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Marcel Bourgade. Contribution for a revision of the taxonomic list of Spherodactyls (Ti-Mabouya) of Martinique . 2020. <hal-02453673v2>

HAL Id: hal-02453673

<https://hal.science/hal-02453673v2>

Submitted on 10 Feb 2020

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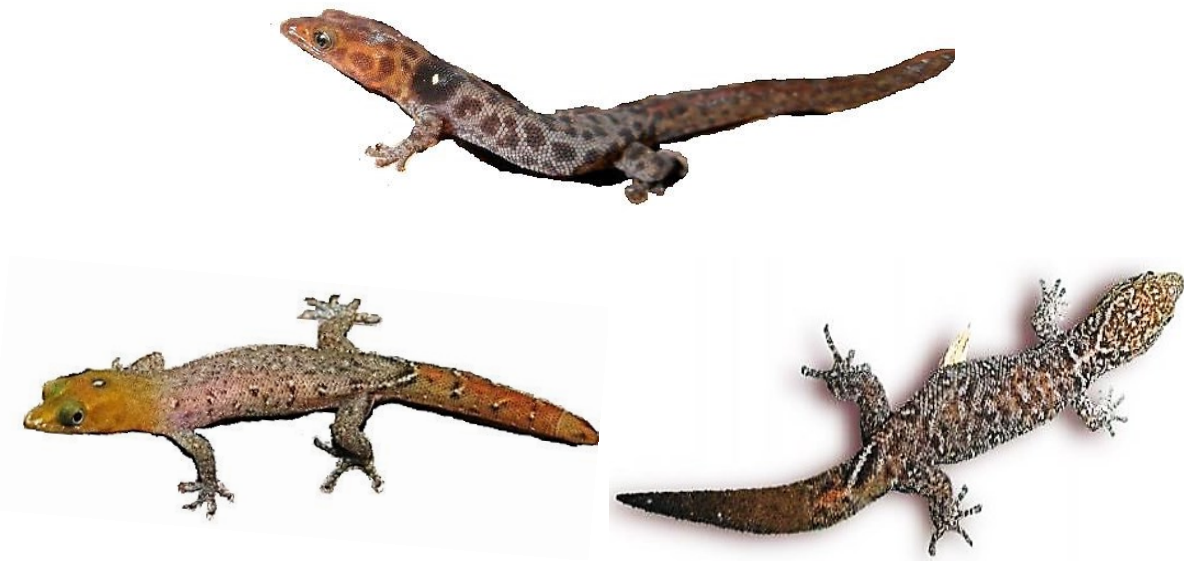
Contribution for a revision of the taxonomic list of Sphaerodactyls (Ti-Mabouya) of Martinique

by

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Summary – This contribution for a revision of the taxonomic list of endemics Martinique sphaerodactyls is established, taking into account the most recent publications, to confirm the existence of a line of *Sphaerodactylus* from south-eastern Martinique corresponding to *S. v. psammius* Schwartz, 1964; line would also correspond to the remark and deduction of Barbour (1921), presuming of the fact not verified by himself, of the presence in Martinique of *S. microlepis* Reinhardt & Lütken, 1862, of Saint Lucia, well observed on the peninsula of Sainte -Anne, genetically well differentiated from the other lines of southwest and north of Martinique, corresponding respectively to *S. vincenti* Boulenger 1891, and *S. festus*, Barbour, 1915. Contribution thus pleading for the rise to the rank and status of 'a third endemic Martinique species of *Sphaerodactylus*: *S. psammius*.

Key-words: Eastern Caribbean, Martinique, dispersion center, Herpetofauna, Squamates, taxonomic list, Sphaerodactyls, Dwarf gecko, *Sphaerodactylus*, *S. vincenti*, *S. festus*, *S. psammius*.

I. INTRODUCTION

Geological history and geosciences are key to understanding the general evolution of biodiversity. The herpetofauna of the islands of the eastern Caribbean and particularly the small amphibians and squamates living in ecological niches on soils requiring litter, are then among the first occupants of land surfaces emerged. And so the geological evolution - tectonic and volcanic - of Martinique and the Caribbean archipelago is decisive for the process of dispersions and therefore of speciations of this herpetofauna originating in the area of the current Orinoco basin. With advances in genetics, research in molecular systematics makes species of this micro herpetofauna in particular indicators allowing revelation and precision of dating of geological phenomena and events. A phylogeny of a herpetofauna which is therefore revealing of a geological history of the Eastern Caribbean where Martinique stands out as exceptional and central on the scale of this Grenadian basin where it is located; playing a main role as a refuge island from - 45 My, then a center of dispersion towards - 12 My for an endemic herpetofauna older than previously thought. A proto-Martinique island refuge in this almost unique Grenadian basin (with proto-Barbados) maintained not submerged from - 25 My, which was quite naturally center of dispersion, first towards a proto-Saint Lucia in geological phase re-emergence around -12 My.

Research in herpetology and in particular the first results of work in molecular systematics (Hedges *et al.* 2007, Surget-Groba & Thorpe 2013, Hedges *et al.* 2015) relating to this Martinican herpetofauna are shaking up the geosciences and obliging a revision of the historical scenario of the basically tectonic geological formation and evolution of the Eastern Caribbean with emerged land (forming an isthmus since the Eocene, well over - 45 My), then almost all submerged around -25 My. This isthmus at the top of " a cordillera (volcanic arc), located on the southeastern edge of the so-called Caribbean plate, at the junction of the three lithospheric films (or plates), Caribbean, North America and South America, formed one of the two bridges, with that of the Aves ride, between the Orinoco basin and the Greater Antilles. (See Fig. 3)

The history of biological endemism on the surface of emerged land therefore does not begin there only in the Miocene at "- 24 My" as it is generally accepted. It is in such a context that the Spherodactyls of Martinique (Ti-Mabouya, in Martinique language), are emblematic of this evolution of biodiversity in a logic of cause and effect with the geological history of this Martinique, obviously intrinsic to that of the eastern Caribbean.

The base of Martinique consists of a fragment of the Aves wrinkle located east of the Caribbean tectonic film which evolved 120 My ago in the Pacific Ocean. This Aves wrinkle, with its two consecutive folds of the west to east displacement of the Caribbean lithospheric film encrusted between the two most important American lithospheric films, is part of a set called the Caribbean Mesozoic Arc . (Stephan, J.F. *et al.* 1990).

Martinique is the only island in the eastern Caribbean to present three phases of volcanic activity juxtaposed with a regular displacement of these activities from east to west since 25 My (Fig. 4 and 5, Germa, Aurélie 2008) . Located remarkably on a position in the far east of this Caribbean arc, "where a North-South tangent passes", precisely at the latitude of the splitting of American lithospheric films. (Fig. 1: Bernard Mercier de Lépinay 2010)

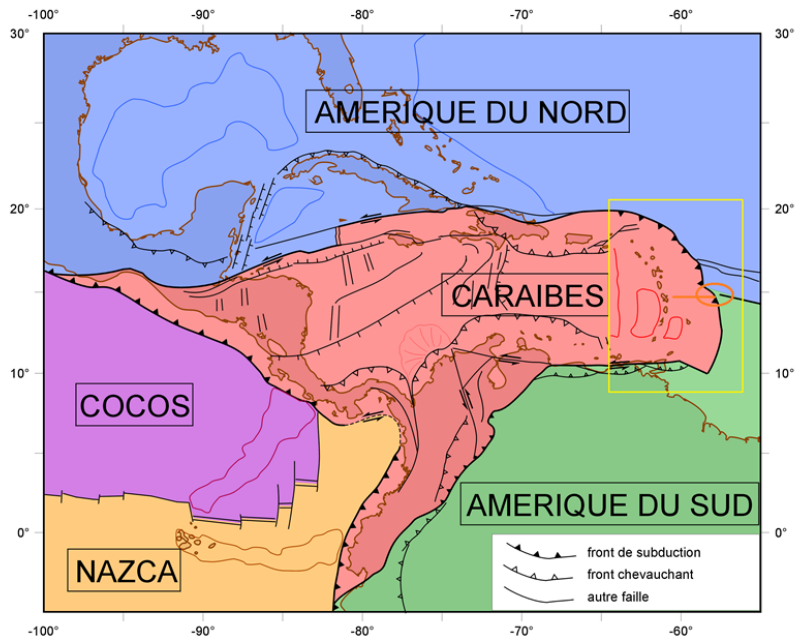
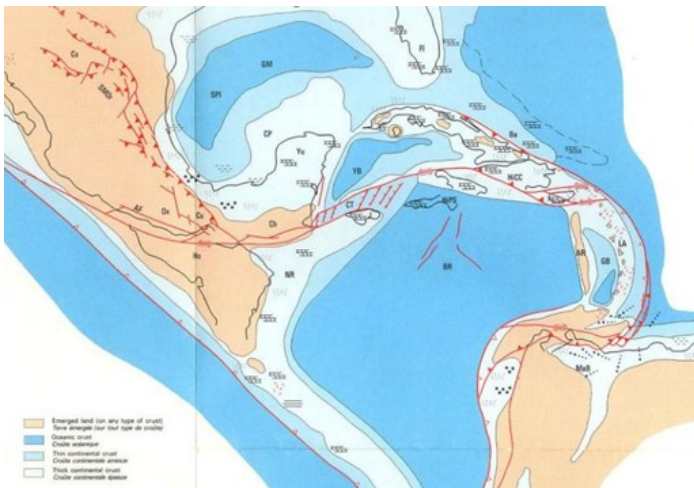


Fig. 1 : Bernard Mercier de Lépinay (2010)

Middle Eocene : - 49 Ma

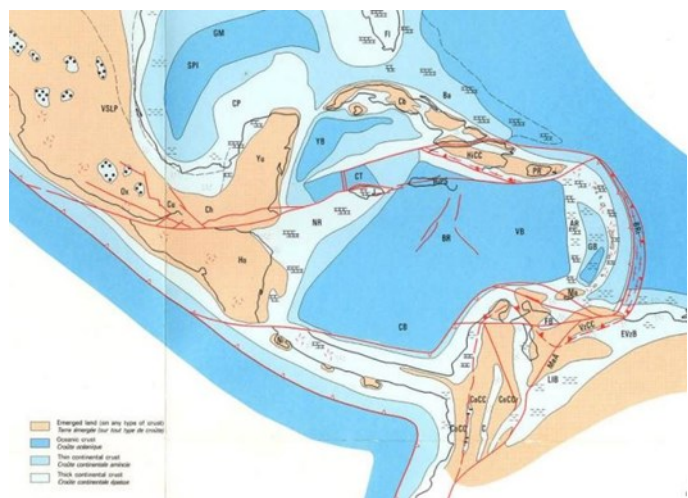


Upper Eocene : - 37 Ma

Fig. 2 : Extracts from cartographic works

by Stephan, J.F. *et al.* (1990).

Paleogeodynamic maps of the Caribbean.
Bulletin n°6



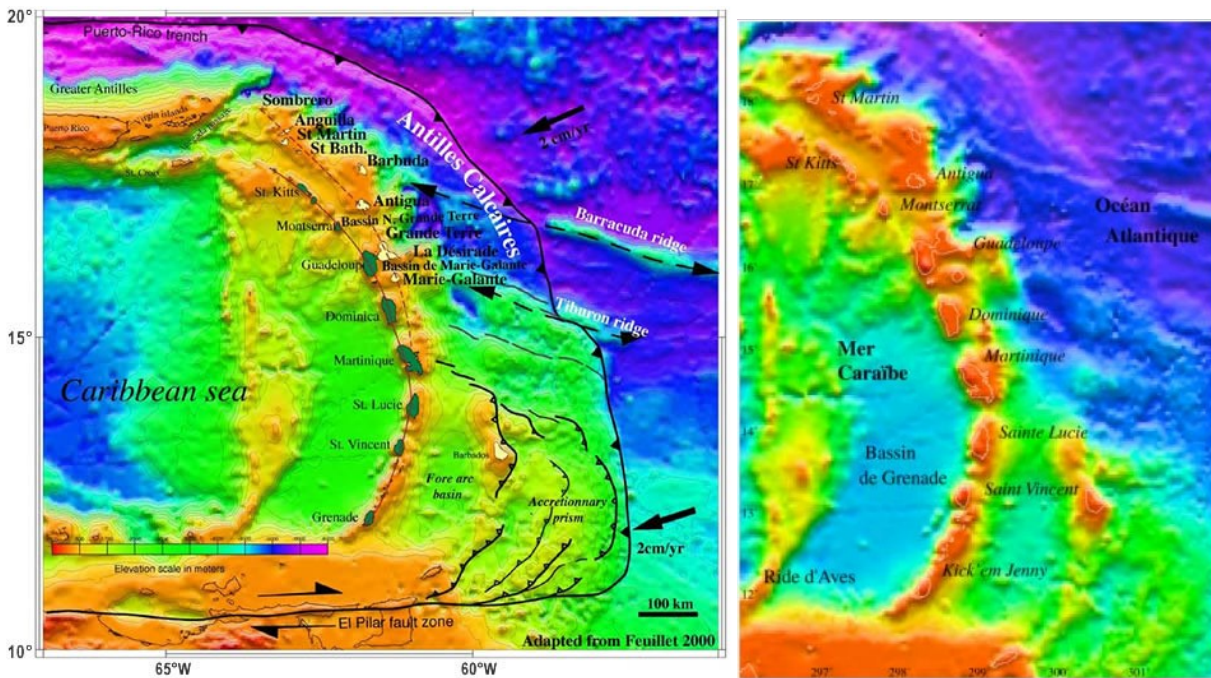
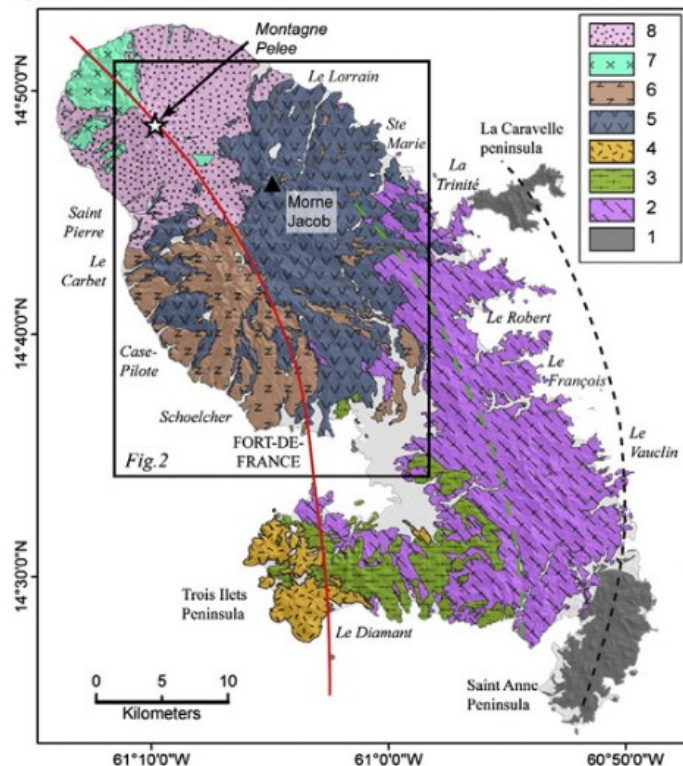
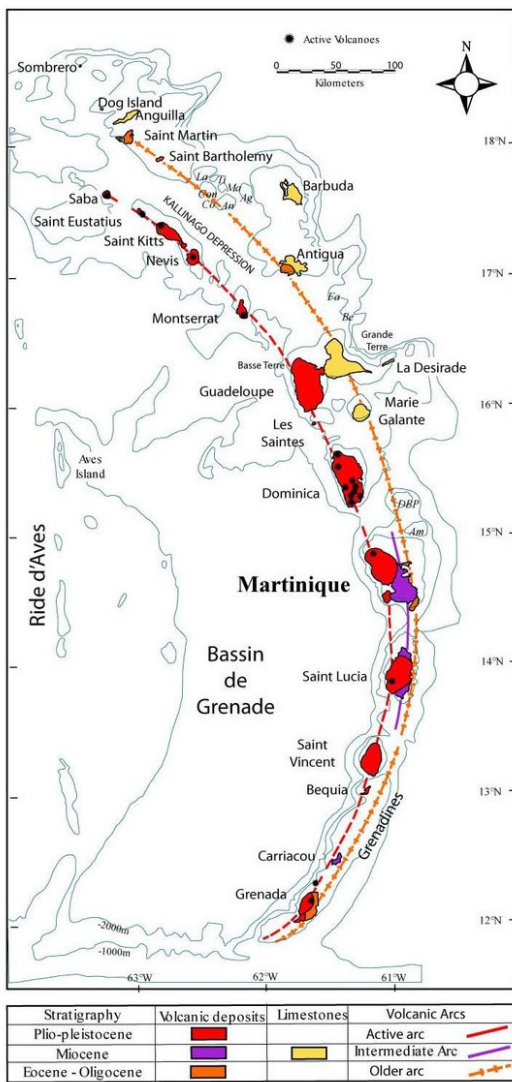


Fig. 3 : DIAGRAM MAP REPRESENTING THE ARCHIPELAGO OF THE EASTERN CARIBBEAN IN THE CONTEXT OF PLATE TECTONICS

Antilles Seismological Data Center , 2004



1) In Martinique, the products of the ancient arc (gray) outcrop on the peninsulas of La Caravelle (east) and Sainte Anne (south-east). 2 - 3) Then the volcanic front moved slightly towards the west. An underwater chain was built between 17 and 8 My (Vaucelin-Pitault chain, purple) then emerged to build the peninsula of Trois Ilet until 7 My (Volcanism of the Southwest, green). 4) The monogenic volcanoes of Trois-Ilets were active from 2.4 to 0.34 My (orange). 5) Le Morne Jacob (dark blue, see below) is a shield volcano which emerged around 5.5 My and was active until 1.5 My. 6) The Carbet complex began to build on the western flank of Le Morne Jacob about 1 My ago. A flank collapse affected its entire western flank and was immediately followed by the eruption of the Pitons du Carbet in the depression. 7 - 8) Mont Conil (light blue) emerged about 550 ka ago. Since then, volcanic activity has never really stopped in the northern block of the island. Around 126 ka, a flank collapse destroyed about 25 km³ of the building, then the volcanic activity of Mount Pelée (pink) proper became centralized in the depression formed. Germa Aurélie (2008).

Fig. 4 et 5 : Martinique and the island arches of the eastern Caribbean (by Germa Aurélie).

II. MATÉRIEL ET MÉTHODE

Cette contribution pour une révision de la liste taxinomique des Sphérodactyles de la Martinique, plaidant pour élever au rang d'espèce le *Ti Mabouya* de la péninsule de Sainte-Anne du sud-est de la Martinique, le *Sphaérodactylus psammius*, se fonde sur des publications datant du début du XXème siècle, mais aussi de publications récentes traitant de biogéographie, de géologie et de systématique : Barbour 1914, 1921, 1930, 1935, 1937, King 1962, Schwartz 1964, 1965, Westerkamp 1975, Schwartz & Thomas 1975, Andreieff, Baubron, Westercamp 1988, Stephan 1990, Hedges 1996, Malhotra & Thorpe 1999, Breuil 2002, 2009, 2011, 2013, Steinberg, Hite, Powell, Henderson 2008, Germa 2008, Hedges & Kumar 2009, Daltry 2009, Henderson & Powel 2009, Powell & Henderson 2012, Pichot 2012, Barat 2013, Surget-Groba & Thorpe 2013, Sepulchre et al. 2014, Sacco 2015, Allard Saint-Albin 2015, Hedges, Marin, Suleski, Paymer & Kumar 2015, Mauvois 2015, Saffache et al. 2018, Bourgade & Fong 2018, Dewynter 2018, Bourgade 2019, Dewynter, De Massary, Bochaton, Bour, Ineich, Vidal, & Lescure 2019.

The taxonomic list of Spherodactyls of Martinique here established includes the three species identified in historical times; it being agreed today by IUCN (Anonymous 2012) that this limit of these so-called historical times must not be earlier than the year 1500 of the Judeo-Christian calendar. The three taxa declined in the list of Spherodactyls proposed are endemic to Martinique; two of them *S. vincenti* and *S. festus* should be considered as subendemic to Martinique (Lescure *et al.* 1991); since they are taxa common to the islands located south of Martinique, Saint-Vincent, Béquia (Grenadines), Saint Lucia, for *S. vincenti*, and north of Martinique, Dominica for *S. festus*.

III. TAXINOMIC LIST OF MARTINIQUE SPHERODACTYLS

ABORIGINAL SPECIES

SAUROPSIDA Huxley, 1864 **SAUROPSIDES**

SQUAMATA Oppel, 1811 **SQUAMATES**

«**SAURIA**» Brongniart, 1800 **SAURIENS**

SPHAERODACTYLIDAE Underwood, 1954 **SPHERODACTYLS**

Sphaerodactylus Wagler, 1830 **Spherodactyl**

- *Sphaerodactylus vincenti* Boulenger, 1891 The Spherodactyl of the péninsula from the southwest of Martinique scattered towards Saint-Vincent, Béquia, St-Lucia
- *Sphaerodactylus festus* Barbour, 1915 The Spherodactyl with ocelli (eyespot) dispersed towards the North of Martinique, then towards the Dominica
- *Sphaerodactylus psammius* Schwartz, 1964 The Spherodactyl of South East of Martinique ; of the peninsula of Sainte-Anne
- *S. p. adamas* Schwartz, 1964 The Spherodactyl present on the Diamond Rock

IV. COMMENTS

The historical scenario of evolution of the genus *Sphaérodactylus* in Martinique presents similarities to that declined for the genus *Anolis* of Martinique. Moreover this historical scenario would be globally valid with chronological differences, for several genera of the micro herpetofauna the most formerly dispersed from the basin of the Orinoco towards the geographical position of the current banks of islands of the eastern Caribbean from the Eocene, for more than 40 My.

The common ancestors of the Ti Mabouya, dwarf geckos, Squamates of the genus *Sphaerodactylus* from Martinique, were able to disperse almost terrestrially, over the Caribbean isthmus (see Fig. 2 and Fig. 3) formed more than - 40 My (Stephan 1990); surviving on the island benches of the Martinique proto of the extinction linked to the submersion of this Caribbean isthmus which took place from -40 My to - 25 My, isolated, they have therefore genetically diverged since that time from their close relatives both from the South, ancestors of *Sphaerodactylus moléi* Boettger 1894 (Trinidad and South America), as well as those from the North, singularly ancestors of *Sphaerodactylus nicholsi* Hass 1991 (Puerto Rico) and generally of the Greater Antilles. The first speciations of this Ti Mabouya on Martinique proto began - 30 My ago (Hedges *et al.* 2015); then other speciation processes and therefore divergences started from - 12 My (Surget-Groba & Thorpe 2013); with dispersion towards new land, proto Saint Lucia, on Gros Ilet, and Maria Islands, generating *S. microlepis* Reinhardt & Lütken, 1862, and *S. festus* towards Caravelle (North Martinique).

It is the particular configuration of the proto Martinique (South-East) geologically, that is to say the existence in the basement, of large limestone formations out of water, compared to that of the other islands of the Eastern Caribbean (including Barbados), to have found itself as the only possible refuge for fauna and flora, with banks of islands tectonically remained emerged between - 24 My and -12 My. It is this situation which explains this scenario of which we have scientific certainty since 2008, of a Martinique center of dispersion on the scale of the Eastern Caribbean, for the *Anolis* (Johansson, Surget-Groba & Thorpe 2008), for the *Sphaérodactylus* (Surget-Groba & Thorpe 2013). This global scenario is presumed to become more precise as the work in molecular biology proceeds, and to be the same for Anurans, Amphibians of the genus *Eleutherodactylus*, as well as concerning the snake reptiles of the genus *Tetracheilostoma*.

Sphaérodactylus vincenti



Photo by A. Fong

The species was first observed and described on the island of Saint-Vincent by Boulenger in 1891, hence its taxon of *vincenti*, which can for an uninformed public, now since 2013 cause confusion. In reality molecular biology tells us that the Sphaerodactyls present in Saint-Vincent, in Béquia and for some in Saint Lucia, are descendants of the line of *Sphaérodactylus* from the peninsula of South-

West Martinique; lineage of the southwest of Martinique itself originating in the southeast of Martinique. (Surget-Groba & Thorpe 2013)

Sphaérodactylus festus



Photo by M. Bourgade

The species was first observed and described in Martinique by Barbour in 1915. It has been reduced to *S. v. festus* from the 1960s to the rank of subspecies subservient to *S. vincenti*, since it was mistakenly believed these Spherodactyla present in Martinique, originating in Saint-Vincent.

Many alleged subspecies have been described in Martinique particularly, in Dominica, in Saint Lucia, Béquia, by Schwartz (1964), Lazell, (1994) and Breuil (2013), under the taxon of *S. vincenti ssp.* ; In reality molecular biology tells us that the lineages of Spherodactyls present in the north of Martinique (and according to our own observations in the north of the peninsula of Southeast Martinique, north of the Montagne du Vauclin), are precisely originating from this southeast of Martinique, from where they dispersed from 12 My ago (Surget-Groba & Thorpe 2013). The *Sphaérodactylus* present in Dominica are descendants of a line of Spherodactyls whose specimens and / or propagules have undoubtedly drifted on rafts of plants towards Dominica (thanks to climatic events and phenomena or geological upheavals), from from the North Caribbean coast of Martinique, at the latitude of the Pitons du Carbet.

« *S. v. psammius* » => *Sphaérodactylus psammius*



Photo by M. Bourgade

Since 2013, Ti Mabouya with very specific phenotypes have been observed on the hills of the Sainte-Anne peninsula and particularly those called limestone hills. Spherodactyls of which many specimens in certain respects and criteria do not correspond to the description declined by Schwartz in 1964 of *S. v. psammius* which he observed on the beaches of the Salines in Sainte-Anne. These Ti Mabouya generally of the hills of Sainte-Anne are rather phenotypically close to *S. microlepis* of Saint Lucia, corroborating moreover the remark and deduction of Barbour (1921), presuming of the fact not verified by himself, of the presence in Martinique of this *S. microlepis* (Bourgade 2019).

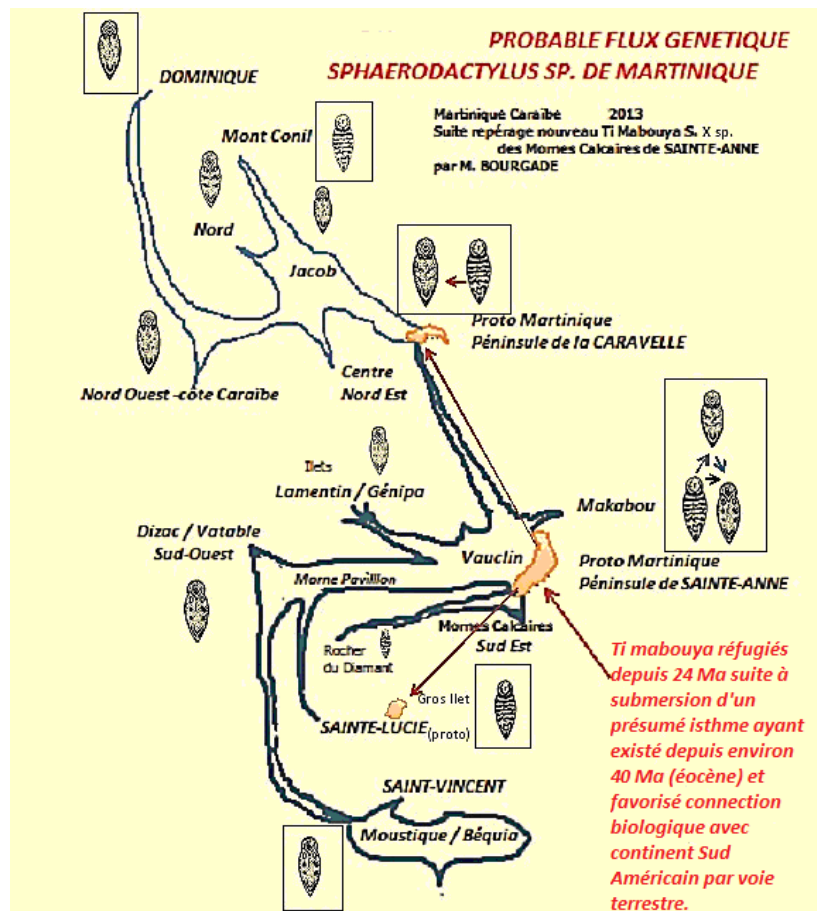
The work of Surget-Groba & Thorpe still in 2013 confirmed the distinction within *S. vincenti* of a line from south-west Martinique, well genetically differentiated from another line from south-east

Martinique. This scientific certainty makes it possible to recommend raising to the rank of species *S. v. psammius*, as a different species which has been observed in the south-east of Martinique since 1964 by Schwartz (Dewynter 2018, 2019).

Considering our own observations and according to criteria of analysis and morphological comparisons, between Ti Mabouya of Sainte-Anne and those of the Diamond Rock, we recommend in the taxonomic list of Spherodactyls proposed here, to classify these Spherodactyls present on the Rock Diamond as an alleged subspecies of *S. psammius*: *S. p. Adamas*. Literally the fabulous Spherodactyl of Diamond.



Opposite, an explanatory diagram worked out in 2013 allowing visualization of the geographic positions relative to the dispersion of the Spherodactyls present in the Eastern Caribbean (from Dominica to the Grenadines), starting from the center of dispersion of the south-east of proto-Martinique.



V. CONCLUSION

In the current state of knowledge, and since 2013, only two taxa are recognized for the Martinique Sphaerodactyl species present in the eastern Caribbean (Dominica, Saint Lucia, Saint Vincent, Béquia): *Sphaérodactylus festus* and *Sphaérodactylus vincenti*.

The geographical position of the current Sainte-Anne peninsula in the south-east of Martinique corresponding with certainty to the zone of refuge then of center of dispersion of the *Sphaérodactylus* which dispersed in the Eastern Caribbean from Dominica to the Grenadines; it is clearly relevant to raise to the rank of new species *S. psammius*, the recognized line of *Sphaérodactylus* from south-eastern Martinique, of the Sainte-Anne peninsula, under the current taxon of subspecies *S. v. psammius*.

Acknowledgments - I warmly thank Ansel Fong, and David Maceira, biologists from Santiago de Cuba, who since 2013 have encouraged me to persevere in my approach to herpetological and geological research. My thanks also go to Roger Mauvois for this basic information on geology, as well as to Garcin Malsa for his readings and reviews of my publications and manuscripts.

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