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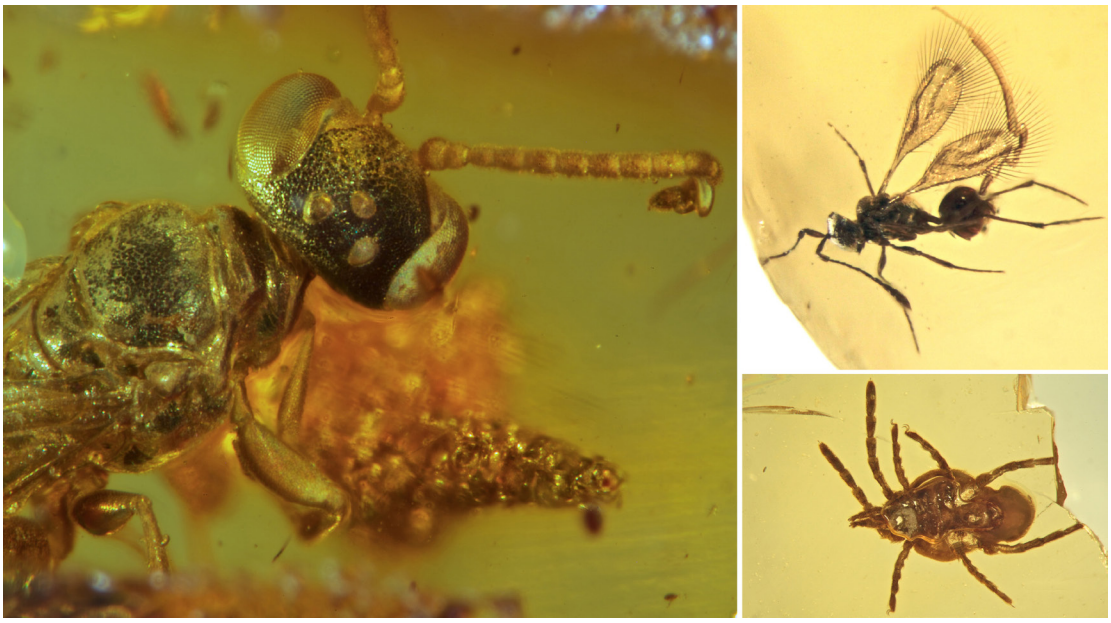
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Paleontological Contributions

Number 10A

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INTRODUCTION TO THEMATIC VOLUME "FOSSIL ARTHROPODS IN LATE CRETACEOUS VENDEAN AMBER (NORTHWESTERN FRANCE)"

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There is growing knowledge of the insect and arachnid Cretaceous diversity worldwide, most notably as a result of the discovery, in the past twenty years, of numerous Konservat-Lagerstätten (highly fossiliferous deposits) that provide a plethora of fossil arthropods (Wang & Szwedo, 2014). Early Cretaceous (Berriasian–Aptian) insects are known primarily from imprints in rocks, while fossiliferous amber yielding arthropod inclusions range mostly from the Albian to the Campanian – the sole exception being Hauterivian-Barremian amber of Lebanon and Jordan.

In France, only few (14) Cretaceous insect deposits are known, with their study still in a very nascent stage. Indeed, the first taxonomic descriptions of Cretaceous French insects did not appear before the 1970s, with 39 species recorded from amber of two Early Cenomanian localities in Anjou (Kühne, Kubig, & Schlüter, 1973; Schlüter, 1978, 1983; see detailed list of taxa in Perrichot & others, 2007: tab. 1). Investigations for additional paleoentomological material have been launched since the early 2000s, that have led to the discovery of twelve further localities (Fig. A1). Insect imprints are remarkably scarce, known only from two Early Cenomanian outcrops, and consisting of few wings or elytra of various Odonata and indeterminate Blattaria, Coleoptera, and Neuroptera, as well as one case of Trichoptera and coprolites of Isoptera (Nel & others, 2008, 2015; Colin & others, 2011; Vullo, Néraudeau, & Dépré, 2013). A significantly larger amount of data have been provided by amber inclusions from ten further localities, most of which from around the Early–Late Cretaceous boundary (Albian–Cenomanian), a crucial period in the evolution of insects (Szwedo & Nel, 2014). A single locality was found from later in the Cretaceous (Santonian), that has yielded relatively few insects (Choufani & others, 2013). All together, more than 2000 fossils of arthropods (arachnids, myriapods, hexapods, and crustaceans) are currently recorded from these outcrops, but mostly from Albian-Cenomanian Charentese amber, in southwestern France (Perrichot & others, 2007; Perrichot & Néraudeau, 2009; Perrichot, Néraudeau, & Tafforeau, 2010; Girard & others, 2013).

The present volume introduces systematic studies on fossil arthropods from a new amber deposit discovered in the early Late Cretaceous (Middle Cenomanian to Early Santonian, 97–85 Ma) of Vendée, a department in northwestern France (Fig. A1), and hereafter referred to as Vendean amber. The outcrop was accessible only briefly during work for enlargement of a road that took place between 2002 and 2005. The precise age of the amber is difficult to assess because the regional geology is rather complex: some boreholes around the outcrop have revealed three Cretaceous lignitic strata dated by palynological analyses as Middle–Late Cenomanian, Early Turonian, and Early Santonian, that sometimes lie unconformably on each other (Ters & Viaud, 1983; Legrand & others, 2006). Unfortunately, the sediment associated with amber yielded only few, poorly preserved palynomorphs without marker species, and the outcrop is currently unaccessible, preventing any stratigraphic correlation. Resolving this issue is still work in progress, and more details on the regional geology, chemical and taphonomical characteristics of the amber, the associated plant remains, and the plant source of the resin will be discussed elsewhere (Néraudeau & others, in prep.).

All the material (5700 pieces of amber totaling 305 grams only) was provided to us by private collectors who discovered and exploited

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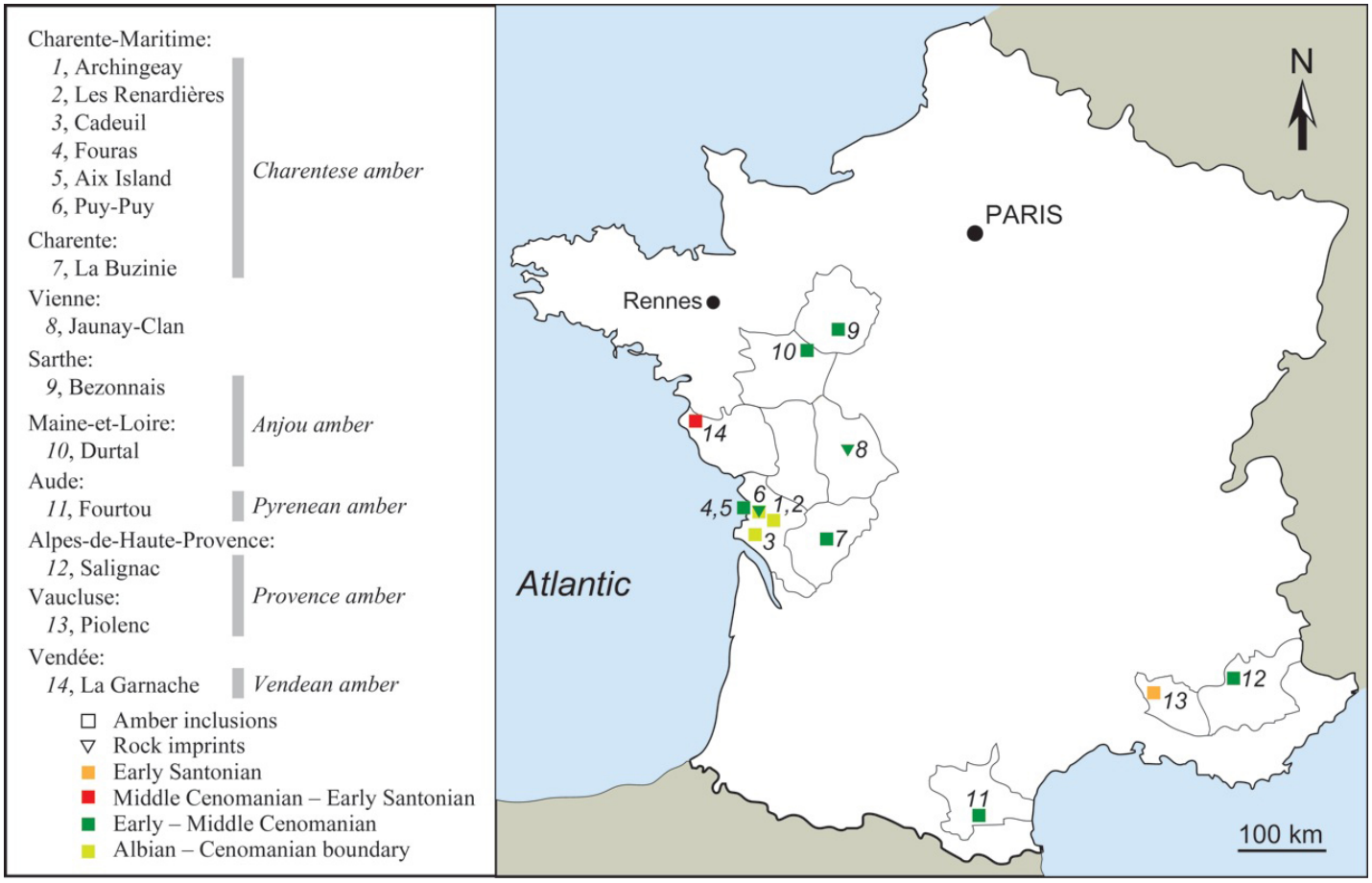


Figure A1. Location of the Vendean amber deposit and other known Cretaceous insect localities from France.

the outcrop before it was sealed by the construction of a paved road. Most of the pieces are 3 to 10 mm in size, but rare larger pieces up to 35 mm were also found (Fig. A2). Amber grains are clear yellow to orange in colour, with only a thin weathered surface, and biological inclusions are generally exquisitely preserved, with only few distortion or alteration. Despite the small amount of amber, investigation for its fossiliferous content revealed a high biotic diversity, with 171 arthropod inclusions recorded (Table A1) together with various microinclusions such as spider webs (Saint Martin & others, 2014), bacterial filaments, fungal hyphae, sponge spines, fern spores, and diatoms (Saint Martin & others, 2015). Vendean amber is therefore exceptionally rich in arthropod inclusions compared to similar amber deposits with a majority of small-sized pieces. Ambers from the Triassic of Italy and the Santonian of southeastern France, for example, are very similar in aspect but contain only a handful of arthropods each (Schmidt & others, 2012; Choufani & others, 2013).

Contributions in this volume provide new insights on the taxonomic diversity of Cretaceous insects and spiders, their morphological disparity, paleoecology, paleobiogeographical distribution, and their relationships with modern lineages. It also enlightens the entomofauna from the Late Cretaceous of western Europe which is otherwise poorly known. Newly described taxa include one species of spider (Penney, 2014: 10B in this volume) and six genera and eleven species of various insects – barklice (Azar, Nel, & Perrichot, 2014: 10C in this volume); earwigs (Engel & Perrichot, 2014a: 10D in this volume); termites (Engel, 2014: 10E in this volume); dustywings (Perrichot & others, 2014: 10F in this volume); flies and midges (Choufani & others, 2014: 10H in this volume; Perrichot & Engel, 2014: 10G in this volume); and wasps (Bennett, Perrichot, & Engel, 2014: 10I in this volume; Engel & Perrichot, 2014b: 10J in this volume).

All specimens described in this volume or to be described elsewhere were kindly donated to the Geological Department of Rennes University by private collectors. We are grateful to all of them: Fanny Dupé who first discovered the Vendean amber, as well as Arlette Boulo, Thérèse Corgnet, Dominique Doyen, Anne-Marie Guèdes, Gérard Guérineau, Alain Guillet and brothers, Didier Graves, Luc Lucas, and Magali Weigandt. This special volume is dedicated to the late André Dupé who also participated in amber collection with his wife Fanny, and sadly passed away before we could publish this work; André and Fanny have long provided tireless efforts and tremendous interest for this fossil deposit. We are also grateful to the Conseil Général de Vendée and the Agence Routière Départementale de Challans for assistance during field work; to colleagues and friends who contributed the different papers or identification of all fossil inclusions; to the many referees for the critical reviews of the manuscripts; and to the chief and technical editors of this volume, Prof. Paul Selden and Denise Mayse for great support in editing of this work.



Figure A2. A sample of Vendean amber showing the size and color of various pieces.

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Class Order	Suborder/Family	Number of specimens
Crustacea		
Isopoda	indet.	28
Tanaidacea	Alavatanaidae	1
Diplopoda		
Polyxenida	Polyxenidae	1
Arachnida		
Acari	Mesostigmata	2
	Prostigmata	8
	'Hydracarina'?	1
	indet.	17
Araneae	Theridiosomatidae*	1
	indet.	8
Opiliones	indet.	1
Entognatha		
Collembola	indet.	1
Insecta		
Blattaria	indet.	1
Coleoptera	Ptinidae	2
	indet.	2
Dermaptera	Neodermaptera*	1
Diptera	Cecidomyiidae	4
	Ceratopogonidae*	10
	Chironomidae	5
	Dolichopodidae*	1
	Anisopodidae	3
	indet.	9
Hemiptera	Eriococcidae	1
	Fulgoromorpha	2
	indet.	2
Hymenoptera	Crabronidae*	1
	Megaspilidae	1
	Mymaridae	4
	Mymarommatidae	5
	Platygastridae	8
	Serphitidae*	2
	indet.	3
Isoptera	'*Meiatermes*-grade'*	1
Neuroptera	Berothidae	1
	Coniopterygidae*	1
Orthoptera	Grylloidea	1
Psocodea	Archaeatropidae*	3
	Amphientometae*	1
	Mesopsocidae*	2
	indet.	3
Thysanoptera	Merothripidae	1
	indet.	1
Indet.		14
Arthropoda	indet.	6
	Total Arthropods	**171**

Table A1. Arthropod taxa recorded from Vendean amber (*denotes taxa described in the present volume)