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An investigation on the geological history of the Ardennes

Abstract

In this investigation, the geological history (of the Ardennes) is analysed using various methods each demonstrated in a practical. By getting hold of a geological map of the Ardennes, we realised that a whole range of younger to older rock exists during the first practical. However, our major discovery was that wherever rivers cut through valleys, different aged rocks appear. The deeper a river cuts through a valley, the older the exposed rocks are as according to Steno's law. We also concluded that the Ardennes have been subject to periods of erosion and to periods of mountain build up, because to the North of the Ardennes a lot of younger rocks are exposed but to the South much more older rocks are exposed. Another important finding was that one could see different layers of aged rocks existing roughly over the whole area, underground. For example, in the Maas valley, on either side the exposed layers match up according to their age.

In the second practical, we said that fossils succeed one another in a definite and determinable order in history; therefore, we could roughly say how old the examined rock is. One of our major important findings was that, in fact, it worked. Because after having identified the fossil in each rock, we could arrange the rocks in order from younger to older. This then allowed us to create a legend for the geological map matching each colour with a certain period in time. For example, we found out that the yellow colour on the map belonged to the Cenozoic age. The most astounding discovery was, however, that certain time periods were not found when we dated each rock layer. These are the Permian, Triassic, and Jurassic periods. They have probably been eroded away in Earth's history.

During the third practical, we combined both concepts of relative dating of the first practical and of absolute dating of the second practical. With this, we created a cross-section profile of the Ardennes. We found out that each layer of rock exposed continues its way underground and may be exposed again in another valley, for example. We also realised that, in our cross-section profile each younger layer of rock is followed by an older layer of rock going deeper underground. Lastly, we got a good idea of how the layers continue to exist underground.

The Fourth practical taught us how stratigraphic succession even occurs to a reef. We discovered that a reef slowly builds its way seaward when sea level rises gradually. What results is a vertical succession of lithofacies. The occasional debris that can be found between layers of different fossilised remains from the reef is probably caused by a storm when large waves manage to destroy fragile reef on the other side of the reef crest. Lastly, we learned how a type of sedimentary rock can be classified according to its fossil content, like mudstone is found at the lagoon and packstone can be found at the reef crest.

Introduction

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The aim of the first practical was to determine the age of rock layers (i.e. the different colours on the map) in a relative sense and place them in order. In other words, we made use of Nicolaus Steno's "Law of superposition." In the second practical our objective was to date rocks that corresponded to each colour on the map in an absolute sense by examining from what period in time the fossil in each rock came from. Thus concluding that, for example, since the fossil was formed during the Cretaceous, the rock in turn must also have been formed during the Cretaceous. The aim of the third practical was to design a cross-section profile of different aged rock layers in the Ardennes. The aim of the fourth practical was to get an understanding of other ways how the 'layering of rocks' occur and the formation, deposition, and fossilisation of reefs. The purpose of these practicals is to get an idea of how the Ardennes formed through time and to date layers of rock in various ways such as relative and absolute dating. However, the overall purpose was to realise what geology inherently is about and to be aware of principles such as the 'law of superposition' and the 'Principle of Original Horizontality.'

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Practical 3, the design of a cross-section profile of the Ardennes.

Part 1

Aim:

To choose between several shorter cross-sections or one longer cross-section of the Ardennes which, in turn, is created.

Method:

First, decide between several shorter cross-sections or just one longer cross-section. We decided to choose the longer cross-section, because it gives a broader view of the Ardennes. Of course, we designed it through valleys and hills since it shows most features of the Ardennes regarding the different aged rock layers as well.
Obtain a transparent topographical map of the Ardennes and place it over the geological map, and make sure that they match up.
Then decide where to create the cross-section profile. It would be a good idea to draw a line (with a pencil) where you want the profile.
Then draw a figure that shows the cross-section of the different aged rock layers of your profile by matching up the colours of the geological map with the legend created in the second practical and making use of the 'Law of superposition.'
Get a sheet of millimetre graph paper and place it in front of the line drawn.
Now, with a pencil, mark on the edge near the line on the millimetre graph paper where the topography of your profile goes higher or lower.
Using a scale such as one the surface 1cm is 4km (x-axis) and 1cm is 100m on the y-axis (thus deeper in the ground); plot the topography of the map on the cross-section profile.
Then, using the legend and the figure drawn before, draw the different aged rock layers onto the profile.

Part 2

Results:

Our cross-section profile shows a couple of minor river valleys, the large Maas valley, and higher hills of the Ardennes. It also shows that all the layers of rock marked with a symbol do not disappear but continue into the ground from where they are exposed to the surface. It is apparent that the time periods such as the Permian, Triassic, and Jurassic are not present. For the rest, each time period succeeds another as we know it. Nevertheless, the cross-section profile gives a good idea of how the Ardennes was formed. Near the river Maas, two symbols on either side of the river represent a layer of sediment that nowhere else is found. This is probably river deposition over time. It is apparent that the deeper into the valley the older the rocks are, that are exposed to the surface. And, we can roughly say that to the left of the river Maas generally younger rocks are exposed on the surface, whereas to the right of the river, older rocks are exposed to the surface. What is more interesting is that the right hand of our cross-section profile two different aged rock layers alternate quite a lot of times. We presumed that one rock layer (brown) is nearly wholly exposed to the surface, but that there are still patches of younger rock (blue) filling the gaps, after the layers have been folded and exposed to strain and then have been exposed to erosion.