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A new disaccate pollen grain from the Triassic of Argentina

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Resumen. UN NUEVO GRANO DE POLEN BISACADO DEL TRIÁSICO DE ARGENTINA. *Cedripites tectus* sp. nov., es un grano de polen bisacado haploxilonoide a ligeramente diploxilonoide de contorno oval, recuperado del Grupo Rincón Blanco (Triásico Medio a Tardío) en la provincia de San Juan, oeste de Argentina. El cuerpo es subrómbico en proyección polar y subtrapezoidal en vista lateral. El pasaje entre los sacos y el cuerpo es transicional. Los sacos muestran una fuerte inclinación distal. La cappula ocupa cerca de un décimo del ancho del cuerpo. Una breve discusión acerca de las miosporas fósiles semejantes a *Cedrus*, reafirma el uso de *Cedripites* Wodehouse.

Abstract. *Cedripites tectus* sp. nov., from the Middle to Late Triassic Rincón Blanco Group of San Juan province, west of Argentina, is a haploxylonoid to slightly dyploxilonoid disaccate pollen grain with a longitudinally oval amb. The corpus is almost rhombic in polar view and trapezium-like in off-polar compression. The sacci show a strong distal inclination and merge gradually with the corpus, encompassing a narrow cappula about one tenth of the corpus breadth. A brief discussion on *Cedrus*-like fossil miospores validates the usage of *Cedripites* Wodehouse.

Palabras clave. Argentina. Triásico. Granos de polen bisacados. *Cedripites*. Sistemática.

Key words. Argentina. Triassic. Disaccate pollen grains. *Cedripites*. Systematics.

Introduction

In Argentina, Middle to Late Triassic basins are widespread in the central-western region (Zavattieri and Batten, 1996). Within the Precordillera, the non-marine Cuyo Basin includes several sub-basins of which Rincón Blanco is one of the north-eastern depocentres in San Juan province (figure 1). Rincón Blanco is a fault-bounded, narrow trough containing about 2300 m of mostly clastic sedimentary rocks (Barredo *et al.*, 1999). The succession begins with the coarse alluvial conglomerates and high-energy sandstones of the Ciénaga Redonda, Cerro Amarillo, and Panul formations. The horizontal stratified, fluvial and lacustrine beds of the Portezuelo Formation overlie these units. The Portezuelo levels include sandstones, shales, marls and tuffs with tetrapod footprints and a scarce taphoflora composed by *Antevsia* sp., *Lepidopteris stormbergensis* (Seward) Townrow, *Taeniopteris* sp., articulates and wood remains. They grade upward into the deep lacustrine facies of the Carrizalito Formation. The sedimentary fill terminates in the lacustrine and fluvial sag facies of the Casa de Piedra Formation. This unit contains conchostracans and characteristic specimens of the *Dicroidium* Flora, such as different species of *Xylopteris*, *Zuberia* and *Taeniopteris* (Barredo *et al.*, 1999). The Portezuelo, Carrizalito and Casa de Piedra Formations yield rich palynofloras related to the Ipswich Microflora (Dolby and Balme, 1976; Zavattieri and Batten, 1996). Among the spores are *Cadargasporites* sp. cf. *C. senectus* de Jersey and Hamilton, *Calamospora tener* (Leschik) de Jersey, *Densoisporites* sp. cf. *D. psilatus* (de Jersey) Raine and de Jersey, *Limatulasporites limatulus* (Playford) Helby and Foster, and *Playfordiaspora cancellosa* (Playford and Dettmann) Maheshwari and Banerji. Pollen taxa include *Alisporites australis* de Jersey, *A. lowoodensis* de Jersey, *Chordasporites australiensis* de Jersey, *Cycadopites follicularis* Wilson and Webster, *Platysaccus queenslandi* de Jersey, and *Striatopodocarpites* sp. cf. *S. pantii* (Jansonius) Balme. *Botryococcus* is consistently represented through the lacustrine levels, mainly within the Casa de Piedra Formation. The new species, *Cedripites tectus*, occurs as a minor but conspicuous constituent of the palynological assemblages, from the Portezuelo through Casa de Piedra Formations, of the Rincón Blanco Group.

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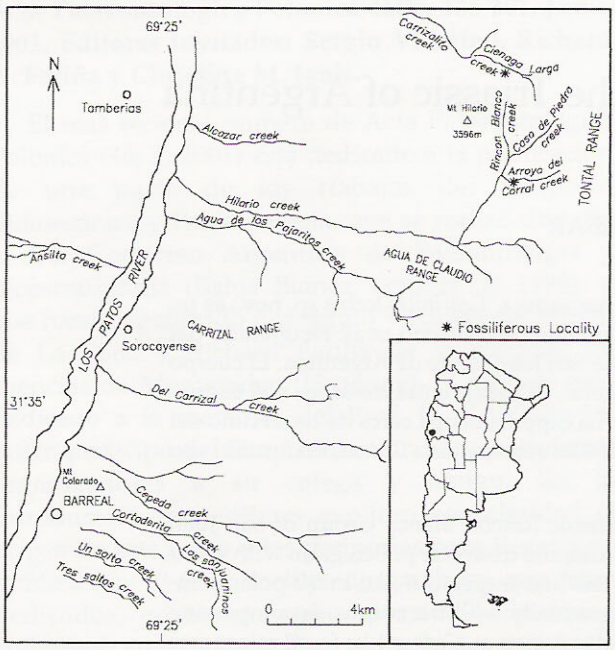

Figure 1. Location map of the Ciénaga Larga and Arroyo del Corral creeks, Rincón Blanco area, San Juan province, Argentina / *Mapa de ubicación de las quebradas de Ciénaga Larga y Arroyo del Corral, área de Rincón Blanco, provincia de San Juan, Argentina.*

Material and methods

This paper is based on the study of 35 palynological samples from Arroyo del Corral and Cienaga Larga creeks, in southwestern San Juan province, Argentina (figure 1). Laboratory procedures followed conventional practices. Carbonates and silicates were removed by treatment with hydrochloric and hydrofluoric (70%) acids. Residues were sieved on a 25 µm mesh and mounted in unstained glycerin jelly as well as in cellozise on glass slides. Specimens were examined under a Leitz Orthoplan binocular microscope. Photomicrographs were taken with a Leitz Orthomat camera using AGFAPAN APX25 film. Palynological slides are prefixed BAFC-Pl. The illustrated specimens are identified with a slide number and England Finder coordinates. Terms used for measurements of pollen grains follow the scheme of Erdtman (1954, 1957).

Systematic palynology

Genus *Cedripites* Wodehouse 1933

1963 *Cedripollenites* Danzé-Corsin and Laveine, in Briche *et al.*, p. 94.

Probable Synonyms (See Discussion for comments on each genus).

1955 *Septaesporites* Leschik, p. 61.

1955 *Lorisporites* Leschik, p. 63.

1955 *Rimaesporites* Leschik, p. 64.

1958 *Parvisaccites* Couper, p. 154.

1964 *Cedripitites* Maljavkina, p. 152.

1995 *Krempipollenites* Tiwari and Vijaya, pp. 93-94.

Type species. *Cedripites eocenicus* Wodehouse 1933.

Discussion. *Cedripites* was erected by Wodehouse (1933) based on a single *Cedrus*-like pollen grain from the Eocene of Colorado, U.S.A. A brief diagnosis and a drawing of the holotype, *Cedripites eocenicus* Wodehouse, were given. Although Wodehouse's diagnosis was sketchy, the genus was undoubtedly validly published according to Article 38 of the ICBN, Saint Louis Code (Greuter *et al.*, 2000). Wodehouse (1933) clearly considered *Cedripites* as morphologically comparable, but not necessarily related, to modern *Cedrus* miospores. Potonié (1958) and Balme (1970) discussed the genus and validated its usage. The circumscription of *Cedripites* causes problems, however, owing to its sketchy diagnosis. The species *C. tectus*, described in this paper, fits very well with the general characters of *Cedripites* (as opposed to those of modern *Cedrus* pollen) regarding the disposition of sacci and ektexine structure. Descriptions and illustrations in Wodehouse (1935), Pokrovskaya (1950), and Erdtman (1954, 1957, 1965) characterize *Cedrus* pollen on the basis of its thick-walled cappa and distally inclined sacci, which merge gradually with the corpus without a sharp demarcation. Forms with a markedly polygonal corpus and narrow cappula as seen in *C. tectus* are not common among extant *Cedrus* or fossil *Cedrus*-like species. We are aware of the difficulties of interpreting the morphology of *Cedrus*-like fossil miospores. However, our detailed studies support the assignment of *C. tectus* in *Cedripites* Wodehouse, although in fact, by doing so, we slightly expand the current circumscription of this genus. However, we avoid emending its diagnosis, because, as originally erected, this genus is broad enough in concept.

Cedripollenites Danzé-Corsin and Laveine (in Briche *et al.*, 1963) is an obligate junior synonym of *Cedripites*. *Saeptasporites* Leschik 1955, *Lorisporites* Leschick 1955, and *Rimaesporites* Leschik 1955 (see also Scheuring, 1974), considered previously as synonymous by Bharadwaj and Singh (1964) and Jain (1968), are probably also synonyms of *Cedripites*. The Gondwanan species, *Rimaesporites aquilonalis* Goubin, 1965 (or cf. *Rimaesporites aquilonalis* Goubin, as currently cited in Australia and Antarctica; see Dolby and Balme, 1976; Helby *et al.*, 1987; Foster *et al.*, 1994), is doubtful. The holotype of the species *R. aquilonalis* shows a proximal cleft but this character is apparently absent from the paratypes. *Cedripitites* Maljavkina 1964 and *Krempipollenites* Tiwari and Vijaya 1995 bear the same morphology in corpus-saccus construction, and are probably also synonyms of *Cedripites*. Following Balme (1970), *Parvisaccites* Couper 1958, closely resembles *Cedripites* and is also

a probable junior synonym of this genus. *Paravesicaspora* Klaus 1963, is clearly haploxylonoid and exhibits a markedly, transverse-elongated corpus. *Scheuringipollenites* Tiwari 1973, displays an almost circular amb, a corpus that is hardly discernible and an ill-defined sulcus. *Klausipollenites* Jansonius 1962 (see also Balme, 1970, and Tiwari and Vijaya, 1995), exhibits small rigid sacci which tend to be joined through the equator giving a monosaccate appearance, and a small, poorly defined distal tenuitas

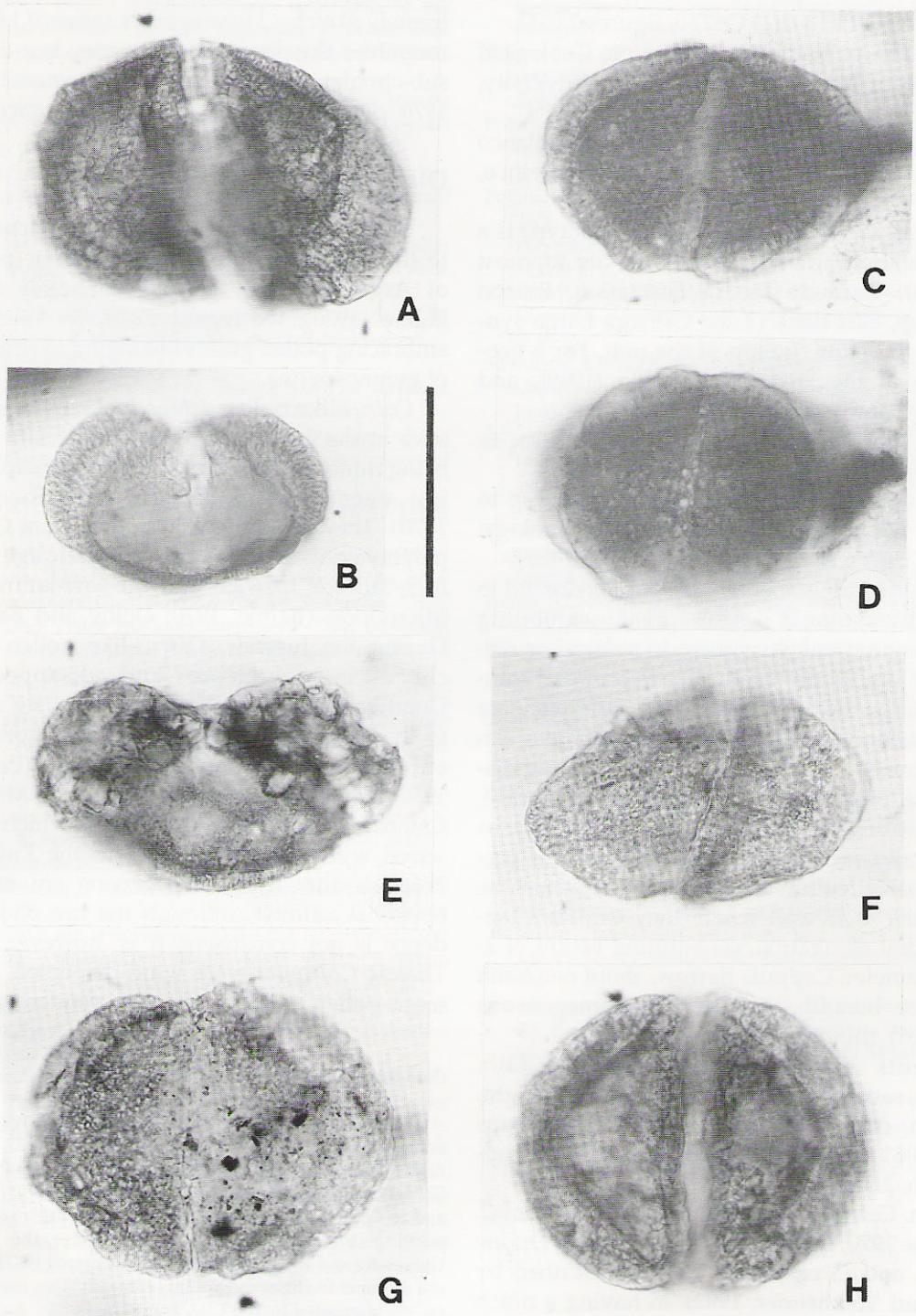

Figure 2. A-H, ***Cedripites tectus*** sp. nov., from Ciénaga Larga and Arroyo del Corral creeks, Rincón Blanco area, San Juan province, Argentina / *quebradas de Ciénaga Larga y Arroyo del Corral, área de Rincón Blanco, provincia de San Juan, Argentina.* **A,** BAFC-Pl 1302(1) N25/0, polar view / *vista polar*; **B,** BAFC-Pl 1300(3) O39/3, lateral view / *vista lateral*; **C,** holotype / *holotipo*, BAFC-Pl 1302(1) O62/0, polar (distal) view / *vista polar (distal)*; **D,** holotype / *holotipo*, BAFC-Pl 1302(1) O62/0, polar (proximal) view / *vista polar (proximal)*; **E,** BAFC-Pl 1182(1) A56/0, lateral view / *vista lateral*; **F,** BAFC-Pl 1181(1) A46/4, polar view / *vista polar*; **G,** BAFC-Pl 1302(3) J21/2, polar view / *vista polar*; **H,** BAFC-Pl 1182(5) M46/0, polar view / *vista polar*. Scale bar / *Escala gráfica*: 50 µm. All specimens to the same scale/*Todos los especímenes a igual escala.*

on the distal pole. *Alisporites* Daugherty 1941, has a well-defined central corpus displaying a homogeneous, unstructured wall.

Cedripites tectus sp. nov.
Figures 2.A-H

Holotype. BAFC-Pl 1302(1) O62/0; figures 2.C-D.
Repository. The palynological collection, Geological Sciences Department, Buenos Aires University, Argentina.
Type Locality. Ciénaga Larga Creek, Rincón Blanco area, northeast of Barreal, San Juan Province, Argentina.
Type Stratum. The sample yielding the holotype is a shale intercalation among the tuffs of the topmost fluvial facies, Casa de Piedra Formation, Rincón Blanco Group, east flank of the Ciénaga Larga syncline, ca. 25 m below the top of the unit. For a geological map of the area, see Barredo (1999), and Barredo and Ramos (1997).
Occurrence. Portezuelo, Carrizalito, and Casa de Piedra Formations, Rincón Blanco Group.
Derivatio nominis. Referring to the sacci, close to one another adjacent to the distal pole (etymology: Latin, *tectus*, covered, hidden).
Diagnosis. Disaccate pollen grains, haploxylonoid to slightly diploxylonoid. Amb oval, exhibiting markedly longitudinal elongation. In polar view corpus almost rhombic, trapezium-like in off-polar compression. Cappa heavily thickened, endoreticulate (alveolar ektexine), 3-3.5 µm thick. Bacula-like elements of ektexine (infratectum) perpendicularly disposed on the proximal pole. Sacci almost elliptical, showing a strong distal inclination. Proximally as well as laterally, sacci merge gradually with the corpus. The endoreticulum is continuous between the cappa and the sacci wall where they exhibit a tendency to radial elongation, constituting brochi of 1-1.5 µm in diameter. Cappula narrow, about one tenth of the corpus breadth, displaying a homogeneous (unstructured), thinned wall.
Measurements (55 specimens). Total breadth, 58(71)87 µm; sacci breadth, 37(48)61 µm; total height, 38(44)52 µm; corpus breadth, 35(51)61 µm; corpus depth, 34(48)61 µm; corpus height, 35(37)41 µm; cappula breadth, 2.5-6 µm.
Comparison. *Cedripites tectus* sp. nov., differs from *C. priscus* Balme 1970, *Cedripites* sp. of Ottone (in Ottone *et al.*, 1992), and *C.* cf. *priscus* Balme (described by Zavattieri and Volkheimer, 1992), in having a much narrower cappula. *Cedripites pannellai* Jain 1968 is markedly diploxylonoid. Paratypes of *Rimaesporites aquilonalis* Goubin 1965, cf. *R. aquilonalis* Goubin, described by Dolby and Balme (1976), and *Lorisporites spectabilis* Leschik, described by Jain (1968), also have a broad cappula. *Paravesicaspora splendens* (Leschik 1956) Klaus 1963, and *P. planderovae* Visscher 1966, display a markedly transverse-elongated corpus. *Alisporites microreticulatus* Reinhardt 1964 (see also Visscher, 1966), seems to be similar to *C. tectus* sp. nov.; however, close comparison of the species is hindered by the fact that Reinhardt's diagnosis is extremely sketchy. *Sulcatisporites krauselii* Mädler 1964, resembles the Argentinian species, but differs in its sub-circular corpus. *Cucullispora cuneata* Scheuring 1970, possesses smooth, rudimentary sacci.

Discussion

Cedripites tectus sp. nov. is an important addition to the rich, pollen-dominated, Triassic palynofloras of Argentina. Following Wodehouse (1933) and Balme (1970), we regard *Cedripites* Wodehouse, as embracing pollen grains belonging to several groups of gymnosperms.

Cedrus-like pollen grains make their first appearance in the geological record in the late Palaeozoic, being minor constituents of Late Permian palynological assemblages of Pakistan and Russia (Balme, 1970). They are present in both typical Gondwanan palynological assemblages of Triassic age namely the high-latitude Ipswich and the low-latitude Onslow Microfloras (Balme, 1970; Dolby and Balme, 1976). During the Jurassic, *Cedrus*-like pollen grains declined in abundance and disappeared from Gondwana, but they are conspicuously represented in the Northern Hemisphere palynofloras throughout the Cretaceous and Cainozoic (Pokrovskaya, 1950; Balme, 1970). Unlike many late Mesozoic and Cainozoic *Cedrus*-like miospores, which can be referred with some confidence to the Pinaceae, Late Permian and Triassic specimens are of unknown botanical affinity. Although the morphological evidence is not conclusive, it is, however, likely that Triassic *Cedripites* were wind-dispersed, siphonogamous pollen grains of probable coniferalean origin.

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References

Balme, B.E. 1970. Palynology of Permian and Triassic strata in the Salt Range and Surghar Range, West Pakistan. In: B. Kummel and C. Teichert (eds.), *Stratigraphic boundary problems: Permian*

and Triassic of West Pakistan, Department of Geology, University of Kansas, Special Publication 4: 305-453.

Barredo, S.P. 1999. El Fanglomerado Panul como unidad diferenciada de la Formación Portezuelo, su importancia en el análisis evolutivo de la Subcuenca Rincón Blanco, provincia de San Juan. *14° Congreso Geológico Argentino* (Salta), *Actas* 1: 441-444.

Barredo, S.P., Ottone, E.G., Marsicano, C.A. and Rodriguez Amenábar, C. 1999. Continental biotic association of the Triassic Rincón Blanco Subasin, Argentina. *7° International Symposium on Mesozoic Terrestrial Ecosystems* (Buenos Aires), *Abstracts*: 8-9.

Barredo, S.P. and Ramos, V.A. 1997. Los depósitos de Rincón Blanco (Precordillera de San Juan): un rift triásico. *2° Jornadas sobre Geología de Precordillera* (San Juan) *Actas* 1: 130-135.

Bharadwaj, D.J. and Singh, H.P. 1964. An Upper Triassic miospore assemblage from the coals of Lunz, Austria. *The Palaeobotanist* 12: 28-44.

Briche, P., Danzé-Corsin, P. and Laveine, J.P. 1963. Flore infraliassique du Boulonnais (Macro- et Microflore. *Mémoires de la Société Géologique du Nord* 13: 1-143.

Couper, R.A. 1958. British Mesozoic microspores and pollen grains. A systematic and stratigraphic study. *Palaeontographica, Abteilung* B 103: 75-179.

Daugherty, L.H. 1941. The Upper Triassic flora of Arizona. *Carnegie Institution Washington Publication* 526, 108 p.

Dolby, J.H. and Balme, B.E. 1976. Triassic palynology of the Carnarvon Basin, Western Australia. *Review of Palaeobotany and Palynology* 22: 105-168.

Erdtman, G. 1954. Pollen morphology and plant taxonomy. *Grana Palynologica* 1: 65-81.

Erdtman, G. 1957. *Pollen and spore morphology/Plant taxonomy-Gymnospermae, Pteridophyta, Briophyta (Illustrations). (An introduction to palynology. II).* Almqvist & Wiskell, Stockholm, 151 p.

Erdtman, G. 1965. *Pollen and spore morphology/ Plant taxonomy-Gymnospermae, Pteridophyta, Briophyta (Text). (An introduction to palynology. III).* Almqvist & Wiskell, Stockholm, 191 p.

Foster, C.B., Balme, B.E. and Helby, R. 1994. First record of Tethyan palynomorphs from the Late Triassic of East Antarctica. AGSO *Journal of Australian Geology and Geophysics* 15: 239-246.

Goubin, N. 1965. Description et répartition des principaux pollenites permiens, triassiques et jurassiques des sondages du bassin de Morondava (Madagascar). *Revieu de l' Institut Français du Pétrole* 20: 1415-1461.

Greuter, W., McNeill, J., Barrie, F.R., Burdet, H.M., Demoulin, V., Filgueiras, T.S., Nicolson, D.H., Silva, P.C., Skog, J.E., Trehane, P., Turland, N.J. and Hawksworth, D.L. 2000. *International Code of Botanical Nomenclature (Saint Louis Code).* Regnum Vegetabile, 138, Koeltz Scientific Books, Königstein, 474 p.

Helby, R., Morgan, R. and Partridge, A.D. 1987. A palynological zonation of the Australian Mesozoic. *Memoirs of the Association of Australasian Palaeontologists* 4: 1-94.

Jain, R.K. 1968. Middle Triassic pollen grains and spores from Minas de Petroleo beds of the Cacheuta Formation (Upper Gondwana), Argentina. *Palaeontographica, Abteilung B* 122: 1-47.

Jansonius, J. 1962. Palynology of Permian and Triassic sediments, Peace River area, Western Canada. *Palaeontographica, Abteilung B* 110: 35-98.

Klaus, W. 1963. Sporen aus dem südalpinen Perm (Vergleiehsstudie für die Gliederung nordalpiner Salzserien). *Jahrbuch Geologische Bundesanstalt* 106: 229-363.

Leschik, G. 1955. Die Keuperflora von Neuewelt bei Basel. II. Die Iso- und Mikrosporen. *Schweizerische Paläontologische Abhandlungen* 72, 70 p.

Leschik, G. 1956. Sporen aus dem Salzton des Zechsteins von Neuhof bei Fulda. *Palaeontographica, Abteilung B* 100: 122-142.

Mädler, K. 1964. Die geologische Verbreitung von Sporen und Pollen in der Deutschen Trias. *Beihefte der Geolologischen Jahrbuch* 65, 147 p.

Maljavkina, V.S. 1964. Spores and pollen from Triassic deposits of the low-Western Siberian Plateau. *Trudy Vsesojuznij Nauchno-isseledovatel'skij Geologo-razvedochnoe Institut* 231, 293 p. (In Russian).

Ottone, E.G., Alvarez, P.P., Benoit, S.V. 1992. Late Triassic plant microfossils from the Rancho de Lata Formation, Main Cordillera, Argentina. *Micropaleontology* 38: 261-278.

Pokrovskaya, I.M. 1950. *Analyse pollinique.* (In Russian). French translation by: E. Boltenhagen, 1958. Annales du Service d' Information Géologique B.R.G.G.M. 24, 434 p.

Potonié, R. 1958. Synopsis der Gattungen der Sporae dispersae. II. Teil: Sporites (Nachträge), Saccites, Aletes, Praecolpates, Polyplicates, Monocolpates. *Beihefte zum Geologischen Jahrbuch* 31, 114 p.

Reinhardt, P. 1964. Über die Sporae dispersae der Thüringer Trias. *Monatsberichte der Deutschen Akademie Wissenschaften zu Berlin* 6: 46-56.

Scheuring, B.W. 1970. Palynologische und palynostratigraphische Untersuchungen des Keupers im Bölchentunnel (Solothurner Jura). *Schweizerische Paläontologische Abhandlungen* 88, 119 p.

Scheuring, B.W. 1974. On the type material of *Accinctisporites* Leschik, *Succinctisporites* Leschik, *Rimaesporites* Leschik and *Sahnisporites* Bharadwaj. *Review of Palaeobotany and Palynology* 17: 205-216.

Tiwari, R.S. 1973. *Scheuringipollenites*, a new name for the Gondwana sporomorphs so far assigned to "*Sulcatisporites* Leschik 1955". *Senckenbergiana lethaea* 54: 105-117.

Tiwari, R.S. and Vijaya 1995. Differential morphographic identity of Gondwanic palynomorphs. *The Palaeobotanist* 44: 62-115.

Visscher, H. 1966. Palaeobotany of the Mesophytic III. Plant microfossils from the Upper Bunter of Hengelo, The Netherlands. *Acta Botanica Neerlandica* 15: 316-375.

Wodehouse, R.P. 1933. Tertiary pollen. 2. The oil shales of the Eocene Green River Formation. *Bulletin of the Torrey botanical Club* 60: 479-524.

Wodehouse, R.P. 1935. *Pollen grains. Their structure, identification and significance in science and medicine.* McGraw-Hill Book Co., Inc., New York, 574 p.

Zavattieri, A.M. and Batten, D.J. 1996. Chapter 20B. Miospores from Argentinian Triassic deposits and their potential for intercontinental correlation. In: J. Jansonius and D.C. McGregor (eds.), *Palynology: principles and applications*, American Association of Stratigraphic Palynologists Foundation 2: 767-778.

Zavattieri, A.M. and Volkheimer, W. 1992. Granos de polen sacados (Saccites) de la Formación Potrerillos (Triásico) en la localidad de Divisadero Largo, provincia de Mendoza, Argentina. *Ameghiniana* 29: 27-44.

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