

## WHAT IS TYPE PALEOCENE?

HOWARD E. SCHORN

Museum of Paleontology, University of California,  
Berkeley, California 94720

**ABSTRACT.** The Paleocene was defined by Schimper and based primarily on the paleobotanical studies of Watelet and Saporta. As originally defined the Paleocene is equivalent to the Suesonian of d'Orbigny. In the Paris Basin type area this includes the Thanetian and Ypresian (Sparnacian and Cuisian substages) stages of current usage. Continued utilization of Paleocene necessitates agreement on limits for the Epoch.

### INTRODUCTION

Lyell (1833, v. 3) first proposed epoch-magnitude subdivisions of the Tertiary, basing their recognition on the percentage of living species of Mollusca present in each Epoch. He designated the oldest subdivision Eocene, and, as concerns us here, he states (p. 55), "To this era the formations first called tertiary, of the Paris and London basins, are referrible [sic]". In the Paris Basin the *terrain tertiaire*, as elaborated by Cuvier and Brongniart (1822), was considered to include all those rocks above the Chalk [the *craie*] (that is, Cretaceous or youngest Secondary). Desnoyers (1829) recognized the younger alluvium (see, Formation VII, *Terrain de transport et d'alluvion*, Cuvier and Brongniart, 1822, p. 9) as a distinct assemblage of rocks from the Tertiary and named it Quaternary. For purposes of this study, it is sufficient to recognize that in the Paris Basin, the rocks originally referred to the Tertiary, those above the Chalk and below the Alluvium, were included by Lyell in his Eocene Epoch.

The Paleocene was defined by Schimper in 1874 to encompass the oldest of the five assemblages of Tertiary vegetation distinguished by him. Defined as it was from the Paris Basin, it includes much of the original lower Eocene of Lyell. Schimper's Paleocene essentially fulfills present-day requirements for a unit of Series-Epoch magnitude: he recognized that a distinctive assemblage of plants was characteristic of a certain sequence of rocks (Series), and that these rocks represented an interval of time (Epoch) in earth history distinct from sub- and superjacent units. Investigators subsequent to Schimper have differed considerably regarding what should or should not be included in the Paleocene. This, in part, is the result of the different disciplines represented but results also from misunderstandings as to what Schimper included in his Paleocene.

The purposes of this paper are: (1) to emphasize what Schimper included in his original definition of the Paleocene, (2) to point out the

major sources of his information, and (3) to discuss briefly some major trends in subsequent usage of the term.<sup>1</sup>

ORIGINAL DEFINITION OF PALEOCENE

Schimper (1874, p. 615-736) devotes the last section in the third volume of his *Traité de Paléontologie Végétale* to a general account of the fossil floras known to him and discusses them in order of their stratigraphic succession. The discussion of the Tertiary floras begins with the recognition of the Paleocene (p. 680):

“VIII. EPOQUE TERTIARE.

1. Période paléocène.

Sables de Bracheux, Travertins anciens de Sézanne,  
Lignites et grès du Soissonais (Suessonien).”

[a listing of plant species follows on pages 682-684]

This is the first use of the term Paleocene with a listing of rock units and their contained plant fossils.<sup>2</sup> Schimper begins his discussion of the Paleocene as follows (p. 680, translation): “I have grouped the vegetation of the Tertiary times into five distinct floras, although this does not mean to say I consider these five floras independent of one another. All these floras are interrelated in time as our local floras are in space. But, in spite of the evident continuity because of evolution in the organic kingdom during the span of geologic time, one can nevertheless distinguish within the continual and progressive change, a ceaseless changing in the grouping and the relative development of types, a changing that permits one to perceive for each epoch [période] and even for each geologic period [epoch] an assemblage of forms constituting what we call the organic physiognomy of the epoch or of the period. The assemblage of plants or the flora of the epoch [période] which concerns us here, although itself directly allied to the Heersian flora, which is the continuation of the Cretaceous flora, and still more directly to that of the Eocene epoch [période] has, nevertheless, a character of its own which distinguishes it at a glance.” This is clear exposition of *why* and *how* Schimper recognized a new Epoch. However, much of the controversy centered around what should be included in or excluded from the Paleocene exists because most workers subsequent to Schimper (with

<sup>1</sup>This manuscript was originally written in January 1968 for a seminar in the Department of Paleontology given under the direction of Jack A. Wolfe and presented before the Cordilleran Section Meeting of the Geological Society of America, March 27, 1969 (see Abs. with Programs for 1969, pt. 3, p. 59-60). Prior to presentation of the abstract I was in correspondence with Dr. Donald E. Russell of the Institut de Paléontologie, Muséum National d'Histoire Naturelle, Paris. Dr. Russell informed me that a meeting had been held in Paris during May 1968 and that much the same conclusions were reached then as I outlined in my abstract. He kindly supplied me with a copy of the summary of the meeting as prepared by C. Pomerol (see also Soc. géol. France Compte rendu, 1968, fasc. 7, p. 248-251, art. 10). Since the conclusions summarized by Pomerol and my own were reached independently, and since those of the Paris meeting appear in the French scientific journal, it is considered desirable to place this information in a journal readily available to North American geologists.

<sup>2</sup>It should be noted that in Volume I of his *Traite*, published in 1869, Schimper uses Eocene as the oldest Tertiary Epoch.

notable exception such as Saporta, 1879; Péroche, 1886; Fritel, 1903) have not recognized *what* was included in the original definition. Most investigators concerned with marine invertebrates, particularly foraminifers, draw the Paleocene-Eocene boundary between the Sparnacian and Cuisian stages, whereas those workers studying fossil mammals recognize the boundary one stage lower, between the Thanetian and Sparnacian stages (see fig. 1). In its original definition the Paleocene is equivalent to the Suessonian of d'Orbigny (1852). This places the original Paleocene-Eocene boundary between the Cuisian and Lutetian stages, that is, one stage higher than commonly placed by students utilizing invertebrate evidence and two stages higher than the position generally accepted by students of mammalian paleontology.

Four statements in Schimper's text show that his Paleocene is equivalent to the Suessonian. The first, generally overlooked by most workers, is that Schimper (p. 680) places the term Suessonien in parentheses following the listing of rock units included in the Paleocene. Subsequently, the list of rock units from this page 680 has usually been interpreted to mean that only the Bracheux sand and Sézanne travertine (Thanetian) and the immediately overlying lignites and clays (Sparnacian) were included in the original definition.

The second and third observations by Schimper make the above interpretation untenable. On page 682 Schimper states (translation): "I have said that the Paleocene flora is represented only by remains in two rather restricted localities, one of which is at the Grottos near Sézanne (Champagne) and the other in the neighborhood of Soissons (sands of Bracheux, lignites and sandstones of Soissonnais)." Although Schimper states the Paleocene flora comes from only two localities, he cites three stratigraphic units in the Soissons area: the sands of Bracheux, the lignites of Soissonnais, *and* the sandstones of Soissonnais. That Schimper did include the sandstones of Soissonnais (that is, the flora from the Belleu sandstone) in the Paleocene is further substantiated by the listing of strata he includes in the Eocene. The oldest stratum from the Paris Basin included in the Eocene by Schimper (p. 684) is the Calcaire Grossier, *not* the sandstones of Soissonnais. These sandstones containing the Belleu flora had already been placed in the Paleocene listing on page 680.

The fourth demonstration that Schimper included the sandstone of Soissonnais in the Paleocene is the list of plant species he assigns to Paleocene (p. 682-684). His list includes plants from the Belleu sandstone (Cuisian equivalent). Inasmuch as Schimper gives only a combined list of Paleocene species and does not indicate their individual stratigraphic level, it is necessary to review the paleobotanical literature pertinent to the original definition in order to recognize the rock units in which the various species occur. When Paleocene was proposed only two major works on early Tertiary plants from the Paris Basin had been published: Watelet (1866), from various localities that include horizons from the Bracheux sands up to and including the Calcaire Grossier, and Saporta

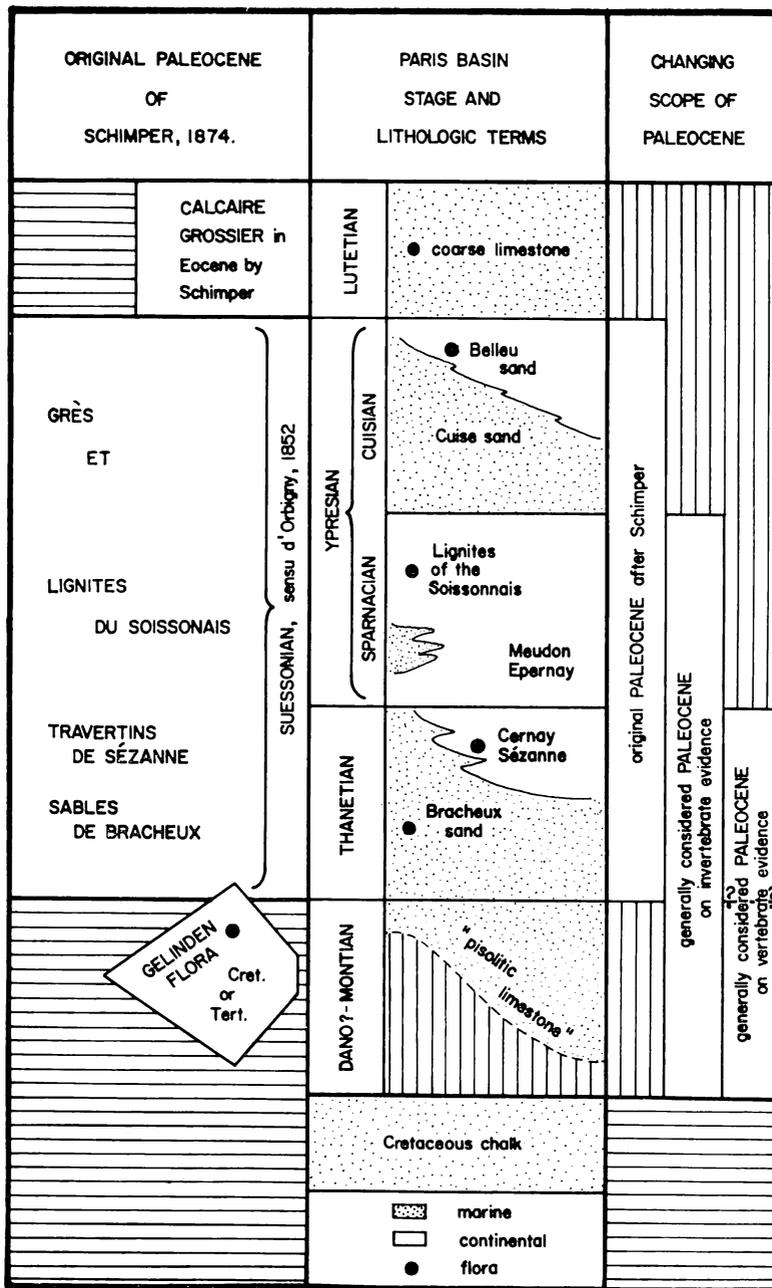


Fig. 1. Generalized Lower Tertiary Stage and lithologic terms in the Paris Basin as they apply to the original definition and subsequent modifications of the Paleocene.

(1868), on the Sézanne flora.<sup>3</sup> Schimper uses these two publications in his characterization of the Paleocene Epoch (see his bibliography). Failure to recognize this has resulted in the generally-held view that Schimper was greatly influenced in his recognition of the Paleocene by the work of Saporta on the Sézanne flora, and that the locality at Sézanne should serve as the type area (see, Lexique Strat. Internat., 1957, p. 150). By holding a similar view of the original definition, other workers have concluded that “. . . the original conception of the stage-name (based on the floras of the Sparnacian and Thanetian) has become obsolescent.” (Banner and Eames, 1966). Such interpretations of the original definition are unsatisfactory and confusing. A comparison of the rock units and species list given by Schimper with those given by Watelet (1866) leave no doubt that the original Paleocene was equivalent to the Suessonian of d'Orbigny. Furthermore, this comparison shows that the work of Watelet was as influential as the work of Saporta in Schimper's recognition of a new epoch. Watelet described plants from a number of localities and strata in the Paris Basin. Following the systematic section, Watelet (p. 251-252) summarizes his concept of the stratigraphic relationships of the plant- and nonplant-bearing beds of the European Eocene. Of particular significance to the present discussion are those plants Watelet lists as coming from the Belleu locality, “Grès supérieurs aux lignites”. When this list is compared with the Paleocene rock units and species list given by Schimper it is clear that the original Paleocene list includes the plants from the Belleu sandstone. Thus, the original Paleocene is equivalent to the Suessonian of d'Orbigny, and in present terminology, this includes the Thanetian stage, and the Sparnacian, and Cuisian substages of the Paris Basin.

Some minor discrepancies in Schimper's stratigraphic placement of a few species need comment. Three species of charophyte oogonia and four other plant species<sup>4</sup> placed by Schimper (p. 709-711) in his Eocene listing are from Paleocene rock units as he defined the Epoch. No explanation for these misplacements is given, although they are probably simple technical oversights.

The London Clay and its equivalents in England were placed in the Eocene by Schimper (p. 684). They are correlative with Sparnacian deposits in the Paris Basin (Blondeau and others, 1966) and therefore should have been included in the Paleocene as defined. It seems probable

<sup>3</sup> The monograph on the Gelinden flora from the Heersian of Belgium (Saporta and Marion, 1873) was only in press at the time Schimper was preparing his third volume (see Schimper, p. 671). The Gelinden flora therefore does not enter directly into his discussion of the Paleocene. Schimper recognized the flora as intermediate between the Cretaceous and Tertiary floras (p. 671) but only suggested that it might indeed belong in the Paleocene (p. 673).

<sup>4</sup> *Chara sparnacensis* Watelet (from Saran and Bernon, the Lignites), *C. onerata* Watelet (from Pont-Sainte-Maxence, Marnes des lignites), *C. Dutemplei* Watelet (from Saran, Marnes des lignites), *Arundo? Papillioni* (Wat.) Schimper (from Vervins, Aisne, Grès intercalés dans les sables de Bracheux), *Arundites dubius* (Wat.) Schimper (from Belleu, Grès supérieur aux lignites), *Potamogeton eocenicus* Watelet (from Belleu, Grès supérieurs aux lignites), and *Flabellaria Goupili* Watelet (from Noyon, Grès supérieurs aux lignites).

that this too is one of the points that has caused confusion among subsequent workers. However, the original Paleocene was based on the lithostratigraphic and biostratigraphic units of the classic Paris Basin Tertiary and a matter of "incorrect" correlation on the part of Schimper cannot alter the original definition.

#### MODIFICATIONS OF THE ORIGINAL DEFINITION

As mentioned previously, some workers early recognized and accepted Schimper's definition of the Paleocene. Notable among these are G. de Saporta, J. Péroche, and F. H. Fritel. As early as 1878, Saporta and Marion revised the Gelinden flora and assigned it to the Paleocene. Again, in a general discussion of Paleocene floras, Saporta (1879, p. 211) clearly recognized and accepted the Paleocene as is shown by his statement that, "Cette première période correspond au *suessonien* de d'Orbigny; . . .". Péroche (1886, p. 50) also stated, "La période paléocène, qui correspond au *suessonien* de d'Orbigny, . . .". Fritel (1903) accepted the original definition, and from his lists and text it is evident that he recognized the important connection between the studies of Watelet (1866) and Schimper.

Most students, however, have modified the original content of the Paleocene. At present it is generally accepted practice to include the Danian in the Paleocene, even though this consensus is by no means unanimous (see for example, Eames, 1968). Schimper (1874, p. 675) followed Desor (1847) and included the Danian in the Cretaceous. It is not within my capacity to analyze properly the "Danian Problem". This remains largely the concern of students studying marine fossils. As regards the upper boundary, modification of the original content apparently results from misunderstanding Schimper's definition. Students of foraminifers have generally accepted the boundary between the Sparnacian and Cuisian substages as the Paleocene-Eocene boundary (for example see, Loeblich and Tappan, 1957; Berggren, 1965; Banner and Eames, 1966). Mangin (1957), although he draws the upper boundary of his "Lower Eocene" at the Cuisian-Lutetian boundary, also misinterprets Schimper's original definition by accrediting only the Thanetian and Sparnacian stages to the original Paleocene. In North America a need for a distinct time term for the oldest Tertiary land-mammal faunas was first championed by Matthew (1914, 1920, 1921, and 1924; for an excellent summary of the historical development of the usage of the term as applied by workers in North American mammalian paleontology see Russell, 1967). It appears that Matthew was not primarily concerned with the limits of the type Paleocene but rather with the need for a term to designate the older mammalian faunas in North America that were then being referred to the Basal or Lower Eocene. The most distinct change in these land-mammal faunas is between the Tiffanian and early Wasatchian ages. The late Tiffanian fauna was assigned by Matthew to the late Paleocene. This faunal change corresponds to the change recognized between the Cernay (late Paleocene) and Mutigny

(early Eocene) faunas in the Paris Basin (Russell, 1964; Russell, Louis, and Savage, 1967). The work by Matthew has been followed largely by students of mammalian paleontology. Much of the controversy between the foraminiferal and mammalian paleontological disciplines, as to the proper upper boundary of the Paleocene (see, for example, Berggren, 1965), is thus seen to be superfluous. Neither discipline has generally employed the boundary as it was originally defined; the students of foraminifers because of apparent misinterpretations of the original definition, and the workers in mammalian paleontology because they have followed a traditional boundary suggested by Matthew in 1914.

#### SUMMARY AND CONCLUSIONS

Fossil plants from the Belev sandstone, equivalent in part to the Cuisian Substage of the Ypresian are included in the original definition of the Paleocene. This means that the Paleocene-Eocene boundary is placed by original definition at the boundary between the Cuisian and overlying Lutetian Stage as recognized in the Paris Basin. Schimper accepted the Danian as a stage of the Cretaceous. Paleocene, by definition, thus includes the Thanetian and Ypresian stages in the Paris Basin. This original content has been modified to include the Danian below and exclude either just the Sparnacian or the Sparnacian and Cuisian substages above (see fig. 1).

If Paleocene continues to be used as a unit of Series-Epoch magnitude all paleontological disciplines should agree on acceptable limits for the unit. If the boundaries are modified the original definition (content) must be considered, if for no other reason than historical fact. Problems in correlation will exist no matter which boundaries are ultimately accepted. However, if we are to utilize Paleocene we must agree on boundaries, so that all disciplines will be at least attempting to correlate with the same standard.

I wish to acknowledge my appreciation to William A. Clemens, Wayne L. Fry, Robert M. Kleinpell, Harry D. MacGinitie, and Jack A. Wolfe for reading the manuscript and adding helpful suggestions. I am especially grateful to J. Wyatt Durham and Donald E. Savage for their help. Donald E. Russell supplied important information concerning the status of the Paleocene as viewed by European geologists.

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