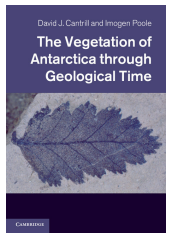
The Vegetation of Antartica through Geological Time



David.J. Cantrill and Imogene Poole

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This book is a co-work of two experienced palaeobotanists, who are concerned with the research of Cretaceous plants from the Antarctica. David Cantrill focuses on Cretaceous macroflora, Imogene Poole is a specialist in the field of xylotomy, Antarctic woods from the Tertiary and the Cretaceous Period in particular. This book is the first comprehensive publication about Antarctic fossil flora. It will surely become an useful one in the library of every palaeobotanist. The book has a wide scope and interconnects numerous information from geology, climatology and geography. It is probably the first book, from which readers get a lot of most recent information about fossil flora of the Antarctica. It is a great pleasure to read this book. It is written in a very readers friendly style. It attracts a reader attention because some parts, especially those discussing dramatic changes in the Earth evolution, make it a gripping, almost a detective book, in spite of scientific character of the publication.

The book is divided into nine parts according to important palaeontological events, that happened in the Antarctica and whole Gondwana. Every chapter is complemented by profound description of geology including clear maps, palaeoclimatic data, diagraphs, and photographs of most frequent fossils as well as exceptionally rich references.
The first chapter informs about the history of Antarctic research including investigations of Larsen's, Scott's, Nordenskiöld's, Shackleton's and subsequent national expeditions, which resulted in constructions of many national polar bases and became a starting point of further internationalisation of Antarctic territory.

The following chapter discusses geology, separately for the East Antarctica and the West Antarctica with the Antarctic Peninsula, the latter of which is considered geologically diverse and rich in fossils. In the concluding part of the chapter, most important information are pointed out, *e.g.* that the Antarctica consists of two radically different blocks. The authors also exemplify, that the Antarctica was ice-free for most of its geological history. In the part dealing with the evolution of early Palaeozoic climate, basic terms from climatology (like the stage of icehouse, greenhouse and hothouse) are explained. Palaeogeographical situation and the oldest fossil remains of plants from the Early and (more frequently) the Late Devonian are included.

The third chapter deals with the formation of Gondwana glaciation in the end of the Carboniferous Period and its subsequent decline in the end of the Permian. The glaciation significantly influenced vegetation and fluctuations of world ocean level. In the subchapter about biodiversity and ecology of Late Palaeozoic boreal forest, the authors discuss well-known *Glossopteris* flora and its environment. Dramatic changes of climate, reflected in sedimentary bedsets from the Transantarctic Mountains exemplifying changes between glaciation periods and a rapid deglaciation combined with development of braided streams, are discussed in particular. The genesis of stable postglacial vegetation with small diversity and predominance of Glossopteridales and Sphenophytes in the Late Permian is documented.

The fourth chapter is devoted to the crisis on the boundary between the Permian and Triassic geological periods, when the greatest extinction event of the Earth's history

happened. According to scientific estimation, up to 95% of plant and animal species disappeared. The causes of this extinction are explained according to palaeogeographical and palaeoclimatical changes (icehouse to hothouse), that are exceptionally apparent in Antarctic sediments. However, the authors are aware that palaeobotanical proofs of P-Tr boundary are scarce in contemporary Antarctica. They emphasize the necessity of futher studies, mainly palynological. Antarctic *Dicroidium* flora and its changes during the Triassic Period is also presented.

In the fifth chapter, breakup of Gondwana supercontinent and subsequent changes in the boundary between Triassic and Jurassic are explained. The supercontinent breakup was associated with a strong volcanism in the Antarctica as well as another parts of the Gondwana. In the introduction part of the fifth chapter, the authors elucidate global greenhouse effect in the Jurassic Period with a high level of CO_2. Then, Jurassic and Cretaceous flora of the West and East Antarctica is discussed. The East Antarctica is characterized by fossils of conifers and Bennettitales conserved in volcanites. Plants found it the fossils posess a thick cuticle with well-developed papillae, which is probably a result of dry climate. The West Antarctica is described by Middle Jurassic, mostly coniferous, flora frome Hope Bay location. In other locations, Bennettitales and ferns of the family Dipteridaceae prevail. Fossils from the boundary between the Jurassic and the Cretaceous Period are very scarce in the East Antarctica and slightly more frequent in the West Antarctica.

In the sixth chapter, the authors discuss Early Cretaceous flora and the invasion of newly evolving angiosperms. After general geographic and climatolgic introduction, polar forest vegetation, which reached the poles in that time, is described as well as its specificity. The most typical phenomenon is fluctuating sunshine, which affects *e.g.* the wood structure of polar trees. The abrupt transition into polar night with lack of of light, is reflected by sharply defined annual rings. The authors inform us about unique vegetation systems, that resisted to severe light conditions and explain their possible survival strategies. There are no paralells for such communities in contemporary world. In the Antarctica, these forests were formed mostly by evergreen conifers from the families Araucariaceae, Podocarpaceae, and Cupressaceae with intercorporated decidouos trees, like *Ginkgo*, which were most capable to cope with these conditions. This period is characterised by bi- and trisaccate pollen grains from Podocarpaceae family. The observations proving relatively late invasion of angiosperms are exceptionally interesting. They came to the Antarctica in the stage of Albian, probably over Africa or India. The authors state that Late Cretaceous fossils are relatively rare in the Antarctica, occuring mostly in the Antarctic Peninsula.

The seventh chapter informs a reader about dramatical, nearly explosive invasion of angiosperms and their rapid spreading into all continents. During the Cretaceaous Period, the amount of CO_2 in atmosphere dropped, which resulted in a fall of air temperatures, apparent at the end of the Cretaceous especially. Late Cretaceous flora in the Antarctica is concentrated in the Antarctic Peninsula and adjacent islands. In this chapter, Late Cretaceous flora from the James Ross Island (where Czech polar base of Gregor Mendel is situated) is discussed. The authors also mention signs of events that happened on Cretaceous–Palaeogene boundary in Antarctica. These layers are located in the Seymour Island and they contain elevated amounts of iridium. Nevertheless, according to palynological studies, no catastrophic processes are apparent, which corresponds to data obtained in New Zealand.

Eighth chapter deals with subsequent warming of global climate in the Palaeogene. During the climatic optimum, the Earth was gradually warming till the Late Eocene. Fossil flora of the Antarctica is characterised by *Nothofagus* and relict conifers. Well pre-

served Palaeogene floras are found in the South Shetland Islands, especially the King George Island and the Seymour Island. For better understanding of fossil terrestial ecosystems of this age, eleven pages long detailed study of evolution of communities in the Seymour Island is added.

Ninth chapter informs about Late Eocene and Pliocene cooling of climate, which is reflected in the change of vegetation. The cooling of the Antarctica resulted in a decrease of species diversity to twenty species of shrubs in the East Antarctica's Oligocene and subsequent total extinction in the next periods, when the glaciation of Antarctica started. Interesting facts are pointed out, *e.g.* recent geophysical measurements. They showed that 34 million years old Earth surface, buried under kilometers of ice now, is not plain, but keeps highly rugged tertiary ground.

The book is equipped by a lot of good-quality maps and graphs and also black-and-white photographs, which is something I consider the only weak point of this book. In the book, relatively small number of photos characterizing fossil flora are presented. Quality of photos is rather average, sometimes even worse. It is a pity, that the photos are not printed on a coated paper. Moreover, information on Antarctic fossil flora represents due to rather general context of the book only about one third of the text. A readed may find also typewriting mistakes in latin names occasionally. In spite of such minor imbalances, the book represent a valuable contribution to history of Antarctic flora. It might be warmly recommended to a wide range of readers interested in polar regions, the Antarctica and history of Earth in general.

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