This pocket book (in Dutch) invites the reader to enjoy three bike circuits in the Hoge Kempen (‘High Campine’) National Park where altitudes vary between 60 and 90 m: 39 or 45 km in the As - Opglabbeek area; 35 km in the Genk area; 22 km in the Zutendaal area. In combination with open air sport, leisure and cultural interest, the purpose of the writers is to document the geological history of this scenic part of the Belgian province of Limburg, largely dominated by green landscapes of which the core now forms a National park. Quarries provide windows to the underlying Cenozoic fluvio-marine formations (the Boldenberg formation to the south and the Diest formation to the north; both mainly made up of sands but containing lignite and sandstones), covered by fluviatile Middle-Pleistocene (Cromerian) gravels, all blanketed by aeolian rocks of Late-Pleistocene age deposited during the Weichselian glaciation with some reworking associated with human occupation of the territory. This book of 144 pages provides very detailed descriptions not only of the outcropping rocks, but also of historical landuse changes, geomorphological and historical building materials used in houses, chapels and monuments encountered along the circuits, and even etymological references with natural phenomena and traditional land use. Descriptions are illustrated by numerous photos, figures, sketches and maps in colour. Moreover, reference is made to the effects and still visible signs of former underground coal mining, particularly to the Waterschei colliery located south-west of the As - Opglabbeek circuit.

L. Dejonghe & M. Dusar
Geological Survey of Belgium.

This magnum opus is composed in 16 chapters each of which can be read as a separate publication, but these can be grouped in two parts. After an introduction justifying the line of thought elaborated throughout the book, the first ten chapters develop the methodology and achievements of the different geoscientific disciplines necessary to decipher the climate signals of the System Earth. The next five chapters intend to explain the climate evolution and variability during the Quaternary up to the Present. The final chapter brings it all together, summarises the palaeoclimatic evolution of the Earth in relation to the major events supposed to drive climate change, and reflects on what we know and do about climate change as a suitable epilogue to a convincing story.

This book is quite unique, compiled out of a geological perspective independent of the IPCC programme, focussing on palaeoclimates as a key element to understand the future evolution of the Earth. The underlying reason is that the author consistently tries to answer the fundamental questions of why there is climate change and how the scientific insight in climate change has evolved (‘knowledge of the climate system unfolds through time’). The climate story is described as part of the endeavour of scientific discoveries and technical advancement of mankind. On the human side the author goes back 200 years, staying within the realm of enlightenment and real natural science, advancing step by step in the development of new ideas and technical breakthroughs (e.g. in dating rocks more precisely), up to the current body of knowledge.
on the climate system. Among the many scientists whose personal contribution to better understanding of past climates are highlighted in this book are the climate modellers from the Université catholique de Louvain, André Berger and his team members, Michel Crucifix, Hugues Goosse and Marie-France Loutre. The author gives tribute to persons who did original research but were subsequently ignored, such as Jacques Joseph Ebelmen, professor at École des Mines and director of the Royal Manufactury of Porcelain in Sèvres, as the inventor - in 1845 - of the geochemical carbon and sulphur cycles and the process of chemical weathering balancing these cycles. His groundbreaking work may have been ignored but 'his ideas were in the air'.

For the story of the System Earth, the author goes back about 450 million years, to the emergence of land plants leading to the start of a continuous and undeniable interaction between Life and the Planet Earth. Indeed, past climates much warmer or colder than today’s allow to test the robustness of the numerical models predicting ongoing and future climate change and the dire consequences of fossil fuel burning. Apparently, few textbooks take the geoscientific perspective on climate change, a gap that has been thoroughly filled with this work. This means that e.g. the orbital variations of the Sun receive rather modest attention, among the many other variables, which may have caused more fundamental changes in the evolutionary path of the Earth, of its carbon cycle and hence of its climate. The ‘primacy of plate tectonic processes as the ultimate drivers of climate change’ is demonstrated, particularly for the Cretaceous and Cenozoic. Anyhow, the key words are palaeoclimatology and palaeoceanography. The author explains e.g. the relation between sea floor spreading, greenhouse gas forcing, surface temperatures, oxygen depletion of subsurface sea waters, ocean currents, their impact on black shale deposits and the resulting consequences on the palaeoclimate. The ambitious objective of describing the System Earth has as a minor inconvenience that the wealth of data, produced by the many researchers studying in great detail the stratigraphical successions, is overlooked, e.g. the Frasnian/Famennian mass extinction is explained by a meteorite impact but recent research has failed to find proof of such a global event and instead focuses on a rapid but not sudden modification of the biogeochemical cycles. On the other hand, the Palaeocene-Eocene Thermal Maximum and the Pliocene warming receive a more balanced treatment. The author gives fair attention to the complex, even contradictory interactions and uncertainties, reflecting how a single tectonic event such as the closure of the Central American isthmus in Panama can provoke initial warming and subsequent cooling of the North Atlantic by influencing ocean currents and salinity. The author describes how orbital changes in insolation as well as variations in solar activity are responsible for climatic oscillations but interference with internal and external dynamics of the System Earth lead to seesaw dissociation of climate events and ultimately to climate drift. Special attention is given to the Little Ice Age and the causes for it end, for its was bound to continue and deepen into a neoglacial Holocene: greenhouse gas forcing has taken over from solar activity in driving global temperature, albeit superimposed on many more natural variables. Divergence between temperature and solar signals since 1940 is demonstrated to be the result of anthropogenic impact. A the author says, the pattern of warming induced by greenhouse gas forcing should be ‘blatantly obvious’. Although climate change during the next decades is expected to be incremental, with positive feedbacks such as destabilisation and melting of large ice sheets unlikely but not to be excluded, it is anyhow leading to a ‘creeping catastrophe’. Moreover, return to a pre-industrial level of atmospheric and oceanic greenhouse gases I impossible to achieve in short notice. Rather it should be compared to the lifetime of high level radioactive waste. Needless to say, the future does not look bright.

What makes this book of 394 pages densely packed with scientific breakthroughs and evolving theories truly impressive is that it represents the works and reflections of just a single author. Colin Summerhayes can claim to cover the whole domain of Earth’s climate evolution, based on rock, water, ice and air interactions, and was so privileged as to witness many of the scientific events. Moreover, it is obvious that this book has been written out of commitment for the climate cause, confronting a community that feels less concerned about the future of humanity. This book is extremely well written, while maintaining a high scientific and editorial standard, flavoured by anecdotes on the peculiar characters of the scientists involved and encounters between the different egos. As a reader you get the sense to be a privileged spectator of a thriller coming to a dramatic end in this century. I recommend this book as an invaluable reference for the wider scientific and engineering community, teachers, policy makers, and environmental NGOs. It will also be of particular interest to historians of the natural sciences, in retrospect of our current dealings with climate change.

Michiel DUSAR
Geological Survey of Belgium.