

# Fossil echinoid (Echinoidea, Echinodermata) diversity of the Early Cretaceous (Hauterivian) in the Paris Basin (France)

Sophie Benetti<sup>1</sup>, Thomas Saucède<sup>1</sup>, Bruno David<sup>1</sup>

<sup>1</sup> UMR CNRS 6282 Biogéosciences, Université de Bourgogne, 6 boulevard Gabriel, 21000, Dijon, France

Corresponding author: *Thomas Saucède* (thomas.saucede@u-bourgogne.fr)

---

Academic editor: *Mike Reich* | Received 8 March 2013 | Accepted 5 August 2013 | Published 20 August 2013

---

**Citation:** Benetti S, Saucède T, David B (2013) Fossil echinoid (Echinoidea, Echinodermata) diversity of the Early Cretaceous (Hauterivian) in the Paris Basin (France). ZooKeys 325: 65–75. doi: 10.3897/zookeys.325.5085 Resource ID: GBIF key: <http://gbrds.gbif.org/browse/agent?uuid=98442b0b-9f7b-4924-9289-5b793946ca01>

---

**Resource citation:** Thomas Saucède (2013) Fossil echinoid (Echinoidea, Echinodermata) diversity of the Early Cretaceous (Hauterivian) in the Paris Basin (France). Online at [http://ipt.pensoft.net/ipt/resource.do?r=hauterivian\\_echinoids\\_of\\_the\\_paris\\_basin](http://ipt.pensoft.net/ipt/resource.do?r=hauterivian_echinoids_of_the_paris_basin), Version 2.0 (last updated on 2013-08-16), GBIF key: <http://gbrds.gbif.org/browse/agent?uuid=98442b0b-9f7b-4924-9289-5b793946ca01>. Data Paper ID: doi: 10.3897/zookeys.325.5085

## Abstract

This dataset inventories occurrence records of fossil echinoid specimens collected in the Calcaires à Spatangues Formation (CSF) that crops out in the southeast of the Paris Basin (France), and is dated from the *Acanthodiscus radiatus* chronozone (*ca.* 132 Ma, early Hauterivian, Early Cretaceous). Fossil richness and abundance of the CSF has attracted the attention of palaeontologists since the middle of the nineteenth century. This dataset compiles occurrence data (referenced by locality names and geographic coordinates with decimal numbers) of fossil echinoids both collated from the literature published over a century and a half, and completed by data from collection specimens. The dataset also gives information on taxonomy (from species to order and higher taxonomic levels), which has been checked for reliability and consistency. It compiles a total of 628 georeferenced occurrence data of 26 echinoid species represented by 22 genera, 14 families, and 9 orders.

## Keywords

Echinoids, Hauterivian, Early Cretaceous, Paris Basin, France, Calcaires à Spatangues Formation

## Introduction

The Calcaires à Spatangues Formation (CSF) consists of shallow marine sediments deposited in the southeast of the Paris Basin (France) during the very Early Cretaceous (early Hauterivian, *Acanthodiscus radiatus* chronozone) about 132 million years ago, at the maximum of a second order sea level rise (Bulot et al. 2000; Courtinat et al. 2006; Bodin et al. 2009). Preserved deposits of near-shore and shallow marine environments are not common in Western Europe for that time-interval where deep-sea basin and deep shelf sediments predominated (Canérot and Cugny 1982; Rat et al. 1987; Schootbrugge et al. 2000). Deposits of the CSF yield a diversified, speciose and locally abundant fossil fauna, essentially composed of benthic invertebrates among which echinoids are common and locally very abundant (Cornuel 1841; Rat et al. 1987; Courtinat et al. 2006). In that respect, the CSF is a window on the little known benthic communities that thrived in shallow marine environments in the Early Cretaceous.

Fossil richness of the CSF has attracted the attention of palaeontologists since the middle of the nineteenth century (Cotteau 1857–1878, 1862–1867; Valette 1908; Corroy 1925; Rat et al. 1987; Walter 1996; Saucède et al. 2012). Fifty-four echinoid species were described in the CSF in all, half of them (26 species) based on type specimens collected in the CSF. However, many nominal species are geographically restricted and morphologically little differentiated. Of the 54 echinoid species ever described, Saucède et al. (2012) recognized only 26 species that belong to 16 different families, among which regular (13 species) and irregular (13 species) echinoids are represented in equal proportion. This still represents a high level of fossil echinoid diversity for that time-period, which can be explained by a putative high beta-diversity due to the numerous microhabitats present in shallow marine environments at that time and by the richness of cassiduloid echinoids, the group being particularly well-diversified in coarse sediment environments in the Early Cretaceous (Kier 1962).

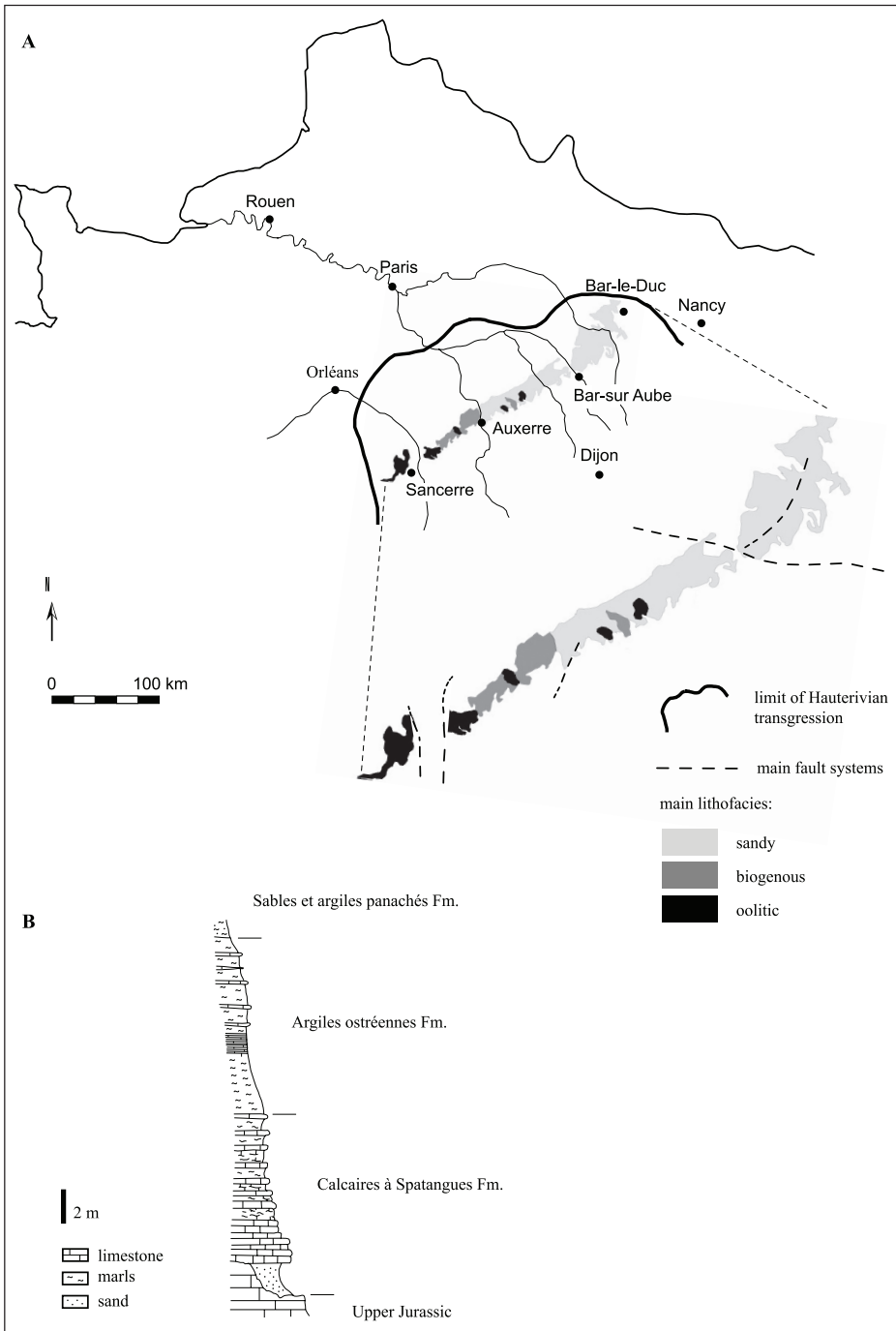
## Project details

**Project title:** Inventory of the fossil echinoid diversity of the Early Cretaceous (Hauterivian) in the Paris Basin (France).

**Personnel:** Sophie Benetti (data manager, data publisher), Thomas Saucède (collection identifier, data collector, data manager, data publisher), Bruno David (data collector, data manager)

**Funding sources:** BioME team, UMR CNRS 6282 Biogéosciences, Université de Bourgogne.

**Study area description.** This dataset inventories occurrence records of fossil echinoid specimens collected in the Calcaires à Spatangues Formation (CSF) that crops out in the southeast of the Paris Basin (France), from the town of Bar-le-Duc in the northeast to Sancerre in the southwest (Fig. 1A). The CSF is dated from the *Acanthodiscus radiatus* chronozone (*ca.* 132 Ma, early Hauterivian, Early Cretaceous) accord-



**Figure 1.** Geographic, geologic, and stratigraphic settings. A. Map showing the area of the Paris Basin (France) where the Calcaires à Spatangues Fm. crops out (modified after Courtinat et al. 2006 and Saucède et al. 2012). Distribution of main lithofacies as defined by Rat et al. (1987). B. Calcaires à Spatangues Fm. section at Lantanges 48°08'N; 4°24'E (modified after Rat et al. 1987).

ing to the cephalopods collected: *Acanthodiscus radiatus* (Bruguière, 1789), *Leopoldia leopoldina* group (d'Orbigny, 1841), and *Cymatoceras pseudoelegans* (d'Orbigny, 1840) (Cornuel 1841; Mégnien and Mégnien 1980; Magniez-Jannin 1984; Rat et al. 1987; Reboulet et al. 2009). The CSF is composed of limestone and clay deposits (Fig. 1B), only a few meter thick (*ca.* 0.5 to 8 m) with dominant bioclastic lithofacies (Rat et al. 1987). The average palaeo-depth was moderate (approximately few meters to *ca.* 20–30 m) based on dinoflagellates, foraminifer and bryozoan assemblages, and the overall sedimentation rate was low as suggested by the abundance of worn ferruginous bioclasts and ooliths (Rat et al. 1987; Walter 1996; Courtinat et al. 2006).

**Design description.** This dataset compiles occurrence data (all data are referenced by locality names and georeferenced WGS1984) of fossil echinoids collated from the literature published over a century and a half, from 1857 to 2012, by Cotteau (1857–1878; 1862–1867), Valette (1908), Corroy (1925), Rat et al. (1987), and Saucède et al. (2012). The dataset was completed by data from collection specimens housed at the department of Geology of Université de Bourgogne (Dijon, France), specimens sampled in the field by J Houdard, A Valette, B David, and P Robert, at the Muséum national d'Histoire naturelle (Paris, France), specimens sampled by J Lambert, and at the department of Geosciences of Université de Rennes 1 (Rennes, France), specimens sampled by P Courville. The dataset also gives information on taxonomy (from species to order and higher taxonomic levels). Systematics was reviewed and homogenized by T Saucède for taxonomic relevance (Saucède et al. 2012).

## Taxonomic coverage

**General taxonomic coverage description:** fossil regular and irregular echinoids (Echinodermata: Echinoidea) of the Calcaires à Spatangues Formation represented by 26 species, 22 genera, 14 families, and 9 orders.

## Taxonomic ranks

**Kingdom:** Animalia

**Phylum:** Echinodermata

**Class:** Echinoidea Leske, 1778

**Orders:** Arbacioida Gregory, 1900; Cassiduloida L. Agassiz & Desor, 1847; Cidaroida Claus, 1880; Holasteroida Durham & Melville, 1957; Holoctypoida Duncan, 1889; Pedinoida Mortensen, 1939; Phymosomatoida Mortensen, 1904; Salenioidea Delage & Herouard, 1903; Spatangoida L. Agassiz, 1840.

**Families:** Cidaridae Gray, 1825; Hemicidaridae Wright, 1857; Emiratiidae Ali, 1990; Stomechinidae Pomel, 1883; Acropeltidae Lambert & Thiéry, 1914; Arbaciidae Gray, 1855; Saleniidae L. Agassiz, 1838; Pedinidae Pomel, 1883; Holoctypidae Lambert, 1899; Conulidae Lambert, 1911; Clypeidae Lambert,

1898; Pygaulidae Lambert, 1905; Nucleolitidae Agassiz & Desor, 1847; Toxasteridae Lambert, 1920.

**Genera:** *Goniopygus* Agassiz, 1838; *Codiopsis* Agassiz, 1840; *Disaster* Agassiz, 1836; *Pseudocidaris* Etallon, 1859; *Pygurus* Agassiz, 1839; *Clypeopygus* d'Orbigny, 1856; *Nucleolites* Lamarck, 1801; *Phyllobrissus* Cotteau, 1859; *Pygorhynchus* Agassiz, 1839; *Plagiochasma* Pomel, 1883; *Plegiocidaris* Pomel, 1883; *Salvaster* Saucède, Dudicourt & Courville, 2012; *Pseudholaster* Pomel, 1883; *Globator* Agassiz, 1840; *Coenholectypus* Pomel, 1883; *Pygolampas* Saucède, Dudicourt & Courville, 2012; *Hemipedina* Wright, 1855; *Loriolia* Neumayr, 1881; *Tetragramma* Agassiz, 1840; *Stomechinus* Desor, 1856; *Hyposalenia* Desor, 1856; *Toxaster* Agassiz, 1840.

**Species:** *Plegiocidaris salviensis* (Cotteau, 1851); *Plegiocidaris lardyi* (Desor, 1855); *Plegiocidaris friburgensis* (de Loriol, 1873); *Plegiocidaris muricata* (Roemer, 1836); *Pseudocidaris clunifera* (Agassiz, 1836); *Loriolia rotularis* (Agassiz, 1836); *Loriolia bourgueti* (Agassiz, 1840); *Tetragramma autissiodorensis* (Cotteau, 1851); *Stomechinus fallax* (Agassiz, 1840); *Goniopygus peltatus* (Agassiz, 1836); *Codiopsis lorini* Cotteau, 1851; *Hyposalenia stellulata* (Agassiz, 1838); *Hemipedina minima* (Cotteau, 1851); *Coenholectypus macropygus* (Agassiz, 1836); *Globator incisa* (Agassiz, in Desor 1842); *Pygurus montmollini* (Agassiz, 1836); *Plagiochasma offersii* (Agassiz, 1836); *Pygorhynchus obovatus* (Agassiz, 1836); *Nucleolites salviensis* Cotteau, 1851; *Phyllobrissus gresslyi* (Agassiz, 1839); *Clypeopygus paultrei* (Cotteau, 1851); *Pygolampas edita* Saucède, Dudicourt & Courville 2012; *Disaster subelongatus* (d'Orbigny, 1853); *Salvaster roberti* Saucède, Dudicourt & Courville 2012; *Pseudholaster intermedius* (Goldfuss, 1829); *Toxaster retusus* (Lamarck, 1816).

## Spatial coverage

### General spatial coverage

The sampling area focuses on the Calcaires à Spatangues Formation that crops out in the southeast of the Paris Basin (France) (Fig. 1A). The study area extends over the six following French departments: Cher, Nièvre, Yonne, Aube, Haute-Marne, and Meuse.

### Coordinates

47°33.00'N and 48°73.00'N Latitude; 2°75.00'E and 5°12.00'E Longitude.

### Temporal coverage

1851–1995.

## Collection description

**Collection names:** J Houdard, A Valette, B David, and P Robert collections housed at Université de Bourgogne (Dijon, France); P Courville collection housed at Université de Rennes 1 (Rennes, Dijon); J Lambert collection housed at Muséum national d’Histoire naturelle (Paris, France).

**Curatorial unit:** Géosciences, Université de Rennes 1 (Rennes, France), Geology department, Université de Bourgogne (Dijon, France), Muséum national d’Histoire Naturelle (Paris, France).

**Collection identifiers:** B David, T Saucède.

## Method

**Method step description.** Specimens were both collected in the field and consulted in public collections of Université de Rennes 1 (Rennes, France), Université de Bourgogne (Dijon, France), and Muséum national d’Histoire Naturelle (Paris, France). Identification of specimens was performed at species level based on descriptions by G Cotteau (1857–1878; 1862–1867), A Valette (1908), G Corroy (1925), P Rat et al. (1987), and T Saucède et al. (2012). Taxonomy was updated when it proved necessary following Kier (1962), Durham et al. (1966), Smith (1984), and Kroh and Smith (2010). Though paraphyletic, some family names have been used for convenience (Nucleolitidae Agassiz & Desor, 1847; Toxasteridae Lambert, 1920). The accuracy and geographic coordinates of localities where collection specimens came from was checked based on geological grounds (BRGM sources). Dubious localities were discarded.

**Study extent description.** The Calcaires à Spatangues Formation consists of shallow marine sediments that were deposited in the southeast of the Paris Basin (France) during the early Hauterivian (*Acanthodiscus radiatus* zone). These deposits are rich and diversified in a benthic fauna among which echinoids predominate. The systematic status of echinoids of the Calcaires à Spatangues Fm. was revised so as to update the list of echinoid species reported in the Formation and better assess its remarkable diversity. Of the 54 echinoid species ever described, 26 species are recognized that belong to 16 different families, among which regular (13 species) and irregular (13 species) echinoids are represented in equal proportion.

**Data resources:** the data underpinning analyses of the paper are deposited at GBIF, the Global Biodiversity Information Facility, [http://ipt.pensoft.net/ipt/archive.do?r=hauterivian\\_echinoids\\_of\\_the\\_paris\\_basin](http://ipt.pensoft.net/ipt/archive.do?r=hauterivian_echinoids_of_the_paris_basin)

## Dataset

**Citation identifier:** [http://ipt.pensoft.net/ipt/resource.do?r=hauterivian\\_echinoids\\_of\\_the\\_paris\\_basin](http://ipt.pensoft.net/ipt/resource.do?r=hauterivian_echinoids_of_the_paris_basin)

**Dataset description:** see design description

**Object name:** Darwin Core Archive hautoerivian\_echinoids\_of\_the\_paris\_basin

**Character encoding:** UTF-8

**Format name:** Darwin Core Archive format

**Format version:** 1.0

**Distribution:** [http://ipt.pensoft.net/ipt/archive.do?r=hautoerivian\\_echinoids\\_of\\_the\\_paris\\_basin](http://ipt.pensoft.net/ipt/archive.do?r=hautoerivian_echinoids_of_the_paris_basin)

**Publication date of data:** 2013-08-13

**Language:** English

**Metadata language:** English

**Date of metadata creation:** 2013-08-13

**Hierarchy level:** Dataset

## Acknowledgements

This data paper is a contribution of the BioME team of Biogéosciences laboratory (UMR CNRS 6282). The authors are indebted to the reviewers N Schlüter and A Kroh who improved the quality of this manuscript.

## References

- Agassiz L (1836) *Prodrome d'une Monographie des Radiaires*. Mémoire de la Société des Sciences Naturelles de Neuchâtel 1: 168–199.
- Agassiz L (1838) *Monographies d'Échinodermes vivants et fossiles*. Première monographie: Des Salénies. Petitpierre, Neuchâtel, 32 pp. doi: 10.5962/bhl.title.1833
- Agassiz L (1839) *Description des Echinodermes fossiles de la Suisse*. 1. Spatangoides et Clypeasteroides. *Nouveau Mémoire de la Société Helvétique des Sciences naturelles* 3(3): 1–101.
- Agassiz L (1840) *Description des Echinodermes fossiles de la Suisse*. 2. Cidarides. *Nouveau Mémoire de la Société Helvétique des Sciences naturelles* 4(2): 1–107.
- Agassiz L, Desor E (1847) *Catalogue Raisonné des Espèces, de Genres, et des Familles d'Echinides*. Part 1. *Annales des Sciences Naturelles* 3(7): 129–168.
- Ali MSM (1990) Cenomanian echinoids from Ras al Khaimah, United Arab Emirates. *Neues Jahrbuch für Mineralogie, Geologie und Paläontologie, Abhandlungen* 179(1): 97–116.
- Bodin S, Fiet N, Godet A, Matera V, Westermann S, Clément A, Janssen NMM, Stille P, Föllmi KB (2009) Early Cretaceous (late Berriasian to early Aptian) palaeoceanographic change along the northwestern Tethyan margin (Vocontian Trough, southeastern France):  $\delta^{13}\text{C}$ ,  $\delta^{18}\text{O}$  and Sr-isotope belemnite and whole-rock records. *Cretaceous Research* 30 (5): 1247–1262. doi: 10.1016/j.cretres.2009.06.006
- Breynius JP (1732) *Dissertatio physica de Polythalamiis, nova testaceorum classe, cui quaedam praemittuntur de methodo testacea in classes et genera distribuendi*. Huic adiicitur

- commentatiuncula de Belemnitis prussicis, tandemque schediasma de Echinis methodice disponendis. Beughem, Gedani, 64 pp.
- Bruguère JG (1789) *Encyclopédie Méthodique. Histoire naturelle des Vers.* Panckoucke, Paris, 757 pp.
- Bulot LG, Ait Ouali R, Baraboschkin EJ, Canérot J, Funk H-P, Guiraud R, Hirsh F, Masse J-P, Memmi L, Mutterlose J, Nikishin A, Platel J-P, Poisson A, Rawson PF, Rey J, Sandulescu I (2000) Early Hauterivian (123–121 Ma) In: Dercourt J et al. (Eds) *Atlas Peri-Tethys, Palaeogeographical maps.* CCGM/CGMW, Paris, 111–118.
- Canérot J, Cugny P (1982) La plate-forme Hauterivienne des Ibérides sud-orientales (Espagne) et ses environnements bio-sédimentaires. *Cretaceous Research* 3 (1–2): 91–101. doi: 10.1016/0195-6671(82)90010-6
- Claus CFW (1880) *Grundzüge der Zoologie.* NG Elwert, Marburg and Leipzig, 1254 pp.
- Cornuel J (1841) Mémoire sur le terrain Crétacé inférieur et supra Jurassique de l'Arrondissement de Wassy (Haute-Marne). *Mémoires de la Société géologique de France* 4: 229–290.
- Corroy G (1925) Le Néocomien de la bordure orientale du Bassin de Paris. *Bulletin de la Société des Sciences naturelles de Nancy* 4: 171–506.
- Cotteau GH (1851) Catalogue méthodique des échinides recueillis dans l'étage néocomien de l'Yonne. *Bulletin de la Société des Sciences historiques et naturelles de l'Yonne* 5: 1–283.
- Cotteau GH (1857–1878) *Etudes sur les échinides fossiles du département de l'Yonne. Tome II. Terrain Crétacé.* J-B Baillière, Paris, 518 pp.
- Cotteau GH (1862–1867) *Paléontologie française. Description des Animaux Invertébrés. Terrains Crétacés. Tome 7. Echinides.* V Masson and fils, Paris, 892 pp.
- Courtinat B, Ferry S, Courtinat S (2006) Les kystes de dinoflagellés des Argiles Ostréennes du Bassin de Paris, France. *Revue de micropaléontologie* 49: 11–19. doi: 10.1016/j.revmic.2005.10.003
- Delage Y, Hérouard E (1903) *Traité de zoologie concrète. Tome III. Les échinodermes.* Schleicher Frères et Cie, Paris, 495 pp.
- Desor E (1842) Des Galerites, *Monographies d'échinodermes vivants et fossiles* In: Agassiz L (Ed) Neuchâtel, 94 pp.
- Desor E (1855–1858) *Synopsis des Échinides Fossiles.* C Reinwald, Paris, 490 pp.
- Duncan PM (1889) A revision of the genera and great groups of the Echinoidea. *Journal of the Linnean Society, Zoology* 23 (141–144): 1–311.
- Durham JW, Melville RV (1957) A classification of Echinoids. *Journal of Paleontology* 31(1): 242–272.
- Durham JW, Fell HB, Fischer AG, Kier PM, Melville RV, Pawson DL, Wagner CD (1966) Echinoids, *Treatise on Invertebrate Paleontology, Part U.* In: Moore RC (Ed) *Echinodermata-Echinozoa-Echinoidea* 3. Geological Society of America, Boulder, Colo., and University of Kansas Press, Lawrence, Kans., 211–640.
- Erallon A (1859) *Etudes paléontologiques sur la Haut-Jura: Rayonnés du Corallien.* Mémoires de la Société d'Emulation du Doubs, série 3 (3): 401–553.
- Goldfuss A (1826–1829) *Petrefacta Germaniæ tam ea, quae in Museo Universitatis Regiae Borussicae Fridericiae Wilhelmae Rhenanae servantur, quam alia quaecunque in Museis Hoeninghusiano Muensteriano aliisque extant, Iconibus et Descriptionibus illustrata.*



- Abbildungen und Beschreibungen der Petrefacten Deutschlands und der angränzenden Länder, unter Mitwirkung des Herrn Grafen Georg zu Münster. Arnz and Co, Düsseldorf, 1(1): viii + 76 pp, 1–25 pls; 1(2): 77–164, 26–50 pls.
- Gras A (1852) Catalogue des corps organisés fossiles qui se rencontrent dans le département de l'Isère. Mainsonville, Grenoble, 54 pp. doi: 10.5962/bhl.title.10767
- Gray JE (1825) An attempt to divide the Echinida, or sea eggs, into natural families. *Annals of Philosophy* 26: 423–431.
- Gray JE (1855) Arrangement of families of Echinidea. *Proceedings of the Zoological Society of London* 23: 35–39.
- Gregory JW (1900) The Echinoidea. In: Lankester ER (Ed) *A Treatise on Zoology*. Part III, the Echinodermata A and C Black. London, 237–281.
- Kier PM (1962) Revision of the cassiduloid echinoids. *Smithsonian Miscellaneous Collections* 144(3): 262 pp.
- Kroh A, Smith AB (2010) The phylogeny and classification of post-Palaeozoic echinoids. *Journal of Systematic Palaeontology* 8(2): 147–212. doi: 10.1080/14772011003603556
- Lamarck JBPA M de (1801) *Système des animaux sans vertèbres*. Déterville, Paris, viii + 432 pp.
- Lamarck JBPA M de (1816) *Histoire naturelle des animaux sans vertèbres*. 3. Radiaires, Vers, Insectes (Echinides). Baillière, Paris, 770 pp.
- Lambert J (1898) Note sur les échinides de la Craie de Ciplly. *Bulletin de la Société belge de Géologie, de Paléontologie et d'Hydrologie* 11: 141–190.
- Lambert J (1899) Note sur le échinides de la craie de Ciplly. *Bulletin de la Société belge de Géologie, de Paléontologie et d'Hydrologie* 11: 1–50.
- Lambert J (1905) Echinides du sud de la Tunisie (environs de Tatahouine). *Bulletin de la Société Géologique de France* 4(6): 695–723.
- Lambert J (1911) Descriptions des Echinides néocomiens du Bassin du Rhône. *Mémoires de la Société paléontologique suisse* 37–38: 1–102.
- Lambert J (1920) Sur quelques genres nouveaux d'Echinides. *Mémoires de la Société académique de l'Aube* 83–84: 145–174.
- Lambert J, Thiéry P (1909–1925) *Essai de nomenclature raisonnée des échinides*. Ferrière, Chaumont, 607 pp.
- Leske NG (1778) *Jacobi Theodori Klein Naturalis dispositio Echinodermatum*, edita et descriptionibus novisque inventis et synonymis acutorum aucta. GE Beer, Lipsiae, xxii + 278 pp.
- Loriol P de (1873) *Echinologie helvétique: Description des oursins fossiles de la Suisse*, deuxième partie. Echinides de la période crétacée. *Matériaux pour la paléontologie de la Suisse* 6: 398 pp.
- Lóvén S (1883) On Pourtalesia a genus of Echinoidea. *Kongliga Svenska Vetenskaps-Akademiens Handlingar* 19 (7): 1–95.
- Magniez-Jannin F (1984) Signification biostratigraphique et paléoécologique des associations de foraminifères de l'Hauterivien-Barrémien. In: Oertli HJ (Ed) *Benthos '83'*, 2e Symposium International sur les Foraminifères Benthiques (Pau 1983). *Bulletin des centres de recherches Exploration-Production Elf-Aquitaine*, 401–408.
- Mégnyen C, Mégnyen F (1980) *Synthèse Géologique du Bassin de Paris*. Volume I: Stratigraphie et paléogéographie. *Mémoires du Bureau de Recherches géologiques et minières* 101: 1–466.

- Mortensen T (1904) The Danish Expedition to Siam 1899–1900: II, Echinoidea. Det Kongelige Danske Videnskabernes Selskabs Skrifter (Naturv.-math. Afd.: R. 7) 1(1): 1–124, 1–7 pls.
- Mortensen T (1939) New Echinoida (Aulodonta). Preliminary Notice. Videnskabelige Meddelelser fra Dansk naturhistorisk Forening i København 103: 547–550.
- Neumayr M (1881) Morphologische Studien über fossile Echinodermen. Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften, mathematisch-naturwissenschaftliche Classe 84: 143–176.
- Orbigny AD d' (1840–1841) Paléontologie française, terrains crétacés, tome 1 (Céphalopodes). Masson, Paris, 662 pp.
- Orbigny AD d' (1853–1859) Paléontologie française, terrains crétacés, tome 6 (Echinoïdes irréguliers). Masson, Paris, 596 pp.
- Pomel A (1883) Classification Méthodique et Genera des Echinides Vivants et Fossiles. Jourdan, Alger, 131 pp. doi: 10.5962/bhl.title.11272
- Rat P, David B, Magniez-Jeannin F, Pernet O (1987) Le golfe du Crétacé inférieur sur le Sud-Est du Bassin parisien: milieux (échinides, foraminifères) et évolution de la transgression. In: Transgressions et régressions au Crétacé, France et régions voisines. Mémoires géologiques de l'Université de Dijon 11: 15–29.
- Reboulet S, Klein J, Barragan R, Company M, Gonzalez-Arreola C, Lukeneder A, Raisossadat SN, Sandoval J, Szives O, Tavera JM, Vašíček Z, Vermeulen J (2009) Report on the 3rd International Meeting of the IUGS Lower Cretaceous Ammonite Working Group, the «Kilian Group» (Vienna, Austria, 15th April 2008). Cretaceous Research 30 (2): 496–502. doi: 10.1016/j.cretres.2008.12.009
- Roemer FA (1836) Die Versteinerungen des norddeutschen Oolithengebirges. Hahn, Hannover, 218 pp.
- Saucède T, Dudicourt J-C, Courville P (2012) Description of two new fossil echinoids (Echinodermata: Echinoidea) from the Early Hauterivian (Early Cretaceous) of the Paris Basin (France). Zootaxa 3512: 75–88.
- Schootbrugge B van de, Föllmi KB, Bulot LG, Burns SJ (2000) Paleooceanographic changes during the early Cretaceous (Valanginian-Hauterivian): evidence from oxygen and carbon stable isotopes. Earth and Planetary Science Letters 181 (1–2): 15–31. doi: 10.1016/S0012-821X(00)00194-1
- Smith AB (1981) Implications of lantern morphology for the phylogeny of post-paleozoic echinoids. Palaeontology 24 (4): 779–801.
- Smith AB (1984) Echinoid Palaeobiology (Special Topics in Palaeontology, 1). Allen and Unwin, London, 190 pp.
- Valette DA (1908) Révision des échinides fossiles de l'Yonne 2. Bulletin de la Société des Sciences historiques et naturelles de l'Yonne 61 (2): 183–385.
- Walter B (1996) La faune de bryozoaires de la transgression hauterivienne dans le Bassin de Paris. Geobios 29 (1): 5–11. doi: 10.1016/S0016-6995(96)80066-0
- Wright TW (1855–60) Monograph of the British fossil Echinodermata of the Oolitic formations, vol. 1, Echinoidea. Monograph of the Palaeontographical Society, London, 481 pp.
- Zittel KA von (1876–1880) Handbuch der Paläontologie (1). R. Oldenbourg, München and Leipzig, 765 pp.

## Appendix

Occurrence records of Hauterivian echinoids of the Paris basin. (doi: 10.3897/zookeys.325.5085.app) File format: Microsoft Excel document (xls).

**Explanation note:** Table with occurrence data (referenced by locality names and geographic coordinates with decimal numbers) of fossil echinoids both collated from the literature and completed by data from collection specimens. The table also gives information on taxonomy (from species to order and higher taxonomic levels), which has been checked for reliability and consistency. It compiles a total of 628 georeferenced occurrence data of 26 echinoid species represented by 22 genera, 14 families, and 9 orders.

**Copyright notice:** This dataset is made available under the Open Database License (<http://opendatacommons.org/licenses/odbl/1.0/>). The Open Database License (ODbL) is a license agreement intended to allow users to freely share, modify, and use this Dataset while maintaining this same freedom for others, provided that the original source and author(s) are credited.

---

**Citation:** Benetti S, Saucède T, David B (2013) Fossil echinoid (Echinoidea, Echinodermata) diversity of the Early Cretaceous (Hauterivian) in the Paris Basin (France). *ZooKeys* 325: 65–75. doi: 10.3897/zookeys.325.5085 Occurrence records of Hauterivian echinoids of the Paris basin. doi: 10.3897/zookeys.325.5085.app

---