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U. S. DEPARTMENT OF THE INTERIOR

U. S. GEOLOGICAL SURVEY

MACROFOSSILS FROM THE IMPERIAL FORMATION
IN THE OCOTILLO WELLS STATE VEHICLE RECREATION AREA,
IMPERIAL AND SAN DIEGO COUNTIES, CALIFORNIA

by

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[U.S. Geological Survey]

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INTRODUCTION

This report is a compilation of macrofossil data for the Ocotillo Wells State Vehicle Recreation Area (SVRA) collected during 1991 and 1992. The report inventories fossil localities and molluscan taxa in the Ocotillo Wells area for use in regional studies of the Imperial Formation and to aid in environmental and land use studies.

The Ocotillo Wells SVRA is located east of the Anza-Borrego Desert State Park in southern California. It is north of the town of Ocotillo Wells along California Highway 78, (figure 1) between the towns of Julian and Brawley.

All outcrops of the Imperial Formation in the Ocotillo Wells SVRA are characterized by marine claystone and siltstone and include the bioclastic oyster and pectinid lenses commonly referred to in the literature as "oyster reefs" (Stump, 1972). These beds are referred to the upper unnamed member (=Deguyos Member of Winker, 1987) of the Imperial Formation. They commonly contain a small, brackish-marine fauna including oysters, pectinids and barnacles which lived in a delta front environment associated with the ancestral Colorado River (Winker, 1987). Outcrops of the Imperial Formation in Ocotillo Wells SVRA generally show little relief because of the semi- to unconsolidated nature of the sediments. The exception to this is Shell Reef which exhibits several well lithified, prominent ledge-forming beds.

PREVIOUS WORK

Dibblee (1984) reported on the stratigraphy and tectonics of the San Felipe Hills, Borrego Badlands, Superstition Hills and vicinity. In that paper he states "The upper part of the shallow marine Imperial Formation ... is exposed below the terrestrial Palm Spring Formation in the San Felipe Hills anticlinal uplift. *** The lower part was penetrated in three deep wells..." The exact location of those outcrops mentioned is unclear, but an enclosed map of the "...western San Felipe Hills and Ocotillo area" refers, in part, to the Ocotillo Wells SVRA. This conclusion is supported by a section, township, and range reference for one of three deep wells located just east of the Ocotillo Wells SVRA. It should be noted that that the town of Ocotillo Wells is mislabeled as Ocotillo on this figure. Another problem arising in Dibblee (1984) is that he later stated "Only the basal part of this formation is exposed at Squaw Peak north of Ocotillo [Wells], where it lies directly on biotite schist." During the present study no deposits of the Imperial Formation were located north of Squaw Peak and all exposures of the Imperial Formation in this area are of the upper member. The exposure at Shell Reef is to the east northeast of Squaw Peak and perhaps this is the exposure referred to by Dibblee (1984), but again the exposure there consists of the upper member of the Imperial Formation. Earlier work by Dibblee (1954) as part of his regional study of the Imperial Valley may have recognized the Imperial Formation in the Ocotillo Wells SVRA as "...partially exposed in the San Felipe Hills, and ... penetrated in that area by three deep wells..." The problem with this reference is that the San Felipe Hills are located about 30 km to the west of the Ocotillo Wells SVRA and according to Merriam (1958) and Gastil and Bushee (1961) no outcrop of the Imperial Formation are recognized in that area.

LOCALITIES AND FAUNA

Fossils were collected as surface float from eight sites scattered in the western portion of Ocotillo Wells SVRA. Fossil collection sites are listed in alphabetical order. The names for these sites are taken from the nearest trail recognized on maps supplied by the Ocotillo Wells Ranger Station. Sites are identified by name, followed by general locality information, the fauna collected and a discussion of the significance of the fauna. Lastly, the localities are plotted on enlarged portions of the Borrego Mountain 7.5' and Shell Reef 7.5' quadrangles.

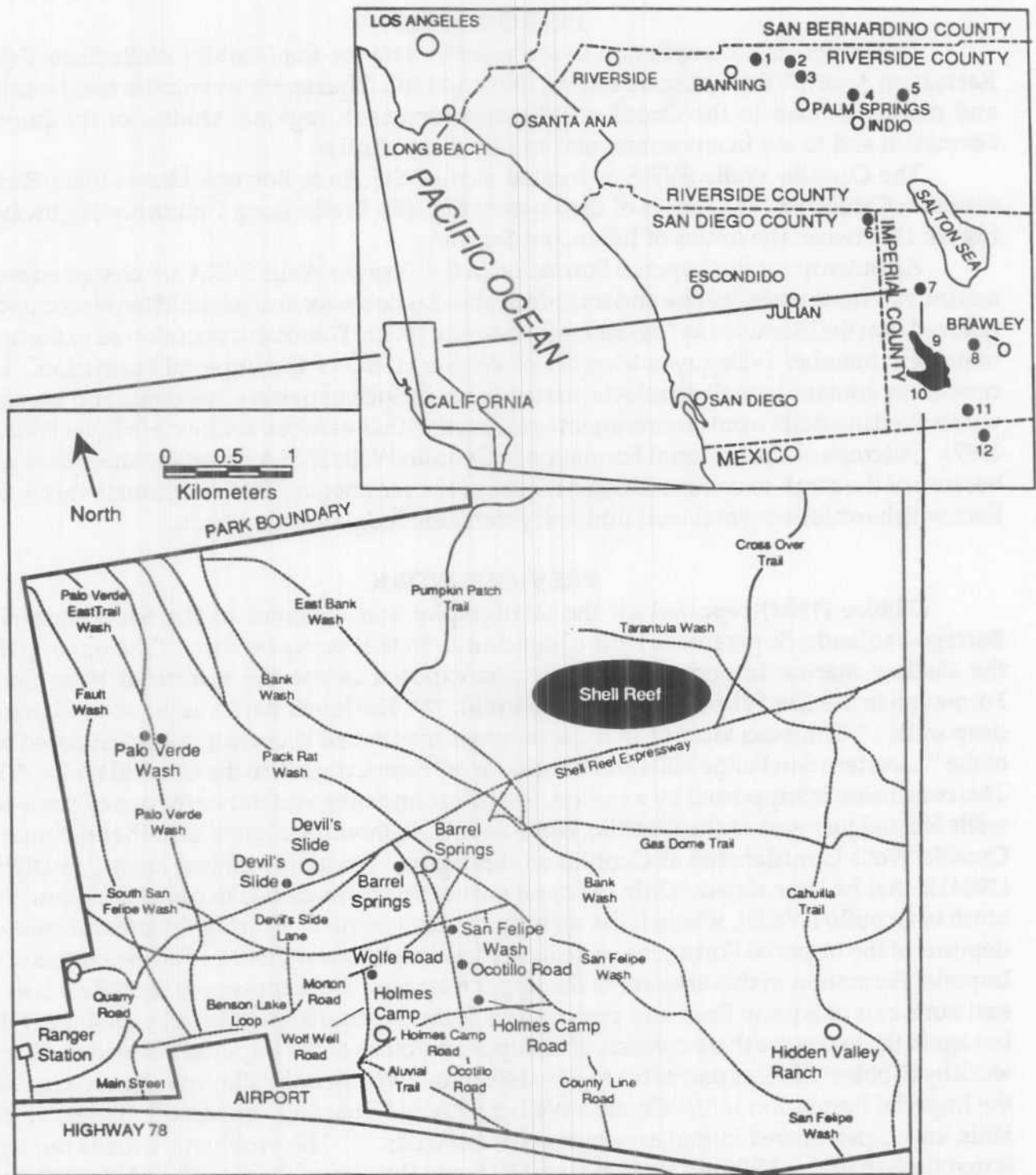


Fig. 1.—Trail map of the western portion of the Ocotillo Wells SVRA showing trails (smaller type), specific sites (open circles), and outcrops of the Imperial Formation (closed circles and stylized ovals to denote area of outcrop, and larger type). Insert shows occurrences of the Imperial Formation in southern California: 1-Lions Canyon; 2-Super Creek; 3-Garnet Hill; 4-Mt. Edom; 5-Willis Palm; 6-Travertine Point; 7-Ocotillo Wells SVRA; 8-Superstition Mountain; 9-Fish Creek Mountains; 10-Coyote Mountains; 11-Yuha Butts; 12-Baja California Norte, Mexico.

Barrel Springs Locality. Surface sample collected on west side of Barrel Springs trail just south of the Shell Reef Expressway, Ocotillo Wells SVRA, San Diego County, California. Latitude: 33.183°N, longitude 116.120°W.

Fauna: Mollusca

Bivalvia

Dendostrea? vespertina (Conrad)

Comments: This is a common shell from the Imperial Formation and ranges in age from Miocene to Pliocene.

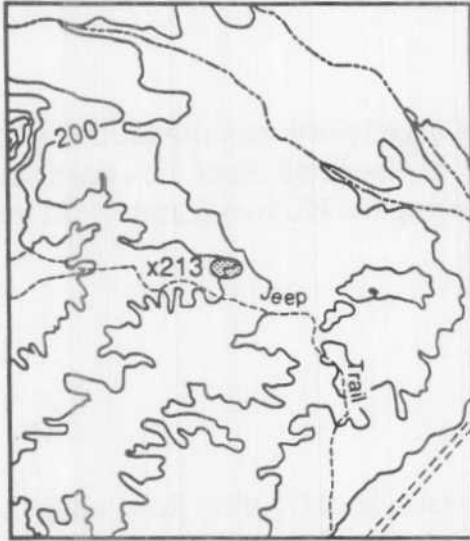


Fig. 2.—Enlarged portion of the southwest corner of the Shell Reef 7.5' quadrangle showing the Barrel Springs locality.

Devil's Slide Localities. East-northeast trending beds exposed for about 50 m just north of the Shell Reef Expressway and west of Devil's Slide, Ocotillo Wells SVRA, San Diego County, California. Latitude: 33.185°N, longitude 116.120°W.

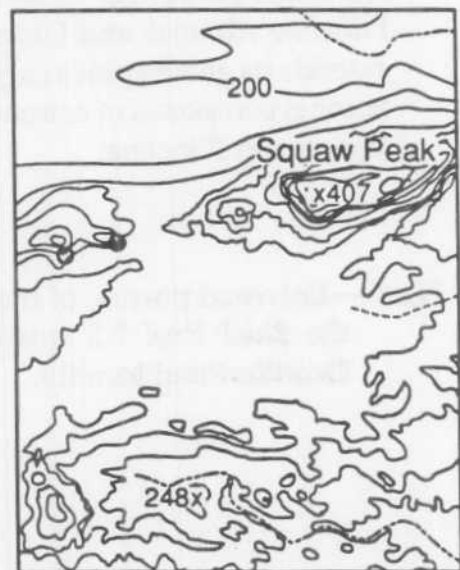
Fauna: Mollusca

Bivalvia

Dendostrea? vespertina (Conrad)

Comments: This is a common shell from the Imperial Formation and ranges in age from Miocene to Pliocene.

Fig. 3.—Enlarged portion of the southwest corner of the Shell Reef 7.5' quadrangle showing the Devils Slide localities.



Holmes Camp Road Locality. Surface sample collected on north side of Holmes Camp Road between Ocotillo Road and County Line Road, Ocotillo Wells SVRA, San Diego County, California. Latitude: 33.152°N, longitude 116.088°W.

Fauna: Mollusca

Bivalvia

Dendostrea? vespertina (Conrad)

Comments: This is a common shell from the Imperial Formation and ranges in age from Miocene to Pliocene.

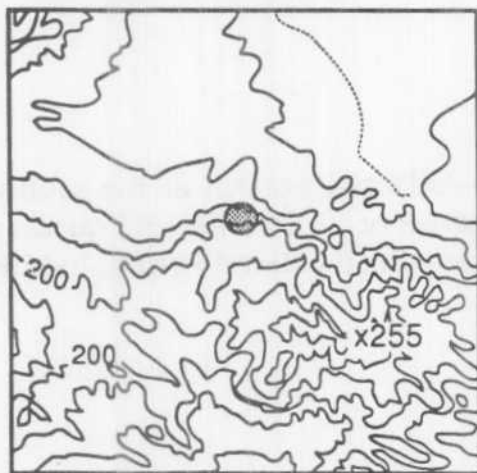


Fig. 4.—Enlarged portion of the southwest corner of the Shell Reef 7.5' quadrangle showing the Holmes Camp Road locality.

Ocotillo Road Locality. Surface sample collected on east side of Ocotillo Road about half way between San Felipe Wash and Holmes Camp Road, Ocotillo Wells SVRA, San Diego County, California. Latitude: 33.157°N, longitude 116.097°W.

Fauna: Mollusca

Bivalvia

Anomia subcostata (Conrad)

Antipekten? sp. cf. A.? praevalidus (Jordan & Hertlein)

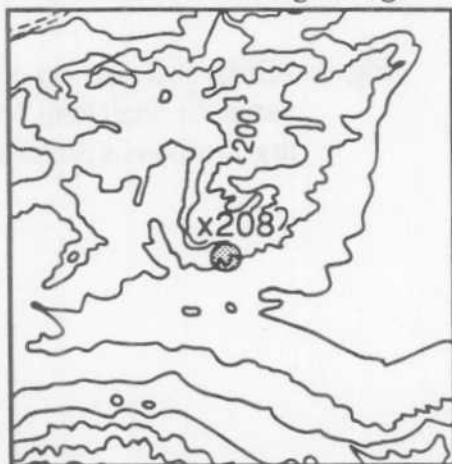
Argopecten sp.

Dendostrea? vespertina (Conrad)

Plicatula? sp.

Comments: Unusual in this collection is the presence of *Antipekten? praevalidus*, questionably identified because of its worn condition, which has previously been found only in the Pliocene Almejas and Gloria Formations of Baja California Sur. Its occurrence here extends its geographic range several hundred kilometers north. The remainder of the fauna is composed of common taxa from the Imperial Formation that range in age from Miocene to Pliocene.

Fig. 5.—Enlarged portion of the southwest corner of the Shell Reef 7.5' quadrangle showing the Ocotillo Road locality.



Palo Verde Wash Localities. Surface samples on both sides of Palo Verde Wash Trail about 1 mile south of its junction with Palo Verde East Wash Trail, Ocotillo Wells SVRA, San Diego County, California. Latitude: 33.237°N, longitude 116.155°W.

Fauna: Mollusca

Bivalvia

Dendostrea? vespertina (Conrad)

Pycnodonte? sp.

Comments: *Pycnodonte? sp.* is represented by a few shell fragments which are most likely referable to *P? heermanni* (Conrad) but because of their fragmentary nature can only be referred to genus. Both molluscan taxa are common in the Imperial Formation and range in age from Miocene to Pliocene.

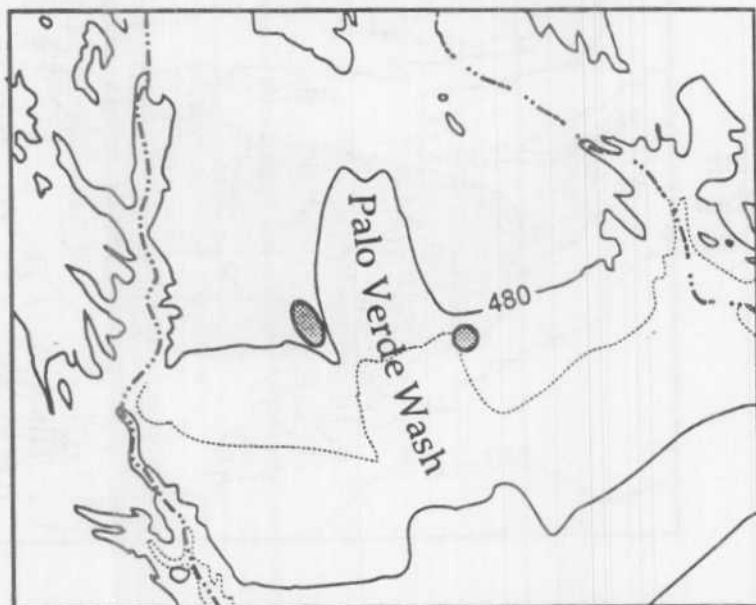


Fig. 6.—Enlarged portion of the southwest corner of the Borrego Mountain 7.5' quadrangle showing the Palo Verde Wash localities.

San Felipe Wash Locality: Surface sample collected on southeast corner of San Felipe Wash Trail at its junction with Ocotillo Road, Ocotillo Wells SVRA, San Diego County, California. Latitude: 33.162°N, longitude 116.097°W.

Fauna: Mollusca

Bivalvia

Anomia subcostata (Conrad)

Argopecten sp.

Dendostrea? vespertina (Conrad)

Comments: Both *Anomia subcostata* and *Dendostrea? vespertina* are common taxa from the Imperial Formation and range in age from Miocene to Pliocene.

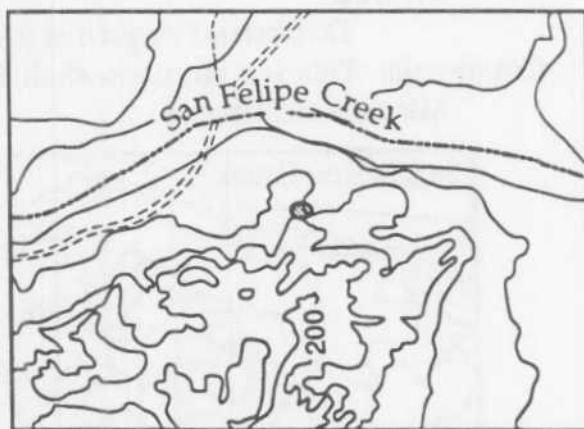


Fig. 7.—Enlarged portion of the southwest corner of the Shell Reef 7.5' quadrangle showing the San Felipe Wash locality.

Shell Reef Locality. Samples from general area of Shell Reef, Ocotillo Wells SVRA, Imperial County, California. Latitude: 33.216°N, longitude 116.071°W.

Fauna: Mollusca

Bivalvia

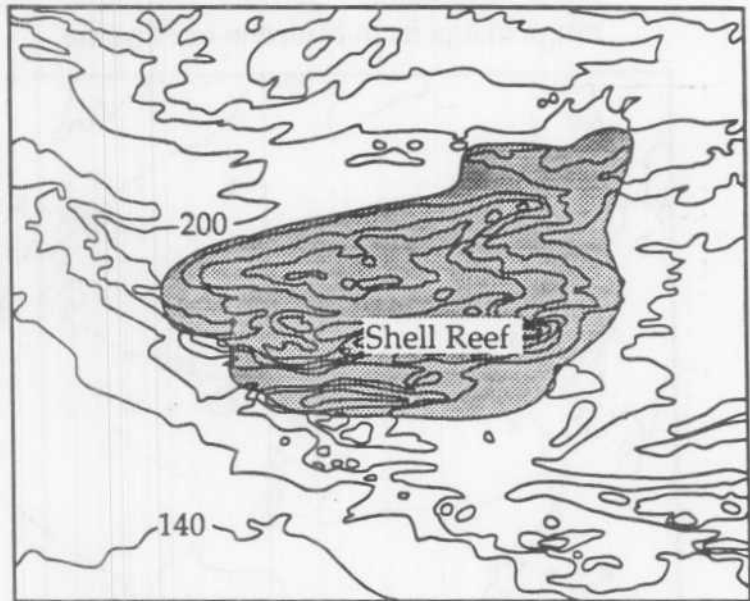
Anomia subcostata (Conrad)

Argopecten sp.

Dendostrea? vespertina (Conrad)

Comments: All taxa are common taxa of the Imperial Formation and the specifically identified taxa range in age from Miocene to Pliocene.

Fig. 8.—Enlarged portion of the southwest corner of the Shell Reef 7.5' quadrangle showing the Shell Reef locality.



Wolfe Well Road Locality. Surface sample collected on southeast corner of Wolfe Well Road at its junction with Morton Road, Ocotillo Wells SVRA, San Diego County, California. Latitude: 33.160°N, longitude 116.105°W.

Fauna: Mollusca

Bivalvia

Dendostrea? vespertina (Conrad)

Comments: This is a common shell from the Imperial Formation and ranges in age from Miocene to Pliocene.

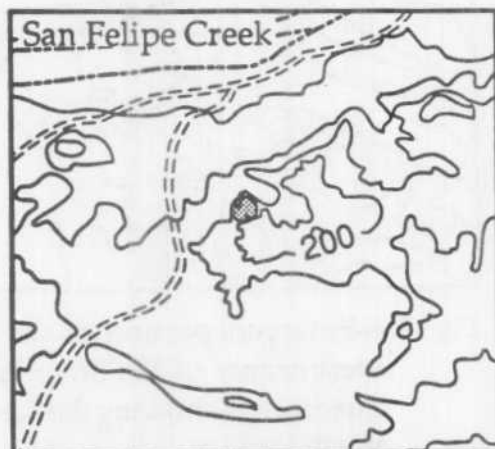


Fig. 9.—Enlarged portion of the southwest corner of the Shell Reef 7.5' quadrangle showing the Wolfe Well Road locality.

CONCLUSIONS

Outcrops of the Imperial Formation in the Ocotillo Wells SVRA are typical of the upper unnamed member exposed along the western margin of the Salton Trough (i.e. Fish Creek Badlands and Carrizo Badlands including the Coyote Mountains, and Willis Palm near Palm Springs, Riverside County). Many outcrops of the Imperial Formation, including the southern Coyote Mountains, are not protected as part of the Anza Borrego State Park and are open for development. As such abundant fossils exposed in outcrops of the upper member of the Imperial Formation near new roads developed north the town of Ocotillo and Plaster City have completely disappeared in the past decade (field work, 1983 and 1992). Potential loss of these localities alone, argues for the preservation of the Imperial Formation at Ocotillo Wells SVRA. In addition, the discovery of *Antipekten? praevalidus* (Jordan & Hertlein)?, a taxa not previously recognized from the Imperial Formation, shows that important scientific discoveries can and are being made within the recreation area. Taken together, these factors argue for preservation of outcrops of the Imperial Formation within the Ocotillo Wells SVRA.

ACKNOWLEDGMENTS

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