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THE GENUS *ASTACOIDES* GUÉRIN (DECAPODA MACRURA)

BY

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E. J. BRILL

THE GENUS *ASTACOIDES* GUÉRIN (DECAPODA MACRURA)

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Since the publication of the revision of *Astacoides* by Monod & Petit (1929) very little has been published on this highly interesting genus of freshwater crayfish, which is the only representative of the family Parastacidae in Africa.

Monod & Petit (1929) considered the genus, which is endemic to Madagascar, monotypic, but they subdivided the type species, *Astacoides madagascarensis* (H. Milne Edwards & Audouin) into 4 subspecies or varieties: *A. m. madagascarensis* (H. Milne Edwards & Audouin), *A. m. betsileoensis* Petit, *A. m. brevisrostris* Monod & Petit, and *A. m. granulimanus* Monod & Petit.

Recently a small collection of *Astacoides* was received by the Rijksmuseum van Natuurlijke Historie, Leiden, from Mr. Y. Therezien, Ingénieur-hydrobiologiste of the Centre Technique Forestier Tropical at Tananarive. A study of this collection, which contains three of the four forms recognized by Monod & Petit, and the examination of several types made it possible to provide some additional information on the genus. This information, though it does not change the taxonomic picture given by Monod & Petit, makes some nomenclatural changes necessary.

Of all four forms as complete a bibliography as possible is given here.

***Astacoides madagascarensis madagascarensis* (H. Milne Edwards & Audouin, 1839) (text-fig. 1a, b, pl. IX fig. a, b)**

- Astacus madagascarensis* H. Milne Edwards & Audouin, 9 May 1839: 152; H. Milne Edwards & Audouin, 1839a: 32; Holthuis, 1956: 107, 108, 112, 116; Hemming, 1958: 141, 147, 151, 156.
Astacus Madagascariensis Audouin & H. Milne Edwards, 1841: 35, pl. 3; Gray, 1845: 410.
Astacus (Astacoides) Madagascariensis Erichson, 1846: 89.
Astacoides madagascariensis Brocchi, 1875: 25; Huxley, 1879: 759, 773, figs. 2B, 7; Huxley, 1879a: 79, 83, fig. 2B; Stebbing, 1893: 209; Calman, 1910: 56; Lenz, 1910: 567; Gruvel, 1922: 3, fig.; Calman, 1927: 52; Grandidier & Petit, 1932: 236; André, 1937: 33, 35.
Astacoides madagascariensis Huxley, 1879a: 92, fig. 7; Huxley, 1880a: 183, fig. 65.
Astacoides madagascarensis Huxley, 1880: 251, fig. 65; Huxley, 1881: 211, fig. 65; Huxley, 1883: xv.
Astacoides madascarensis Huxley, 1883: 224, fig. 65.
Astacoides Madagascariensis Moleyre, 1885: 680.
Astacoides madagascariensis var. Petit, 1927: 103.
Astacoides madagascariensis brevisrostris Monod & Petit, 1929: 10, 18, 33, text-figs. 1A, F, H, 3D, 4D, M, N, 5A, C, D, E, H, 6D, 8A, B, 10, pl. 3; Decary, 1950: 167; Pretzmann, 1961: 162.
Astacopsis madagascariensis André, 1937: 32.

Material examined.

Madagascar; leg. M. Goudot; don. Museum Paris, received 1843. — 1 ♂ cl. 80 mm, preserved dry. Paralectotype of *Astacus madagascarensis* H. Milne Edwards & Audouin, 1839; Rijksmuseum van Natuurlijke Historie, Reg. No. Crust. D. 5592.

Marsh with small streams, E. of Forestry Station Ambatoloana, Manjakandriana district, east of Tananarive, Madagascar; 16 October 1961; leg. Y. Therezien. — 1 specimen. R.M.N.H., Reg. No. Crust. D. 17726.

In the collection of the Leiden Museum a syntype of *Astacus madagascarensis* H. Milne Edwards & Audouin is preserved. It was obtained in 1843 from the Paris Museum. A letter of 7 February 1843 from H. Milne Edwards to W. de Haan, which is present in the archives of the Leiden Museum, announced the dispatch of the collection. This letter may be cited here in full as it gives a good picture of the exchanges that in that time took place among various museums:



Fig. 1. a, b, *Astacoidea m. madagascarensis* (H. Milne Edwards & Audouin), paralectotype; c, d, *Astacoidea m. caldwelli* (Bate), lectotype of *Astacoidea goudotii* Guérin. a, c, scaphocerite in ventral view; b, d, scaphocerite in dorsal view. a-d, $\times 7$.

“Muséum d’Histoire Naturelle. Le 7 février 1843. Monsieur. Aussitôt la réception de votre lettre j’ai fait déposer chez M. Verreaux une caisse en votre adresse, contenant une série de Crustacés du Chili &c., ainsi que diverses insectes et j’espère que ces objets vous seront agréables.

C’est avec plaisir que j’accepte vos propositions relatives à des échanges ultérieurs entre nos Musées respectifs. D’après l’organisation des établissements publics en France nous ne pouvons rien vendre et ce ne serait, par conséquent, qu’à titre de renseignements propres à nous guider dans nos échanges, que je pourrais indiquer la valeur vénale des objets que je vous expédierai. Le montant de la valeur des collections acceptées par vous serait porté en déduction des sommes dont le département entomologique du Muséum vous serait redevable pour les

animaux articulés reçus de vous et dans le cas où la dette contractée de la sorte par l'établissement de Paris excéderait le total des évaluations fixées par vous à vos envois, nous tiendrions à votre disposition le complément en espèces. Enfin je partage tout à fait votre opinion relativement à la nécessité de nous réserver réciproquement la faculté de renvoyer les objets que nous posséderions déjà ou qui nous paraîtraient d'un prix trop élevé.

Les bases de nos relations étant ainsi posées, je vous demanderai de commencer notre système d'échanges en m'envoyant le plus tôt possible toutes les espèces de Cétonides dont vous pouvez disposer et dont les noms ne sont pas indiqués dans le catalogue imprimé que vous trouverez dans votre caisse de Crustacés. Je désire avoir, autant que possible un échantillon de chaque sexe et je vous prierai de m'envoyer la boîte par la diligence avec l'adresse suivante: à l'administration du Muséum d'Histoire Naturelle au Jardin du Roi (Entomologie) à Paris.

Je ne doute pas, Monsieur, que nos échanges ne s'effectuent à notre satisfaction mutuelle et dès qu'il me sera possible de vous envoyer quelques uns des objets mentionnées dans votre lettre je ne manquerai pas de la faire. Agréez je vous prie Monsieur l'expression de ma parfaite considération. H. Milne Edwards'.

In the list of the "Crustacés donnés par le Muséum de Paris à Mr. Dehaan", accompanying this letter, "*Astacus madagascariensis*, Edw." is indicated under no. 14. At that time it was common practice among musea to exchange type material; several paratypes of De Haan's Japanese Crustacea, for instance, can now be found in Museums outside the Netherlands.

In their enumeration of the specimens of *Astacoides* present in the Paris Museum, Monod & Petit (1929) do not mention the types of *Astacus madagascariensis*. However, as Mr. Jacques Forest of the Paris Museum informed me, such type material does exist, and he kindly sent me photographs of the specimen which probably served for the illustration in Audouin & H. Milne Edwards's (1841, pl. 3 fig. 1) paper. This specimen is now selected to be the lectotype of the species. The specimen in the Leiden Museum thereby becomes a paralectotype.

A careful study of the Leiden type specimen and of the pictures of the Paris lectotype showed that both belong to Petit's variety *brevirostris* and not to the form which Monod & Petit (1929) considered the typical one. The width of the orbit in the Leiden specimen is 5.5 mm, while that of the rostrum is 7 mm. In the types the orbit is not deeply rounded but more or less angular (this is especially distinct in the lectotype). The rostrum is anteriorly truncated, while the true lateral margin, which is the continuation of the orbital margin, is distinctly visible throughout its length, not being obscured by the lateral carina of the rostrum. The thorax in both types is provided with granules in the anterolateral part, while in the posterolateral part these granules are longer and much more distinct, being more like blunt spinules. The scaphocerite (fig. 1 a, b) has the outer margin with three very distinct rounded teeth. The merus of the large cheliped has both the inner and outer margin of the lower surface serrate with distinct but rather low teeth. The teeth on the inner margin of the carpus behind the very strong anterior

tooth are inconspicuous. The carina along the lower margin of the chela is low and not denticulated.

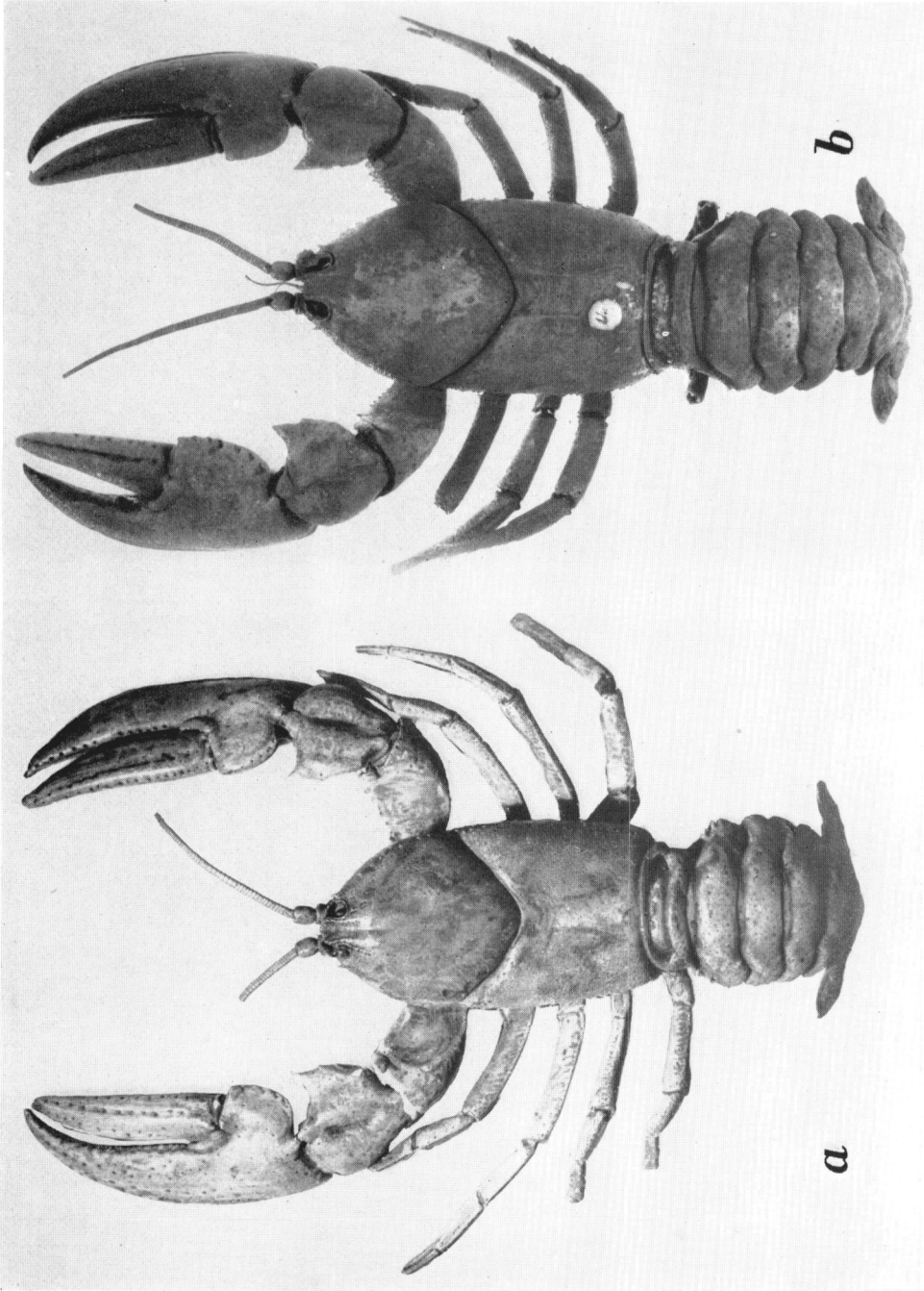
These characters all are typical for the form named *Astacoides madagascariensis brevisrostris* by Monod & Petit (1929). It is clear that this form is the typical subspecies which should be known as *Astacoides m. madagascarensis* (H. Milne Edwards & Audouin, 1839). The fact that this form is the one which according to Monod & Petit (1929: 33) occurs in the region around Tananarive and is "celle qui est le plus communément, peut-être exclusivement, vendue sur le marché de Tananarive", also makes it quite likely that it was represented in Goudot's material, though, as will be pointed out below, also an other form was present in Goudot's collection.

As to the orthography of the name "*madagascarensis*", this is often incorrectly given as "*madagascariensis*". In the original description of the species the former of these two spellings was used, and this consequently has to be adopted as correct. This correct spelling is the one in which the name was placed on the Official List of Specific Names in Zoology (as name no. 1545) by the International Commission on Zoological Nomenclature in their Opinion 519 (1958, Opin. Decl. Int. Comm. zool. Nomencl., **19**: 141).

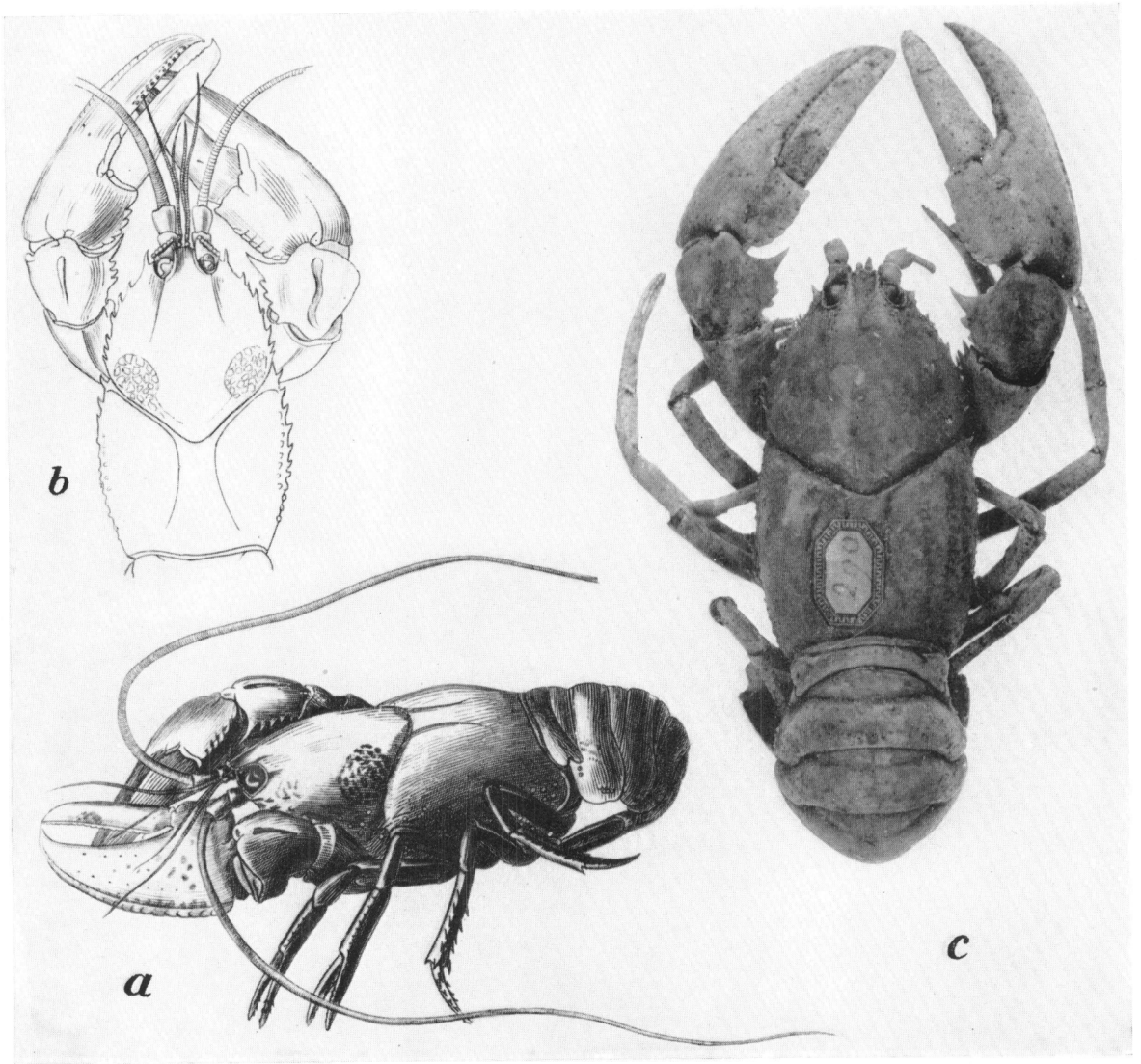
The relative priority of the specific names *madagascarensis* H. Milne Edwards & Audouin, 1839, and *goudotii* Guérin, 1839, will be discussed in the text dealing with *Astacoides madagascarensis caldwelli* (Bate, 1865) on p. 313 of the present paper.

The figure of the present species given by Huxley in the numerous English and translated editions of his "The Crayfish" distinctly shows a specimen of the typical subspecies.

Distribution. — The type locality is "Madagascar", no more accurate indication being provided either in the original description or with the type material. The type locality may be restricted here to the region of Tananarive, where the present subspecies is quite common and where Mr. Goudot, the collector of the type material, evidently obtained it. The records given in the literature are as follows: Madagascar (H. Milne Edwards & Audouin, 1839, 1839a; Audouin & H. Milne Edwards, 1841; Erichson, 1846; Brocchi, 1875; Huxley, 1878, 1879, 1879a, 1880, 1880a, 1881, 1883; Moleyre, 1885; Stebbing, 1893; Calman, 1910, 1927; Gruvel, 1922), region of Anjozorobé (Grandidier & Petit, 1932), market of Tananarive (Monod & Petit, 1929; Grandidier & Petit, 1932), Tananarive (as Antananarivo) (Pretzmann, 1961), region of Tananarive (Monod & Petit, 1929), Imerina, central area of Madagascar around Tananarive (Monod & Petit, 1929; Decary, 1950), E. of Tananarive (Petit, 1927), Manjakandriana (Petit, 1927; Monod & Petit, 1929; Grandidier & Petit, 1932), Ambatolaona on the railway from Tamatave to Tananarive (Grandidier & Petit, 1932), Marorangoetra, Antsihambavy, Andranomahero and Antanjona rivulets, Manjakandriana district (Monod & Petit, 1929), Mandraka (Monod & Petit, 1929), Ankazondrano, Ampataka, and Andomba rivulets, Andramasina district (Monod & Petit, 1929). Lenz (1910) reported the



Astacoides m. madagascariensis (H. Milne Edwards & Audouin). a, lectotype (Paris Museum);
b, paralectotype (Leiden Museum). a, $\times 0.5$; b, $\times 0.6$.



Astacoides madagascarensis caldwelli (Bate). a, b, figures of a type specimen of *Astacoides goudotii* Guérin (after Guérin, 1839a, pl. 686 fig. 4, resp. 4a); c, lectotype of *Astacoides goudotii* Guérin (Philadelphia Museum). c, $\times 0,8$.

species from Tamatave, which, however, judging by the map of distribution given by Monod & Petit (1929: fig. 10) lies some distance outside the range of the species.

***Astacoides madagascarensis caldwelli* (Bate, 1865) (text-fig. 1 c, d, pl. X figs. a-c)**

Astacoides Goudotii Guérin, 29 April-13 May 1839: 109; Guérin, 1839a: 390, pl. 686 fig. 4, 4a; Brocchi, 1875: 24; Petit, 1927: 102.

Astacus caldwelli Bate, 1865: 469, pl. 27.

Astacoïdes madagascariensis Faxon, 1898: 668; Faxon, 1914: 404.

Ecrevisse malgache Bertrand, 1900: 348.

Astacoides madagascariensis var. Petit, 1927: 103.

Astacoides madagascariensis madagascariensis Monod & Petit, 1929: 10, 12, 33, text-figs. 1C, I, J, 4G, O, P, 5F, 6A-C, 8E, F, 10, pl. 2 fig. 1; Decary, 1950: 167; Pretzmann, 1961: 161.

Astacoides goudotii Holthuis, 1956: 107, 108, 112, 116, 118; Hemming, 1958: 135, 143, 146, 147, 151, 156, 158.

Material examined.

Madagascar; leg. M. Goudot; coll. F. E. Guérin no. 290, don. Dr. T. B. Wilson. — 1 ♂ cl. 58 mm, preserved dry. Lectotype of *Astacoides goudotii* Guérin, 1839; coll. Academy of Natural Sciences, Philadelphia.

When in 1839 the traveller Goudot came back in Paris from a visit to Madagascar, he had in his collection the first Madagascar crayfish ever to reach the attention of scientific circles in Europe. Part of his material was donated by him to the Paris Museum, part came in the hands of Mr. F. E. Guérin Méneville of Paris. Guérin recognised the animals as belonging to a new genus and new species and described them under the name *Astacoides Goudotii*. The material donated to the Paris Museum was almost simultaneously described by H. Milne Edwards & Audouin as *Astacus madagascarensis*. As discussed in a previous paper (Holthuis, 1956: 107, 108) the name *Astacoides Goudotii* was published between 29 April and 13 May 1839, and probably between 6 and 13 May, while that of *Astacus madagascarensis* was published on 9 May 1839. According to the International Code of Zoological Nomenclature the name *madagascarensis* has priority over *goudotii* by 4 days. However, as the possibility exists that additional information might actually show that the name *goudotii* is published before 9 May 1839, the International Commission on Zoological Nomenclature was asked (Holthuis, 1956: 116) to definitely validate the name *madagascarensis* by the suppression, under their plenary powers, of the name *goudotii*. In Opinion 519 (Hemming, 1958: 135, 143) the Commission indeed adopted this course. The name *goudotii* therefore cannot be used anymore for the species, even if new evidence would show it to be older than *madagascarensis*. Such additional evidence which seems to show that *goudotii* is the older of the two names, actually was discovered recently by me in a quite unexpected place. In the ninth volume of his "Dictionnaire pittoresque d'Histoire naturelle" Guérin (1839a), as an addendum to Lucas's article "Thalassine, *Thalassina*. (Crust.)", gave a quite long account of *Astacoides Goudotii*. After a few introductory remarks he quoted verbatim the diagnoses of the

genus and species as given by him in the original publication. Then he went on: "Ce Crustacé a été décrit, après nous, dans le Journal l'Institut du 9 mai 1839, no. 280, p. 153, sous le nom d'*Astacus madagascariensis*, Edwards, mais cette publication est un peu tardive puisque notre description a paru en avril; ce nom spécifique de *Madagascariensis* doit donc être mis en synonymie du nom de *Goudotii*". It seems rather unlikely that the April number of the Revue et Magasin de Zoologie, containing pp. 97-128, actually should have been published in April as on p. 119 a report of the meeting of 29 April of the Royal Academy of Sciences of Paris is given: one day seems to be rather short to set up and print 10 full pages of text. On the other hand Guérin's claim for priority was published in the same year as that in which the two rival publications appeared, so that a lapse of memory seems not very likely. At the present time it is impossible to prove or disprove Guérin's claim and it is fortunate therefore that the question has already definitely been decided by the International Commission.

In the Dictionnaire pittoresque Guérin (1839a, pl. 686 fig. 4) also published good figures of his new species. These figures, the first ever to be published of *Astacoides*, seem to have been entirely overlooked by subsequent zoologists. Therefore both are reproduced here (pl. X fig. a, b).

One of the types of *Astacoides goudotii* was sold (or donated) by Guérin to T. B. Wilson, a gentleman from Philadelphia, who was a patron of the Academy of Natural Sciences of Philadelphia. Mr. Wilson presented the specimen to the Academy. This specimen which is still extant could be examined by me through the kind cooperation of Messrs. C. W. Hart and Tucker Abbott of the Philadelphia Academy. A photograph of it is reproduced here (pl. X fig. c). This is the same specimen reported upon by Faxon (1898, 1914). As far as I can make out, it is the only one left of Guérin's types and therefore it is made here the lectotype of Guérin's species. The specimen agrees extremely well with Guérin's description and figures and even may have served for these figures. It differs considerably from the two type specimens of *Astacus madagascariensis* H. Milne Edwards & Audouin dealt with above, and a close examination proves that it belongs to the subspecies of *Astacoides madagascariensis* that was considered by Monod & Petit (1929) to be the typical form. The width of the orbit of the Philadelphia specimen is 5 mm, being exactly the same as the width of the rostrum. The rostrum is anteriorly truncated, with a few tubercles; it does not differ essentially from that of the types of *A. madagascariensis* in this respect. When seen in dorsal view, the true lateral margin of the rostrum is hidden in its anterior part by the lateral carina. The anterolateral part of the carapace is provided with anteriorly curved spines, which are distinctly larger than the granules and short spinules of the posterolateral area. The scaphocerite shows on the outer margin two rows of about three small blunt teeth each; these teeth are far less conspicuous than those of the types of *A. madagascariensis*. The inner and outer margin of the merus of the large chelipeds bear spines (3 or 4 on the inner, 5 or 6 on the outer margin), which are strong and sharp, being much more distinct than those of the typical subspecies. Also

the teeth on the inner margin of the carpus behind the strong distal tooth are much more pronounced than in the typical form. The carina on the lower margin of the chela is perhaps somewhat more distinct than in the typical form, but the difference is very small.

The name *goudotii* thus is the oldest available name for the present subspecies. However, the name is not valid as it is suppressed by the International Commission on Zoological Nomenclature under their plenary powers in Opinion 519 (Hemming, 1958: 135, 143).

In 1865 Bate described and figured a new species of crayfish from Madagascar under the name *Astacus caldwelli*. His account is such that there cannot be the least doubt that his specimen belongs to the same subspecies as *Astacoides goudotii*. The strong development of the anterolateral spines of the carapace, the shape of the scaphocerite, the strong spines on the merus of the large chelipeds, all clearly show the true identity of the animal. The present subspecies therefore must be indicated with the name *Astacoides madagascariensis caldwelli* (Bate).

Bate's description was entirely overlooked by Monod & Petit (1929) who found in the collection of the Paris Museum a specimen of *Astacoides madagascariensis betsileoensis* with the label "Astacoides Caldewelli Sp. Bate"; the two authors considered this name to be a manuscript name of Bate's and placed it in the synonymy of *A. m. betsileoensis*. That the Paris Museum specimen was incorrectly identified and that Bate's type is different from *A. m. betsileoensis* is clearly shown by Bate's original description and his figures of *Astacus caldwelli*, especially by the shape of the scaphocerite and by that of the exorbital spine.

The type of *Astacus caldwelli* seems to be no longer extant, no trace of it could be found in the British Museum; it may even have gotten lost before the collection of the Zoological Society was transferred to the British Museum.

Distribution. — As shown by Monod & Petit (1929: 33, fig. 10) the present subspecies lives in streams on the eastern slopes of the Ankaratra Mountains; its area lies to the south and slightly to the south-west of that of the typical subspecies. The records in the literature are: Madagascar (Guérin, 1839, 1839a; Faxon, 1898, 1914; Pretzmann, 1961), near Tananarive (as Antananarivo) (Bate, 1865), streams in the Ankaratra Mts. (Bertrand, 1900; Petit, 1927; Monod & Petit, 1929; Decary, 1950), Manjakatampo (Monod & Petit, 1929), Vakinankaratra (as Vakinankarana) (Petit, 1927; Monod & Petit, 1929), Sambaina and Antsirabé, Vakinankaratra province (Monod & Petit, 1929), Soanindrariny (Monod & Petit, 1929), Ambositra province (Monod & Petit, 1929).

***Astacoides madagascariensis granulimanus* Monod & Petit, 1929**

Astacoides madagascariensis var. Perrier de la Bathie, 1927: 24; Petit, 1927: 103.

Astacoides madagascariensis granulimanus Monod & Petit, 1929: 11, 22, 34, text-figs. 1E, 4C, F, H, J, 6E, 7D-I, 8C, D, 9, 10, pl. 1; Decary, 1950: 167; Pretzmann, 1961: 161.

Material examined.

Marsh along the highway to Ranomena near Ampamaherana, district Fianarantsoa; 29 November 1961; Y. Therezien no. 14. — 2 specimens. R.M.N.H. no. Crust. D. 18368.

Sakalava River near Ampamaherana, Fianarantsoa district; 1 December 1961; Y. Therezien no 21. — 1 specimen. R.M.N.H. no. Crust. D. 17725.

The account of the present subspecies given by Monod & Petit (1929) fits very well for the present material.

Distribution. — The subspecies inhabits the south-eastern part of Madagascar; its area, according to Monod & Petit (1929), being more extensive than that of any of the other forms; it is distinctly separated from the area inhabited by *A. m. madagascarensis* and *A. m. caldwelli*, but partly coincides with that of *A. m. betsileoensis*. The records in the literature are: S. E. Madagascar (Decary, 1950), Andringitra Mountains (Perrier de la Bathie, 1927; Petit, 1927; Monod & Petit, 1929), Ifanodrana (Monod & Petit, 1929), Fianarantsoa (Monod & Petit, 1929), Andrambovato and Beromazava rivulets, near Ampamaherana, Fianarantsoa district (Pretzmann, 1961), Vinanitelo (Monod & Petit, 1929), region of Fort Carnot (Petit, 1927; Monod & Petit, 1929), Ikongo Mountains, Farafangana province (Petit, 1927; Monod & Petit, 1929), Farafangana (Monod & Petit, 1929), Ivohibé (Monod & Petit, 1929), Vondrozo (Monod & Petit, 1929), Midongy (Monod & Petit, 1929), region of Isaka (Petit, 1927; Monod & Petit, 1929).

***Astacoides madagascarensis betsileoensis* Petit, 1923**

Astacoides madagascariensis betsileoensis Petit, 1923: 219; Petit, 1927: 103; Monod & Petit, 1929: 10, 14, 33, text-fig. 1B, D, G, 2, 3C, 4A, B, E, I, K, L, 5B, G, 6F, 7A-C, 10, pl. 2 fig. 2; Decary, 1950: 167; Pretzmann, 1961: 161.

Material examined.

Sahambavy River, Fianarantsoa district; fishing with electricity (470 V, 1.7 A); 12 January 1962; Y. Therezien no. 17 and 19. — 2 specimens. R.M.N.H. no. Crust. D. 17724.

The specimens, one of which is adult, the other much smaller, agree excellently with the description and figures provided by Monod & Petit (1929) of this form. The differences from the other forms are so striking that I would be inclined to consider *A. m. betsileoensis* an independent species. As, however, Monod & Petit's opinion that it is only a subspecies of *A. madagascarensis* is based on much more material than that which I have at my disposal, I abide, for the time being at least, by their decision.

According to field notes by Mr. Therezien the present form is named "oram-banonga" or "orambato" by the natives.

Distribution. — The area of the present subspecies lies far to the south of those of *A. m. madagascarensis* and *A. m. caldwelli* being separated by a considerable distance from these; it partly overlaps the northern part of the range of *A. m. granulimanus*. There is one record of the species from a locality much farther north, namely from Moramanga, rather close to the region inhabited by *A. m. madagascarensis*. Monod & Petit (1929: 18, 34) who published this record consider it aberrant. The other records given in the literature are: Madagascar (Pretzmann, 1961), S. Madagascar (Monod & Petit, 1929), Betsileo area (Decary,

1950), Fianarantsoa (Petit, 1923; Petit, 1927; Monod & Petit, 1929), Ikongo Mountains (Petit, 1927; Monod & Petit, 1929), Ikongo Forest (Monod & Petit, 1929).

RÉSUMÉ

L'examen des spécimens types d'*Astacus madagascarensis* H. Milne Edwards & Audouin, 1839, et d'*Astacoides goudotii* Guérin, 1839, et l'étude de la littérature ont montré que les noms corrects des sous-espèces que Monod & Petit (1929) nommaient *Astacoides m. madagascariensis* et *A. m. brevisrostris* sont en réalité *Astacoides madagascarensis caldwelli* (Bate, 1865) et *A. m. madagascarensis* (H. Milne Edwards & Audouin, 1839). Une bibliographie des quatre sous-espèces d'*Astacoides madagascarensis* est donné.

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