

DISCOVERY OF *SONORASPIS* IN SOUTHERN CALIFORNIA

BY ALEXANDER STOYANOW AND TAKEO SUSUKI

Genus *Sonoraspis* was erected by the senior writer (Stoyanow, 1952, p. 50, Pl. 14, figs. 1-6) for the Middle Cambrian trilobites from Sonora, Mexico, which differ from *Anoria* Walcott (1924, p. 54; 1925, p. 67) and *Glossopleura* Poulsen (1927, p. 268), under which generic names they had been originally listed (Stoyanow, 1942, p. 1263-1264), in having eight instead of seven thoracic segments and in possessing mixed characteristics of those two genera.

The discovery of Cambrian trilobites in Sonora led McKee (1947, p. 282) to postulate an early Middle Cambrian seaway from the Grand Canyon area to Sonora across southwestern Arizona. This view was based chiefly on the presence of *Glossopleura* in Harquahala Mountains south of the Grand Canyon. The above interpretation was opposed by the senior writer (Stoyanow, 1948, p. 323-324) who pointed out the absence of Cambrian strata between the two regions, and especially the fact that in Cambrian time southwestern Arizona was occupied by the Precambrian massive, Altar Headland (Stoyanow, 1942, p. 1264) of Mazatzal Land (Stoyanow, 1936, p. 462; cf. Cooper and Arellano, 1946, p. 608), which probably extended southward into Sonora. A westward Paleozoic portal in the Sonora basin was suggested.

A trilobite of the *Anoria-Glossopleura* group but with eight thoracic segments, collected from the Middle Cambrian strata in Bristol Mountains, southern California, was described as *Balhyuriscus howelli* var. *lodensis* by Clark (1921, p. 6) but was not figured. Later Resser (1928, p. 10, Pl. 3, fig. 9) illustrated Clark's type advancing it to the status of species, *Dolichometopus? lodensis* (Clark), and also mentioned eight thoracic segments. However, in a more recent paper Resser (1935, p. 29, 34) placed this species, as *Glossopleura lodensis* (Clark), with other species possessing

only seven thoracic segments, as also did Mason (1935, p. 109, Pl. 15, fig. 11) while describing, as *Anoria lodensis*, a plesiotype of Clark's species collected in Marble Mountains. Like *Anoria*, Clark's species has a macropleural fifth thoracic segment. The illustrations of Resser and Mason do not allow the figuring of the number of thoracic segments (eight as by Clark, or seven as by Resser and Mason) in either of two types with any degree of assurance. Clark's holotype was not available at the time of this writing, but Mason's plesiotype, preserved in the Los Angeles Museum, has been examined by the writers through the kindness of Dr. G. P. Kanakoff. It has seven thoracic segments with the fifth segment macropleural as in *Anoria*. Since the thoracic axis is completely destroyed in this specimen, it is impossible to establish the presence or absence of the axial tuberculation.

The possible presence of *Sonoraspis* in southern California, as suggested by Clark's mention of eight thoracic segments, stimulated a more detailed research in the Middle Cambrian strata of California. Through indefatigable and systematic field studies the junior writer eventually located *Sonoraspis* in Marble Mountains about 50 feet below the base of Bonanza King formation. Like *S. torresi* and *S. gomezi* of Sonora, it has, besides the presence of eight thoracic segments of the generic diagnosis, and like those two species, certain mixed characteristics of *Anoria* and *Glossopleura*. *Sonoraspis californica*, sp. nov., has tubercles on the anterior thoracic segments and the course of the facial sutures as in *Anoria*, but like *Glossopleura* it lacks the macropleural enlargement of the fifth thoracic segment. If Clark's species from Bristol Mountains has eight segments in the thorax, it is distinguished by the presence of the latter characteristic. The diagnostic description of the new species is presented below.

*Sonoraspis californica*, sp. nov.

(Plate 1, figures 1 and 2)

This species has eight thoracic segments (none macropleural) as in the genotype, *S. torresi* (untuberculated thoracic segments and facial sutures as in *Anoria*), and as in *S. gomezi* (tuberculated thoracic segments and facial sutures as in *Glossopleura*) from Sonora. It differs from the first species in having tubercles on the thoracic segments and from the second by the *Anoria*-like course of the facial sutures which is as in *S. torresi*. It is further distinct from *S. gomezi* by the presence of tubercles in the anterior segments of the thorax.

In holotype the tubercles of two posterior segments are destroyed, but the paratype, although with a damaged median line, clearly shows that all thoracic segments were tuberculated, as in *Anoria*.

Diagnostic differences: from *Anoria* and *Glossopleura*, by eight thoracic segments; from *S. torresi*, by the thoracic tuberculation; from *S. gomezi*, by the course of facial sutures.

Type: Holotype: U.C.L.A. Pal. Coll., Cat. No. 23460; Paratype: U.C.L.A. Pal. Coll., Cat. No. 23461.

Occurrence: In bedded buff to yellow limestone, Cadiz formation, 50 feet below the base of Bonanza King formation, Marble Mountains, San Bernardino County.

The paleogeographic significance of the described find is as follows. The presence of either *Anoria* or *Glossopleura* in Sonora has not been established. The four figured specimens from the Cambrian of Sonora with the thorax of eight segments preserved, other than those described by the senior writer, which were discussed under *Glossopleura* by Lochman (1952, p. 137, Pl. 31, figs. 8, 9, 12, 14), all belong in *Sonoraspis*. There is not a single thorax illustrated or mentioned in the text within the

assemblage of cranidia and pygidia described by Lochman (1952, p. 135, Pl. 25, figs. 1-21) as *Glossopleura leona*. All these specimens may as well belong in *Sonoraspis*. The logical conclusion might be that the *Sonoraspis* fauna was endemic to the Sonora basin, but the find in Marble Mountains described here clearly indicates intermigration with southern California. No eight-segmented forms of the *Anoria-Glossopleura* group have been reported from the Cambrian of the Grand Canyon thus far, but along the main Cordilleran trough such specimens appear to be present as seen from Walcott's illustrated material from Canada and (less certainly) from Utah (Stoyanow, 1952, p. 50-51).

The Marble Mountains, where the *Sonoraspis* beds have been located, are in San Bernardino County between Barstow and Needles, about 2 miles northeast of Chambliss on U. S. Highway 66, 90 miles east of Barstow. This locality has been described twice. In an earlier paper, Hazzard and Crickmay (1933, p. 60, 64, 65, 68) placed in the Middle Cambrian about 370 feet of strata between the topmost Lower Cambrian layer with Mesonacidae and the gray massive and bedded limestone complex above which was tentatively interpreted as Goodspring formation. The index fossil collected in the upper 105 feet of the Middle Cambrian, thus defined, was identified as *Dolichometopus productus* (H. and W.). In the second paper (Hazzard and Mason, 1936, p. 232, 233) the combined Middle Cambrian sequence of Providence and Marble Mountains was termed Cadiz formation, whereas the tentative Goodspring formation was changed to Bonanza King formation and added to the Middle Cambrian as also tentatively was the overlying Cornfield Spring formation. The fauna from the upper 105 feet of Cadiz formation was identified and listed. A collection from Marble Mountains was described by Mason (1935). The Cadiz fauna, as

PLATE 1.—*SONORASPIS CALIFORNICA*, N.SP. AND COLLECTING GROUNDSFIGURE 1.—HOLOTYPE. U.C.L.A. PAL. COLL., CAT. NO. 23460.  $\times 1.8$ FIGURE 2.—PARATYPE. U.C.L.A. PAL. COLL., CAT. NO. 23461.  $\times 2.1$ 

FIGURE 3.—GENERAL VIEW OF MARBLE MOUNTAINS FROM U. S. HIGHWAY 66

FIGURE 4.—WESTERN PART OF MARBLE MOUNTAINS



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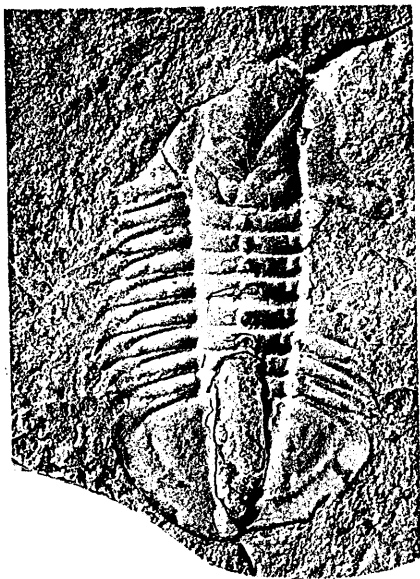


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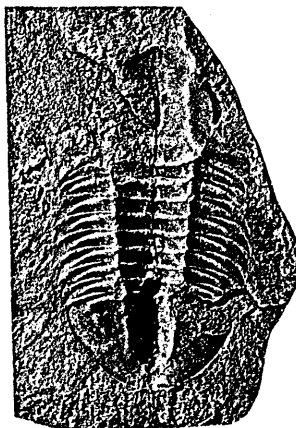


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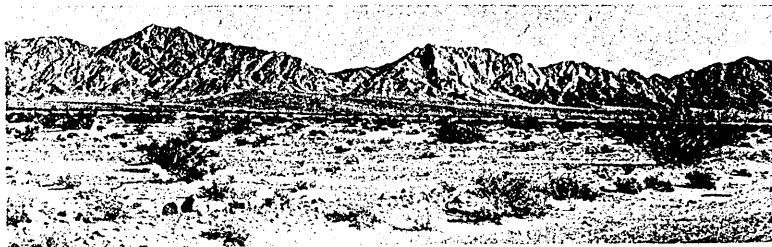


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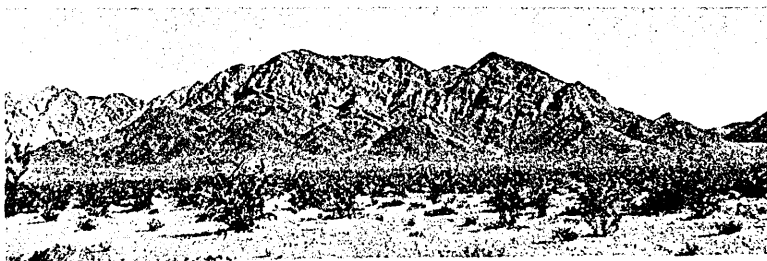


FIGURE 4

*SONORASPIS CALIFORNICA*, N. SP., AND COLLECTING GROUNDS

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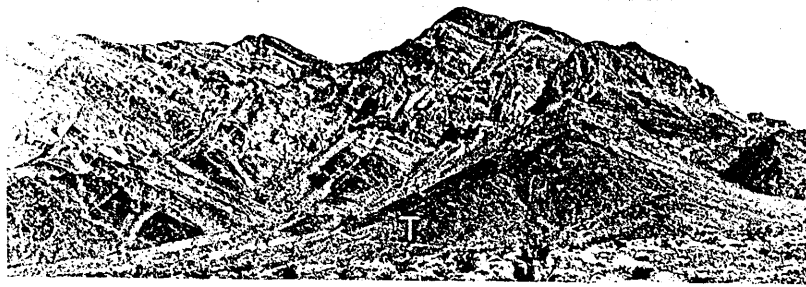


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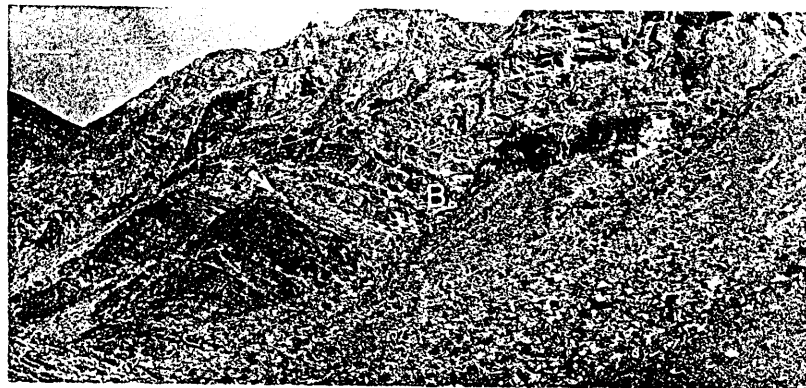


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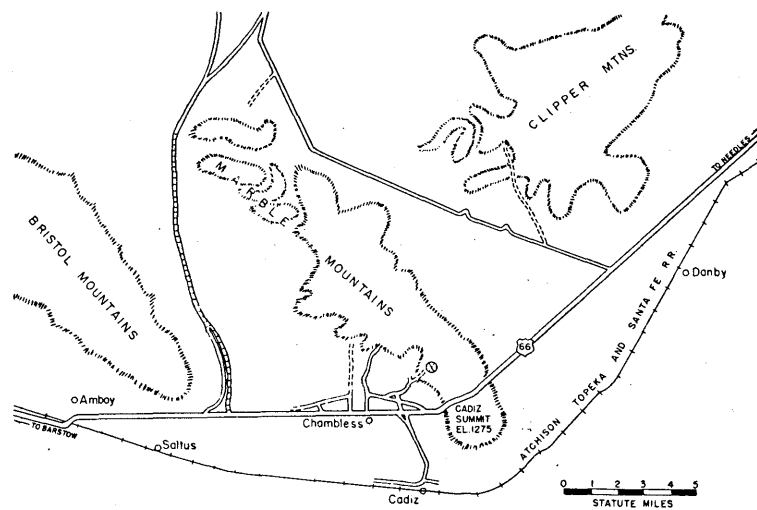


FIGURE 3

VIEWS OF COLLECTING LOCALITY

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It is safe to say that *Sonoraspis* is found only within the Sonora, which is *noraspis* in this trilobite of *Arellanella* Arellano, 195 is indicated as the bend of the 13 of the same

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listed, apparently represents several individual horizons.

It is safe to conclude that the strata with *Sonoraspis* in Marble Mountains are correlatively within 500 feet of Arrojos formation in Sonora, which is the vertical range of *Sonoraspis* in that formation, and within which this trilobite genus occurs between the zones of *Arellanella* and *Zacanthoides* (cf. Cooper and Arellano, 1952, p. 6; location of Arrojos Hills is indicated as "800" south of the southern bend of the Rio Magdalena, see map on page 3 of the same publication).

#### ADDENDUM

The recent paper of A. R. Palmer (1954) on the appraisal of Middle Cambrian trilobites from Great Basin was received by the writers after the present article had been submitted for publication. Palmer's text concerning *Sonoraspis* reads (p. 67):

"*Sonoraspis* (Stoyanow, 1952) is based on poorly preserved material that differs from *Glossopleura* by having 8 instead of 7 thoracic segments. The writer does not consider this sufficient justification for generic distinction, especially with inadequate knowledge available concerning variation of this feature within a population. *Sonoraspis* is considered here to be a synonym of *Glossopleura*."

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The present writers are of opinion that: (1) the qualitative characteristics of Cambrian trilobites by far outweigh in significance the qualitative features (so profusely used for generic and specific diagnoses in the post-Walcottian literature); (2) the genus *Sonoraspis* was erected not only on the additional thoracic segment, but also on the conjoining of characteristics separately belonging to *Anoria* and *Glossopleura*, whereas no such combinations have been demonstrated for the above genera; (3) the principal task of any paleontologist is in the application of his

ability to derive correct interpretation from impaired materials, and deductions made by the senior writer from the less perfect Sonora material have been corroborated by the excellent specimens from California; (4) there is a considerable range of intrageneric variations (including spinosity) in *Sonoraspis*, but the eighth thoracic segment invariably is present.

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#### PLATE 2.—VIEWS OF COLLECTING LOCALITY

FIGURE 1.—COLLECTING GROUNDS, MARBLE MOUNTAINS, SAN BERNARDINO COUNTY, CALIFORNIA

T—indicates the trail

FIGURE 2.—CLOSE VIEW OF COLLECTING LOCALITY

Arrow indicates *Sonoraspis* beds. B—marks the basal part of Bonanza King formation.

FIGURE 3.—ORIENTATION MAP

- bites: *Smithson. Misc. Coll.*, v. 93, no. 5, p. 1-46.
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