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## Taxonomy and systematics

### A new species of *Eriogonum* (Polygonaceae) from the Cape region of the Baja California Peninsula, Mexico

### *Una especie nueva de Eriogonum (Polygonaceae) de la región de Los Cabos de la península de Baja California, México*

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#### Abstract

We describe and illustrate *Eriogonum calaverense*, a new species of Polygonaceae from the southern tip of the Baja California peninsula, Mexico. It is known only from the granitic rock crevices of Cerro de la Calavera, and others in the vicinity, in the southern Cape region mountains. This species is characterized by its suffrutescent habit, as well as by its densely tomentose indumentum, which on its leaves is manifested by different color shades on the upper and lower sides. We present a detailed botanical description, illustrations, and photographs of this new taxon. Since this species seems to be linked to special edaphic conditions, we provide some locations where it might also be found with additional field exploration. The exact taxonomic placement of this new taxon within the genus *Eriogonum* is still in question and future cytogenetic and molecular data might help to address this problem.

**Keywords:** Eriogonoideae; Baja California Sur; Cape region; Micro-endemism

#### Resumen

Describimos e ilustramos *Eriogonum calaverense*, una especie nueva de Polygonaceae del extremo sur de la península de Baja California, México. Crece solamente en las grietas de la roca granítica en el cerro de la Calavera y otros cerros aledaños, en las montañas sur de la región de Los Cabos. Esta especie se caracteriza por su hábito leñoso en la base, así como por su indumento densamente tomentoso, que en sus hojas se manifiestan en diferentes tonalidades en el haz y el envés. Se presentan la descripción, ilustraciones y fotografías detalladas. Debido a que este taxón nuevo parece estar vinculado a condiciones edáficas particulares, se presentan algunos sitios adicionales

donde podrían encontrarse más poblaciones con una mejor exploración de campo. La ubicación taxonómica exacta del nuevo taxón dentro de *Eriogonum* es todavía incierta y futuros datos citogenéticos y moleculares servirán para analizar este problema.

*Palabras clave:* Eriogonoideae; Baja California Sur; Región del Cabo; Microendemismo

## Introduction

*Eriogonum* Michaux (1803: 246) is one of the most diverse genera in the North American flora. With an estimated diversity of 250 species, plus ca. 200 varieties (Reveal, 2005), some authors consider the genus in an active process of speciation, mostly in arid and semi-arid habitats in the southwestern USA (Kempton, 2012; Grady & Reveal, 2011). Taxonomic specialists of the genus, such as Reveal (2005), also estimate that at least one third of the taxa are uncommon, narrow endemics or grow in impacted habitats, and are becoming rarer.

According to the floristic catalogue of Rebman et al. (2016), *Eriogonum* is one of the most diverse genera on the Baja California peninsula, with 53 taxa (including 14 infraspecific), of which 29 (54.7%) are endemic. The region that harbors most of the taxa is located in the extreme northwestern portion (30° N-31° N) of the peninsula, where a mediterranean-type climate prevails. This region represents an extension of the California Floristic Province and has vegetation of coastal sage scrub, chaparral, Sonoran Desert transition, as well as oak-conifer woodlands (Rebman et al., 2016). The diversity and distribution of the *Eriogonum* taxa on the peninsula gradually fades southward; thus, in the mid-peninsula (Vizcaino Desert, 27° N-28° N) only 8 *Eriogonum* taxa occur, 6 of them narrowly endemic. In continental Mexico, the diversity of *Eriogonum* is rather low, mostly occupying arid habitats along the central plateau (Reveal, 2005).

In 1981, Ann Zwinger, an American free-lance naturalist writer, explored the Cape region of Baja California Sur for natural history purposes (Zwinger, 1983). In early spring, when visiting the southern mountains of the Cape, she found a plant atypical for the region, with the characteristics of *Eriogonum*, of which a sample was collected (Zwinger 455) and deposited in the COCO herbarium in Colorado, USA (acronyms follow Thiers, 2019). This specimen was originally misidentified and labelled as *Eriogonum fasciculatum* Benth. var. *polifolium* (Benth.) Torr. & A. Gray (1870: 169), a well-known taxon from the northern part of the peninsula and southern California. Later, in 1999, the foremost taxonomic authority on the genus *Eriogonum*, Dr. James

L. Reveal, had the opportunity to review Zwinger's herbarium specimen, and handwrote "*Eriogonum* aff. *cinereum* Benth." (1844: 45) on the voucher. However, in 2012, after further inspection, Reveal considered the collection as a new species, and labeled the same voucher as "*Eriogonum grapheum* Reveal, ined.", the specimen was then taken and deposited at MO. Unfortunately, Dr. Reveal died in 2015 and, to the best of our knowledge, this new species was never formally described or published.

After receiving funding from the National Geographic Society's Committee for Research and Exploration to look for various "lost" plant species on the Baja California peninsula, we decided to seek out the locality referred to on Zwinger's specimen because it was the only known specimen of *Eriogonum* taxon in the region. We found the site and revisited it in order to get flowering and fruiting specimens for study. Thus, after careful inspection of the morphological characters and comparing it to other *Eriogonum* taxa in Mexico and in the USA, we believe this entity is different enough to warrant naming it as a new species. In this paper, we describe and illustrate this new taxon, and identify some other local mountain areas that might have similar microhabitat conditions where this rare species could occur.

## Materials and methods

The original population of this new taxon is found on Cerro de la Calavera, in the Cape region, at the southernmost part of the Baja California peninsula, in the Mexican state of Baja California Sur. This hill is a granitic monolith that lies 26 kilometers north of the city of Cabo San Lucas. It is part of a large batholith that makes up the rugged mountains of the Cape region, which includes vegetation with oak-pine woodlands at the highest elevations (1,000 to 2,100 m) and seasonal dry-tropical forest in the mid elevations (500-1,000 m) (León-de la Luz et al., 1989). Cerro de la Calavera is located at 23°06'58.07" N, 109°55'11.09" W and 1,093 m in elevation at its highest peak, making this area transitional between these 2 vegetation types (Fig. 1). A second population was recently discovered at Las Casitas mountain at 4.5 km from the former location, in the same edaphic conditions.

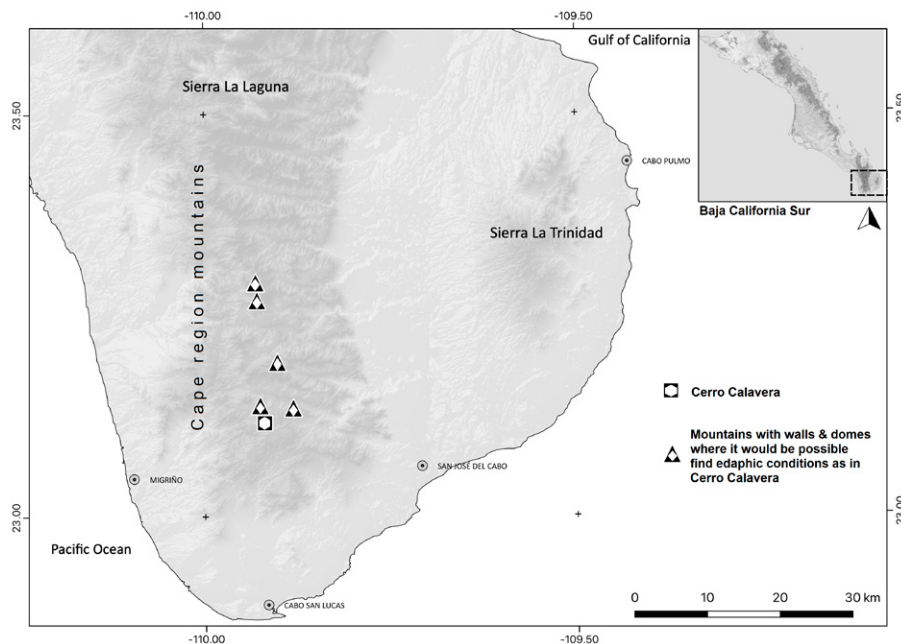


Figure 1. Geographical location of Cerro de la Calavera in the Cape region of the Baja California Peninsula, Mexico. The light gray area shows the Cape region mountainous topography. The symbols show the location of Cerro de la Calavera, and the regional exposed boulders above 800 m, as potential locations favorable for additional *Eriogonum calaverense* populations in the southern Cape mountains.

We visited Cerro de la Calavera in November 2017 in search of this species because it was previously known only from one specimen collection. At that time, we found a dozen sterile plants, but in April 2018, we visited the locality again and several of the plants were in full bloom, with others either not yet flowering or were starting to set fruit. To our knowledge, no specimens of any wild *Eriogonum* species have been documented south of 25.5° N on the Baja California peninsula except for Zwinger 455, and now our recent collections of this new taxon.

A careful examination of morphological characters was conducted based on the reproductive specimens. The morphology of this taxon was compared closely with *Eriogonum* taxa of the Vizcaíno region on the Baja California peninsula and southern California (Reveal 1975, 2005; Reveal & Hanson 1967; Shreve & Wiggins, 1964; Wiggins, 1980) as well as online image databases, particularly with 15 taxa with a distribution in mainland Mexico (BajaFlora, 2021; GBIF, 2021; NaturaLista, 2022). Measurements of vegetative structures were made from fresh material, and reproductive structures were measured either on dry or re-hydrated material from the herbarium.

Photographs were taken using a Stereo Stemi DV4 Spot microscope (Zeiss, Jena, Germany), and cameras Coolpix B500 (Nikon, Minato-ku, Tokyo, Japan) and PowerShot A650 IS (Canon, USA).

## Description

*Eriogonum calaverense* León de la Luz and Rebman sp. nov. (Figs. 2, 3)

**Diagnosis.** *Eriogonum calaverense* differs from *E. cinereum* from having only one involucre per node instead 3-10, as well as mostly 2 leaflike subtending bracts instead mostly 3, scalelike and triangular; also, by having quadrangular stems instead cylindrical, and finally by occupying mountain habitat linked to granitic rock crevices instead coastal environments.

Low, suffrutescent plants that form narrow subshrubs from a subterranean branched woody caudex or rootstock, inserted in granitic rocks crevices; branches short, up to 40 cm long, spreading to erect, indurate. Mature branches quadrangular in cross section. Leaves entire, somewhat persistent in the dry season, cauline in whorls of 2(3),

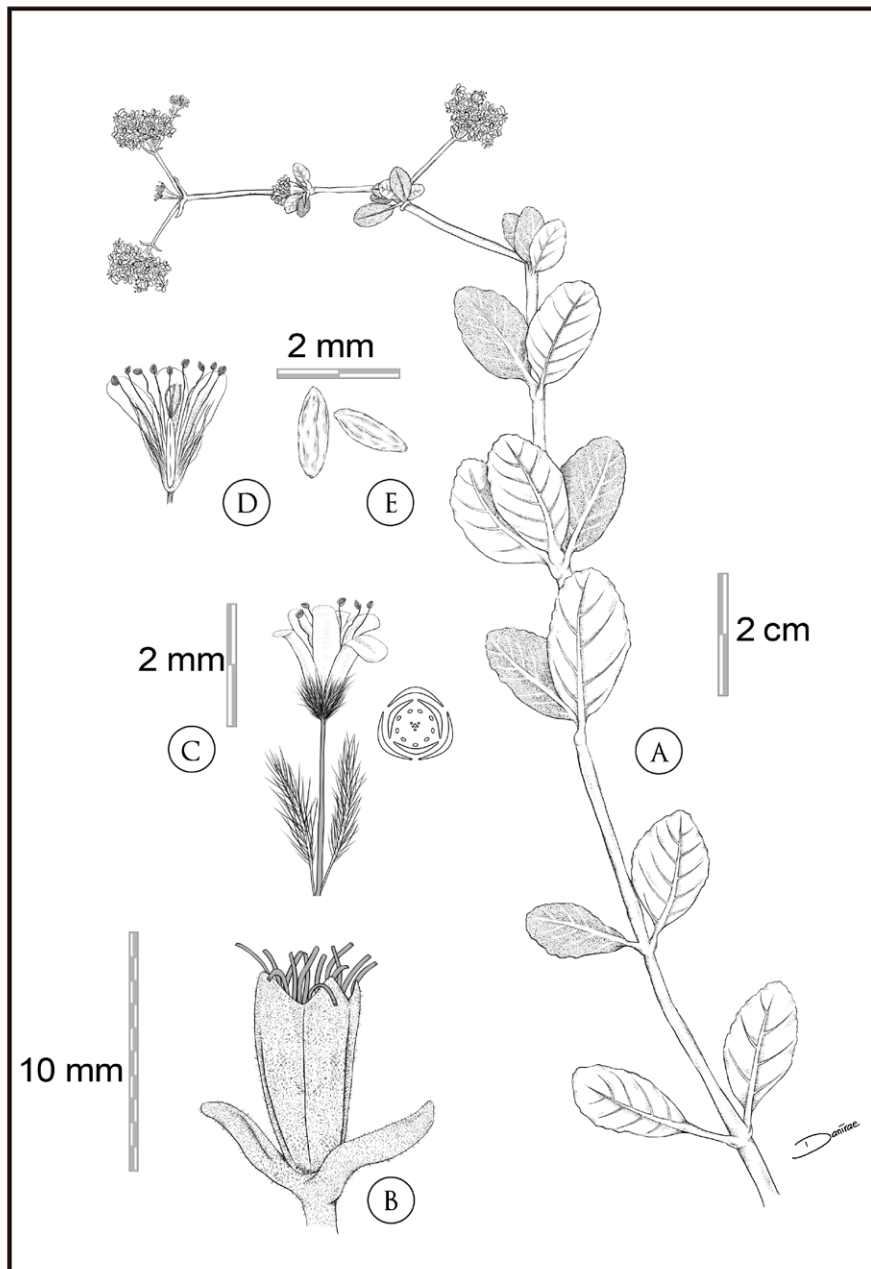


Figure 2. *Eriogonum calaverense* sp. nov. A, Flowering shoots with 2 and 3 whorled leaves per node, including inflorescences. Note the slightly bicolored leaves that are darker on the adaxial surface; B, detail of the sessile, ribbed, densely tomentose involucre that is subtended by 2 foliose bracts. Note that the pedicels exceed the involucre; C, flower, perianth of 6 monomorphic tepals in 2 whorls of 3 each; note the fine pilosity in the lanceolate bracts associated to the base of hypanthium and outer tepals; D, longitudinal section of the perianth showing the 9 stamens and pistile; E, detail of unwinged young achenes.

20-28 mm long x 10-14 mm wide, oblong to broadly elliptic; margin crenulate and undulate; apex retuse to obtuse; base slightly decurrent; petiole 4-6 mm long; venation simple, prominent; vestiture densely tomentose,

greenish adaxially and hoary-canescens abaxially, stipules absent. Flowering stems terminal, accrescent from 7 cm up to 10 cm long at fruiting, with 5-8 flowering nodes, the basal nodes with divergent flowering branching, the upper

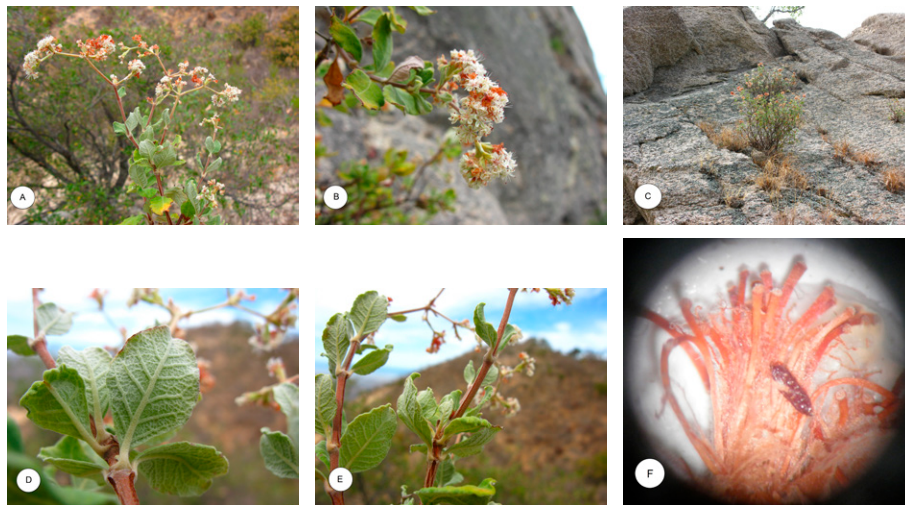


Figure 3. *Eriogonum calaverense* sp. nov. A, Flowering shoot growth pattern; B, close up picture of the flowers; C, plant growth form in a granitic rock crack; D, leaf abaxial surface showing prominent venation, the fascicle of 3 leaves sheathing the stem, and the fine and densely tomentose vestiture that covers leaves and reproductive surfaces; E, view of the quadrangular stems; F, immature achene inside an involucre, with numerous flower pedicels. All the photos from the authors.

scorpioid; internodal segments accrescent, from 20 mm long to 30 mm at fruiting; vestiture tomentose, canescent. Inflorescences cymose, capitulate terminal 1-1.5(-2) cm wide; with 2(3) subtending bracts, these leaflike, connate proximally, 2-3 mm long, canescent abaxially but glabrous adaxially, entire apically. Involucre sessile, 1(2) per node or cluster, congested, turbinate-campanulate, prismatic, ribbed, rigid, 7-8 mm long  $\times$  5-6 mm wide, the teeth 5, erect, deltate, unequal in length from 0.4-0.6 mm long, vestiture thinly canescent. Flowers perfect, 15-20 per involucre; devoid of a floral stipe; pedicels 3-4 mm long, 2 bracteoles linear 2.5-3 mm long, pilose; the perianth of 6 almost-monomorphic tepals in 2 whorls of 3 each, connate proximally, each tepal 2 mm long and 1 mm wide, white with pink midveins, glabrous, entire apically, the hypanthium pilose 1/3-1/4 length of perianth; stamens 9, exserted, 3-4 mm long, filaments adnate basally, sparsely pilose throughout, anthers purple, tiny  $< 0.3$  mm; ovary glabrous 2 mm; pistil 3-carpellate, style 3 cleft to base, segments 2 mm long, stigmas capitate. Achenes trigonous, unwinged, red-brown, 2-3 mm long, some tuberculate, glabrous with a minutely papillate beak.

#### Taxonomic summary

*Type:* México: Baja California Sur: Municipio Los Cabos, cerca San Vicente de la Sierra, ladera oeste del Cerro de la Calavera a 1.3 km de la Ranchería El Barranquito, 23.116224° N, 109.920126° W, 1,098 m, 24 abril 2018,

Alfonso Medel Narváez 1213 (holotype HCIB 31427), (isotypes to be distributed to SD, RSA, and MEXU)

*Paratypes:* México: Baja California Sur: Municipio Los Cabos, Cerro de Calavera, Rancho Barranquitas, 23.116353° N, 109.919992° W, 1,095 m de elevación, 24 Abril 2018, José Luis León de la Luz 12627 (HCIB 31565!); Cerro de la Calavera, 1,085 m, 15 November 2017, Jon Rebman 33862; Cerro del Rancho Las Casitas, 23.135055° N, 109.881209° W, 793 m, 18 Marzo 2022, José Luis León de la Luz 13058 (HCIB 31867!); top of Calavera hill, isolated plants in granite cracks, 3,675 ft (1,125 m), 7 March 1981, Ann Zwinger 455 (MO).

*Etymology:* the specific epithet *calaverense* is in reference to the original location, Cerro de la Calavera. The Spanish name *calavera*, which is used by local ranchers, refers to the perception that at a distance the exposed white and rounded granitic monolith resembles a cranial vault of a skull. Suggested common names. Cape buckwheat, flor de borrego de Los Cabos.

*Distribution and habitat:* *Eriogonum calaverense* seems to be restricted to specific microenvironmental soil conditions only found in the monolith cracks of Cerro de la Calavera and adjacent mountain tops with similar geology. We noticed about 12-15 plants on the lower half of the monolith, but it is very likely also at the summit, which we could not access without climbing gear. Thus, there could be a much larger population that is outside of the reach of cattle grazing. Associated plants in the local area

of the monolith include: *Quercus devia* Goldman (1916: 322), *Dodonaea viscosa* Jacq. (1760: 19), *Randia capitata* DC. (1830: 387), *Brickellia peninsularis* Brandegee (1903: 160), *Coreocarpus dissectus* (Benth.) S. F. Blake (1913: 344), *Jatropha vernicosa* Brandegee (1905: 206), *Stachys coccinea* Ortega (1797: 20), and *Russelia retrorsa* Greene (1888: 176), species typical of the transition between the dry-tropical forest and the oak-pine woodland, as described for the Sierra de La Laguna plant communities (León de la Luz et al. 2012).

**Phenology:** based on data from the known specimens, *Eriogonum calaverense* flowers from the late winter to late spring (February to May), with the fruits likely persisting into early summer. Leaves seem to persist most of the year but are somewhat deciduous in the dry summer season. Some species of flies (Diptera) were seen laid on its flowers and it is suggested that they would eventually be agents of pollen dispersal.

**Conservation status:** this new taxon is restricted to Cerro de la Calavera and at least one adjacent mountain top in the Cape region of Baja California Sur. Presently, only about 20 different individual plants in the 2 localities have observed. There are a few other similar sites in the local granitic mountains of the southern Cape ranges that appear to possess walls and domes between 800 and 1,900 m and might also contain similar edaphic conditions matching those in the cracks at the top of Cerro de la Calavera and Las Casitas (Fig. 1).

It should be noted that there are active ranches in the whole region, with both goats and cattle. The vegetation on much of the hills is severely impacted by the effects of livestock grazing. The extreme vertical cliff-like microhabitat on which this new species grows appears to keep the plants protected from livestock browsing. In fact, some juvenile plants in Cerro de la Calavera were observed at the site suggesting that the population is reproducing. It also should be noted that the non-native and invasive weedy-grass *Melinis repens* (Willd.) Zizka (1988: 55) was observed growing in the same microhabitat as *E. calaverense* and could pose a threat and compete with the establishment of new plants.

#### Remarks

The systematics of *Eriogonum* is still a pending issue, as it is a difficult task to resolve due to the complexity of the genus itself, as well as the diversity of its specific taxa. However, in the treatment for the genus in the Flora of North America, Reveal (2005) created a division of subgenera based purely on morphological aspects. Based on the subgeneric key to the 8 subgenera recognized in that treatment, *E. calaverense* fits with the subgenus *Eucycla* (Nuttall) Kuntze (204. 1903) due its abruptly narrowing

flowers that have an acute base and are on slender pedicels that do not form a floral stipe. The sub-shrubby growth habit, as well the sessile and angled involucre also conform to this subgenus. This is consistent with the former identification in the Zwinger specimen made by Reveal, as *E. aff. cinereum*, since this taxon pertains to the subgenus *Eucycla*, whose taxa, according Reveal (2005), occupy arid regions from western North America to northwestern Mexico.

The southernmost *Eriogonum* species on the Baja California peninsula was, until now, *E. inflatum* Torr. & Frém. (1845: 317), which ranges south to 25.5° N latitude, near the city of Loreto. This is a widespread, low desert species that is widely distributed to the north in the US-Mexican region and in Sonora. *Eriogonum inflatum* is in the subgenus *Ganysma* (S. Watson) Greene (151: 1891), characterized by herbaceous stems, leaves not in fascicles, and a solitary smooth involucre per node (Reveal 2005).

On mainland Mexico, there are some 15 taxa of *Eriogonum* according a searching in BajaFlora (2021), GBIF (2021), and NaturaLista (2022) facilities, but none of them fits with *E. calaverense*. Our new species seems to be in a geographical position that allow argue opinions about the migration route of the original population; i.e., if the ancestral population of *E. calaverense* may have migrated southward to the Cape region, along the same route as most of the 53 extant peninsular *Eriogonum* taxa, with close affinities to the California flora; or instead, it might be allied with the Sierra-madrean/dry tropical flora, like the bulk of the species of the Cape region mountains. Future research should involve a phylogeny based on molecular analysis that will allow positioning this new taxon, possibly one of the most geographically isolated of the genus.

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Raymundo Domínguez Cadena enthusiastically participated in the search and collection of field material. Glenn Ehrenberg kindly shared his valuable photos. We would like to thank the Committee for Research and Exploration at the National Geographic Society for funding to search for this new species as part of a larger project to rediscover “lost” plant species on the Baja California Peninsula. Danira León Coria made the wonderful botanical illustration. We thank the Editor and reviewers of RMB: Socorro González E. (CIIDIR-Durango), Victor Steinmann (Autonomous University of Queretaro), and Travis Columbus (California Botanic Garden) for their insightful comments and suggestions to improve our description.

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