

Type specimens of *Crotalus scutulatus* (Chordata: Reptilia: Squamata: Viperidae) re-examined, with new evidence after more than a century of confusion

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Abstract.—The original description of *Crotalus scutulatus* (Chordata: Reptilia: Squamata: Viperidae) was published in 1861 by Robert Kennicott, who did not identify a type specimen or a type locality. We review the history of specimens purported to be the type(s) and various designations of type locality. We provide evidence that ANSP 7069 (formerly one of two specimens of USNM 5027) is the holotype and that the appropriate type locality is Fort Buchanan, near present-day Sonoita, in Santa Cruz County, Arizona.

Keywords: Cope, Kennicott, Klauber, Mohave rattlesnake, Mojave rattlesnake, type locality

The original description of what is now *Crotalus scutulatus scutulatus* (Chordata: Reptilia: Squamata: Viperidae) by Robert Kennicott was published in August 1861, under the name *Caudisona scutulata*. In typical fashion, Kennicott provided a detailed description of the scutellation of the head and body, as well as noting overall color and pattern, yet he did not identify by museum number the specimen(s) that he was describing, nor did he provide a collecting locality. At the time, according to Adler (1989, 2007), large collections of preserved material were being shipped to the United States National Museum from government surveys of the American West. Museum director Spencer Baird assigned snakes of certain genera, including the rattlesnakes, to

Kennicott to be cataloged and described. Kennicott was also a member of the Philadelphia Academy of Natural Sciences (Academy of Natural Sciences of Philadelphia 1859) and was active at both institutions in 1859 and 1860. Kennicott died in 1866 (Adler 2007) and was, therefore, unavailable to collaborate with subsequent authors. Herein we present evidence that the specimen described by Kennicott (1861) was one of two animals originally comprising USNM 5027. Sometime between 1861 and 1882, the type specimen was sent to the Philadelphia Academy of Natural Sciences to become ANSP 7069 and, subsequently, a new specimen tag was mistakenly numbered “5021” and placed in the USNM 5027 jar with the older fading tag and the single specimen remaining in Washington.

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In his report on the amphibians and reptiles collected on the surveys west of the 100th meridian, Henry Yarrow (1875:533) included a synopsis of the genus *Crotalus* that was written by Professor Edward Cope and in which was listed *Crotalus scutulatus* Kennicott with the locality of Arizona. A few pages later, Yarrow also provided (1875:536) a revised checklist from Cope that purportedly was "shortly to be published by the Smithsonian Institution" in which the species was called "*Crotalus adamanteus*, Beauv., subspecies *scutulatus*, Kennicott." During that same year, Cope (1875:33) referred to this rattlesnake as *Crotalus adamanteus*, Beauvois, subspecies *scutulatus*. In 1882, Yarrow produced a catalog of reptiles and amphibians in the National Museum in which he listed specimen USNM 5021 twice: once as *Crotalus adamanteus scutulatus* (Beauvois) Cope and again under *Crotalus lucifer* Baird & Girard. For each species he (Yarrow 1882:76) indicated only a single specimen under USNM 5021. USNM 5027 was not listed.

Cope apparently was the first author to identify a type specimen for "*Crotalus adamanteus scutulatus*" when he designated USNM 5021 as "the type specimen" (Cope 1900:1160). He also provided detailed drawings (1900:1159, Fig. 332) that included scutellation of the head and was captioned:

Crotalus adamanteus scutulatus Kennicott.
= 1.
Fort Buchanan, (Tucson) Arizona.
Cat. No. 5021, U.S.N.M."

Crotalus scutulatus was recognized as a distinct species by Boulenger (1896) and Klauber (1930), who briefly reviewed the history of use of the name. Subsequently the species was recognized by Gloyd (1940) and Klauber (1956) in their seminal treatises on rattlesnakes and continues to be treated as a distinct species.

Klauber (1956) mentioned confusion regarding USNM 5021 and 5027 as the

type specimen (p. 42, footnote 21), noting that 5021 was the wrong species but 5027 was *C. scutulatus* "and may have been the specimen Cope had in mind." He went on to mention that 5027 was cataloged as *Caudisona lepturus* (a name that was never published) on 30 January 1861, suggesting that this may have been the type specimen but noting that the labial counts do not agree with Kennicott (1861).

Specimens USNM 5021 and 5027 were entered into the U.S. National Museum catalog on 30 January 1861 as being received from Dr. B. J. D. Irwin. According to the catalog, USNM 5021 consisted of one specimen: a head of *Crotalus lucifer* from Arizona; USNM 5027 was recorded as consisting of two specimens of *Crotalus lepturus* from Ft. Buchanan, Arizona, with the additional notation "1 Phila." Specimen catalogs at the Academy of Natural Sciences of Philadelphia (ANSP) were not started until ca. 1894 and identify ANSP 7069 as "*Caudisona scutulata* Kennicott 1861" with the notation that this animal was received from the Smithsonian Institution, where it was one of two specimens cataloged as USNM 5027.

In 1950, Hobart Smith & Edward Taylor (1950:353) proposed to restrict the type locality of *Crotalus s. scutulatus* to Wickenburg, Maricopa County, Arizona, and cited Smith & Taylor's (1945) checklist to the snakes of Mexico as the bibliographic reference in support of their proposal. However, Smith & Taylor (1945:194) recorded "None" as available data on the Type and Type Locality of this rattlesnake and cited Kennicott (1861), Klauber (1930), and Gloyd (1940) in their synonymy. Gloyd (1940:200) had added "(No type specimen nor type locality designated)" to Kennicott's citation in his synonymy and provided a generalized narrative description of the species' range, which was quoted by Smith & Taylor (1945:194).

In 1992, John Cadle (pers. comm.) confirmed that the head scale counts of

Recent Investigation

We have verified the agreement between Kennicott's 1861 description and the specimen tagged ANSP 7069 (Fig. 1). We have compared the detailed drawing by Cope (1900:1159, Fig. 332), identified as USNM 5021, with the head scales of the USNM 5027 specimen remaining at the National Museum and found strong congruence (Fig. 2).

We also examined two very old specimen labels in the jar with the single specimen of USNM 5027. The older label initially appeared blank but showed a hint of faded writing when dried. We photographed the label under UV light and digitally enhanced the contrast and discovered writing that indicated "5027 *Crotalus Lepturus* Kenn" and "Ft. Buchanan [maybe something illegible] Dr. Irwin." On this label, the "5" and part of the "0" are well defined but the last two digits are barely visible. The more recent label is fully legible and reads "5021 *Crotalus adamanteus scutulatus*" in ink, with an apparent pencil line through "*adamanteus*," then "Ft. Buchanan, Dr. Irwin" (Fig. 3).

Investigation of Klauber's personal notes (archived in the Research Library

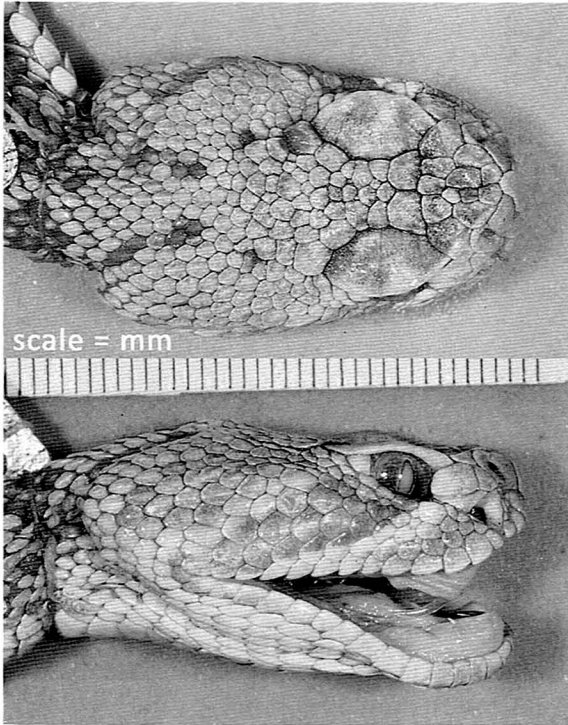


Fig. 1. ANSP 7069, holotype of *Crotalus scutulatus*. (Photo: NG)

ANSP 7069 match Kennicott's 1861 description and that the color and pattern are in general agreement. He concluded that ANSP 7069 is the holotype of *C. scutulatus*. McDiarmid et al. (1999) listed ANSP 7069 as the holotype and were followed by Campbell & Lamar in 2004.

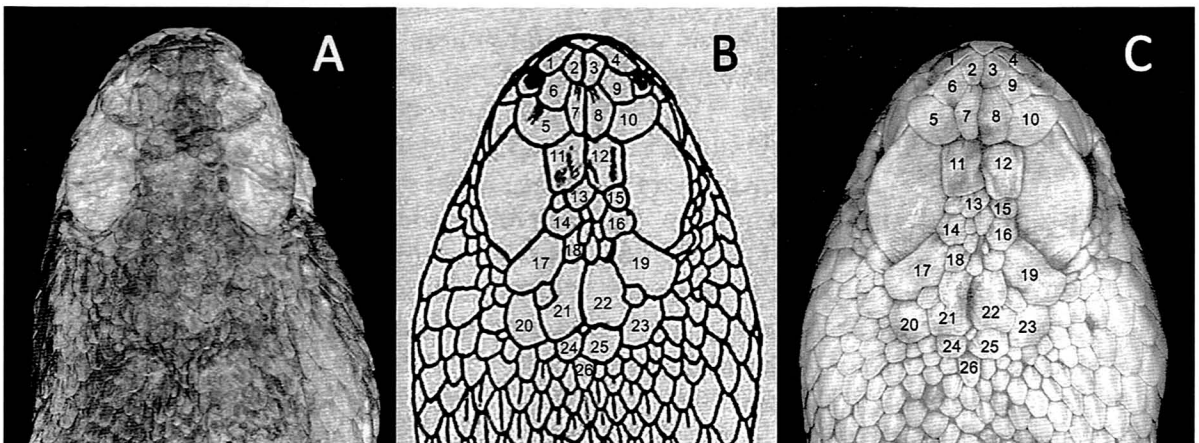


Fig. 2. Drawing (B) from Cope (1900) labeled "Cat. No. 5021, U.S.N.M." compared to actual USNM 5021 (A) and USNM 5027 (C). Note the corresponding shapes and arrangement of crown scales (both numbered and unnumbered) between Cope's drawing and USNM 5027 and the dissimilarity with the crown of USNM 5021. (Photos A & C: JAP)

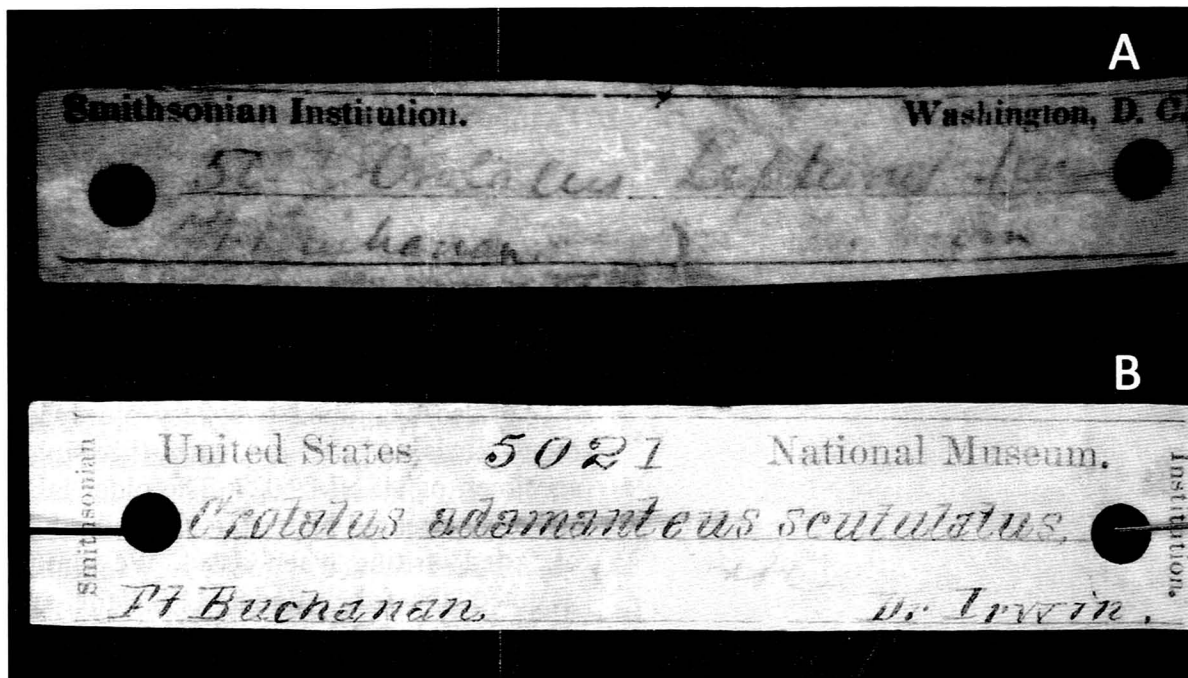


Fig. 3. Jar labels from USNM 5027. The older faded label (A) was photographed under ultraviolet light and the contrast was digitally enhanced; the newer label (B) was photographed under full-spectrum light. (Photos: SWG and JAP)

of the San Diego Natural History Museum) reveals that upon examining a series of specimens borrowed from the USNM in September 1928, Klauber discovered USNM 5021 to be a *C. oreganus* head; he also noted that the single specimen comprising USNM 5027 was a *C. scutulatus* but that it did not match Kennicott's original description (i.e., it was a different specimen). After a 1934 visit to ANSP (aka PANS) and USNM, Klauber wrote the following comment in his notes regarding Cope's (1900) identification of USNM 5021 as the type: "5027 is probably what he meant, but the USNM specimen doesn't agree with the description. The one in PANS does." The top of Klauber's data sheet for ANSP 7069, dated 12 September 1934, bears the bold inscription in red: "May be type of *scutulatus*." Despite these and other relevant notes, Klauber inexplicably omitted any comment in footnote 21 (1956:42) or in his other publications about ANSP 7069 possibly being the type.

Fort Buchanan was established on a low plateau next to the Sonoita River ca. 7

March 1857 and was abandoned and burned on 23 July 1861 (Frazer 1972), at the beginning of the Civil War. Its ruins are ca. 2 km W of the present-day town of Sonoita and ca. 65 km SE of Tucson, in what is now Santa Cruz County, Arizona. Dr. Bernard J. D. Irwin was an Army assistant surgeon assigned to the 7th U.S. Infantry in Arizona and posted to Fort Buchanan sometime prior to April 1859 [anonymous (Weekly Arizonian) 1859]. According to Smithsonian Institution annual reports, he made large collections for the USNM from his post at Fort Buchanan in 1859 (Henry 1860:67) and delivered these "important contributions from the vicinity of Fort Buchanan" in 1860, including new species of reptiles and insects (Henry 1861:72).

Discussion

We concur with the identification by McDiarmid et al. (1999) of ANSP 7069 as the holotype of *C. scutulatus*. We conclude

that Cope erred in 1900 when he referred to USNM 5027 (mislabeled as USNM 5021) as the type specimen and that type designation is therefore invalid.

We also conclude, however, that Cope's (1900: Fig. 232) identification of "Fort Buchanan, (Tucson) Arizona" as the origin of USNM 5027 (and of ANSP 7069) is the most appropriate type locality. Why Smith & Taylor (1950) suggested Wickenburg as a suitable type locality is unknown; perhaps it reflected familiarity with the rattlesnake fauna of the area through collaborative interactions with Dr. Fred Shannon, a medical doctor interested in snakebite who also lived in Wickenburg and had coauthored several papers with Smith at about that time. Such general restrictions have no bearing on the type locality and we follow the interpretation of Dunn & Stuart (1951) that these restrictions are without legal status and therefore immaterial to interpreting the type locality of *Crotalus scutulatus*.

Of the four specimens of *C. scutulatus* believed to have been at the National Museum in 1861 (USNM 260, 285, and potentially both 5027s), only the one that went to Philadelphia and is now cataloged as ANSP 7069 agrees with Kennicott's description. In the same paper as the description of *C. scutulata*, Kennicott (1861) described *Caudisona lepida*, noting that its description was based on two specimens (now lost). He gave the labial count as "12 above 10–12 below." From this description we infer that the lower labial counts of the two specimens were unequal. If he had described *C. scutulata* from multiple specimens, especially ones with unequal scale counts, we would have expected the *C. scutulata* description to have been similarly worded, but it is not.

We can find no record of Cope's (1900) rationale for choosing USNM 5027 as the type. Although Kennicott had been dead for more than three decades, the two men had been colleagues at both the Smithsonian Institution and at the Academy of

Natural Sciences of Philadelphia in 1860, and Cope may have had some personal knowledge of Kennicott's work. We hypothesize that sometime between 1861 and Yarrow's 1882 listing of USNM 5021 as both *C. adamanteus scutulatus* and *C. lucifer* (and omission of USNM 5027), a new specimen tag reflecting updated taxonomy was added to the 5027 jar. In the process, "5027" was miscopied as "5021" on the new tag, setting the stage for more than a century of confusion.

Fort Buchanan is well within the distribution of *C. scutulatus* and was apparently the base of operations of those who collected the animals that originally comprised USNM 5027. While the exact origin of these specimens remains elusive, we suggest that Fort Buchanan is more appropriate for the type locality than that selected arbitrarily ("by present restriction") by Smith & Taylor (1950), which is 330 km to the NW of Fort Buchanan.

Acknowledgments

We thank John Cadle (CAS), Ron Coleman (CSUS), Margaret Dykens (SDNHM), Jamie Kneitel (CSUS), John McManus (MST), and Kate Reeve (AZ Historical Society) for various support and assistance in the research for this paper. The manuscript benefitted from suggestions by R. P. Reynolds (USGS) and an anonymous reviewer.

Literature Cited

- Academy of Natural Sciences of Philadelphia. 1859. Proceedings of the Academy of Natural Sciences of Philadelphia 10:273.
- Adler, K. 1989. Herpetologists of the past. Pp. 5–141 in K. Adler, ed., Contributions to the History of Herpetology. Society for the Study of Amphibians and Reptiles, Contributions to Herpetology, Volume 5, 202 pp.
- Adler, K. 2007. Herpetologists of the past, part 2. Pp. 7–273 in K. Adler, ed., Contributions to the History of Herpetology, Volume 2. Society for the Study of Amphibians and Reptiles,

- Contributions to Herpetology, Volume 21, 389 pp.
- Anonymous. 1859. Successful surgical operation. *Weekly Arizonian* 28 April 1859:3.
- Boulenger, G. A. 1896. Catalogue of the snakes in the British Museum (Natural History). Volume III., containing the Colubridae (Opisthoglyphae and Proteroglyphae), Amblycephalidae, and Viperidae. Trustees of the British Museum, London, xiv + 727 pp. + 25 pls.
- Campbell, J. A., & W. W. Lamar. 2004. The venomous reptiles of the western hemisphere. (Two-volume set.) Cornell University Press, Ithaca, New York, 976 pp.
- Cope, E. D. 1875. Check-list of North American Batrachia and Reptilia; with a systematic list of the higher groups, and an essay on geographical distribution. Based on the specimens contained in the U. S. National Museum. *Bulletin of the United States National Museum* 1:1-104.
- Cope, E. D. 1900. The crocodylians, lizards, and snakes of North America. Pp. 153-1270 + 36 pls. in *Annual Report of the Board of Regents of the Smithsonian Institution*, showing the operations, expenditures, and condition of the institution for the year ending June 30, 1898. Report of the U. S. National Museum. Government Printing Office, Washington, D. C.
- Dunn, E. R., & L. C. Stuart. 1951. On the legality of restriction of type locality. *Science* 113:677-678.
- Frazer, R. W. 1972. Forts of the west: military forts and presidios and posts commonly called forts west of the Mississippi River to 1898. University of Oklahoma Press, Norman, xxxvii + 246 pp.
- Gloyd, H. K. 1940. The rattlesnakes, genera *Sistrurus* and *Crotalus*. A study in zoogeography and evolution. The Chicago Academy of Sciences, Special Publication No. 4, vii + 266 pp. + index + 31 pls.
- Henry, J. 1860. Annual report of the board of regents of the Smithsonian Institution, showing the operations, expenditures, and condition of the institution for the year 1859. Thomas H. Ford, Washington, D. C., 450 pp.
- Henry, J. 1861. Annual report of the board of regents of the Smithsonian Institution, showing the operations, expenditures, and condition of the institution for the year 1860. George W. Bowman, Washington, D. C., 448 pp.
- Kennicott, R. 1861. On three new forms of rattlesnakes. *Proceedings of the Academy of Natural Sciences of Philadelphia* 13:206-208.
- Klauber, L. M. 1930. New and renamed subspecies of *Crotalus confluentus* Say, with remarks on related species. *Transactions of the San Diego Society of Natural History* 6(3):95-144.
- Klauber, L. M. 1956. Rattlesnakes: their habits, life histories, and influence on mankind. University of California Press, Berkeley & Los Angeles, Vol. 1:xxix + 708 pp; Vol. 2:xviii + 709-1476 pp.
- McDiarmid, R. W., J. A. Campbell, & T. A. Touré. 1999. Snake species of the world. A taxonomic and geographic reference. Volume 1. The Herpetologists' League, Washington, D. C., 511 pp.
- Smith, H. M., & E. H. Taylor. 1945. An annotated checklist and key to the snakes of Mexico. *Bulletin of the United States National Museum* 187:iv + 239 pp.
- Smith, H. M., & E. H. Taylor. 1950. Type localities of Mexican reptiles and amphibians. *The University of Kansas Science Bulletin* 33:313-380.
- Yarrow, H. C. 1875. Report upon the collections of batrachians and reptiles made in portions of Nevada, Utah, California, Colorado, New Mexico, and Arizona, during the years 1871, 1872, 1873, and 1874, by Dr. H. C. Yarrow. Pp. 509-584 in *Report upon geographical and geological explorations and surveys west of the one hundredth meridian*, in charge of First Lieut. Geo. M. Wheeler, Vol. V.—Zoology. Government Printing Office, Washington.
- Yarrow, H. C. 1882. Check list of North American Reptilia and Batrachia, with catalogue of specimens in U. S. National Museum. *Bulletin of the United States National Museum* 24:1-249.

Associate Editor: Robert P. Reynolds.