*Caloplaca obamae* looks most similar to *C. xanthostigmoidea* (Räs.) Zahlbr. (syn. *C. epiphyta* Lygne) an areolate species with a circumpolar distribution in Japan, North America (largely north of the continental United States except for populations in the Appalachian Mountains), and northern Europe (Søchting & Tønsberg 1997, Wetmore 2001), which forms similar sized granules but is often abundantly fertile. It is usually corticolous although it also occurs on calcareous rock or soil and organic matter overlaying calcareous rocks. *Caloplaca obamae* of course differs from *C. xanthostigmoides* in not having areoles, in having a well developed hypothallus adapted to a terricolous habit, and in not being found on rock or on the bark of shrubs or trees. The marine terraces of Santa Rosa Island are formed mostly of a fine clay, derived partially from Monterey shale, or sand, and are not calcareous. *C. obamae* has not been

discovered on soils derived from caliche in the Sandy Point area of Santa Rosa Island, and it is has not been found on the similar calcareous soil of San Miguel Island.

In the specimens of *Caloplaca obamae* that were collected, apothecia (see figure 2) were rare and if present were generally limited to one or two except in the holotype. They are described above in case they belong to *C. obamae*, but probably belong to *C. ludificans*. It is more likely that *C. obamae* is completely sterile as it can easily propagate on the marine terraces without producing ascospores. The species is easily recognized in the field. The sterile orange patches of granules always form a discreet pattern.

No lichenicolous fungi were found on any specimens.

ADDITIONAL SPECIMENS EXAMINED (ALL PARATYPES). – U.S.A. CALIFORNIA. SANTA BARBARA CO.: Santa Rosa Island, Channel Islands National Park, bluff above ocean between Lobos Canyon and Cow Canyon, 34°01'05"N, 120°06'00"W, 54 m, 25.x.2008, *K. Knudsen 10568* (NY, UCR), *K. Knudsen 10572* (B, NY, UCR); bluffs west of Verde Canyon, 34°01'13"N, 120°07'11"W, 50 m, 19.viii.2007, *K. Knudsen 8911.2* (UCR); Vail Ranch, abandoned pasture near maritime bluff, 34°00'06"N, 120°03'01"W, 26 m, 17.viii.2007, *K. Knudsen 8808* (PRM, UCR); above Lobos Canyon along Smith Highway, 34°00'16"N, 120°05'25"W, 124 m, 24.x.2008, *K. Knudsen 10547*, *S. Chaney & K. Niessen* (NY, fertile; UCR, sterile); Brockway Point, 34°01'20"N, 120°08'45"W, 64 m, 24.x.2008, *K. Knudsen 10523* (PRM, UCR); gully between Dry Canyon and Verde Canyon, 33°59'48"N, 120°06'56"W, 124 m, 24.x.2008, *K. Knudsen 10529* (UCR).

#### ACKNOWLEDGEMENTS

I thank Ulf Arup and Jan Vondrák for reviewing this paper and for their valuable comments, very helpful to an author who usually works on Acarosporaceae. I thank James C. Lendemer for photographing specimens. I thank Kate Faulkner and Sarah Chaney of Channel Islands National Park for helping me in many ways. I thank Channel Islands National Park for financial support through a cooperative agreement between the National Park Service and the University of California at Riverside (UCR). I thank Dr. J. Giles Waines, director of the UCR Herbarium and the Botanic Garden, for his unfailing support of my research. I thank Jana Kocourková (PRM) for reading this manuscript before submission and for her valuable comments and discussion. I thank Harrie Sipman (B) for help with my poor Latin and his generous friendship.

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