



Charles Lyell and the loess deposits of the Rhine valley



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ABSTRACT

The study of loess began in the Rhine valley, and Charles Lyell played a major role in this development. He included a section on loess in the 'Principles of Geology' (in 1833) and with the widespread distribution of this important book loess became known. His views on loess changed as successive editions were produced and his first proposal, that loess was produced by a sudden flood changed, after discussion with H.G. Bronn, to a concept of gradual deposition. He had some interaction with Samuel Hibbert and this helped to shape his views on loess. The first published reference to loess in English was probably in Hibbert's 1832 book on the Neuwied volcanoes. By the time of the 5th edition of the Principles in 1837 Lyell was acknowledging eleven fellow scholars who had influenced his loessic endeavours, they were: Bronn, Leonhard, Boue, Voltz, Noeggerath, Steining, Merian, Rozet, Von Meyer, Hibbert and Horner. The most influential of his associates were probably Bronn, Leonhard, Hibbert and Horner, although Horner only joined the list in 1837. Lyell may have observed loess on a brief visit to the Eifel region in July 1831; talking with Hibbert later that year there was certainly discussion of the 'Loess from Kruft to Andernach'.

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"In an excursion through part of the Duchy of Darmstadt by Mayence[Mainz], Oppenheim, Alzey, Florheim, Eppelsheim and Worms, I found the loess spread almost everywhere."

Charles Lyell 1834

1. Introduction

On 5 September 1831, Charles Lyell visited Samuel Hibbert at his house in Edinburgh. He went to talk about the Eifel region where Hibbert had worked for six months with his wife Charlotte; work which would lead to the book on Neuwied volcanoes (Hibbert, 1832). Lyell recorded the visit and his subsequent thoughts in the journal which he was keeping for Mary Horner (whom he would marry in 1832):

Kinnordy 8 September 1831: [the Hibberts spent much time mapping the Eifel region] "Never having heard of that beautiful map which Von Oeyenhausen lent me, they lost much time in constructing a map, which Hibbert did trigonometrically. They

have really collected both rocks and shells, and worked and sketched to great effect. In the 'loess' descending from Kruft to Andernach, they found a vast number of land shells, which seem to indicate a modern date to that formation". (see Lyell, 1881, p.333).

"The loess from Kruft to Andernach" deserves a place in the history of loess investigation. Here is one of the first appearances of 'loess' in English—not to be published until 1881 but read by Mary Horner in 1831. In 1831 not many people were writing or talking about loess in English; not many people were writing or talking about loess in German, but there were conversations in the Rhine valley region, and loess science was spreading from the lecture rooms and laboratories of Professors Bronn and Von Leonhard in Heidelberg.

His great book the 'Principles of Geology' (Lyell, 1830–1833) was to make Lyell famous; he quickly became the president of the Geological Society and was suitably feted and honoured (Fig. 1). He obviously took a real interest in loess, which peaked perhaps in the mid-1830s. He only published one major paper on loess (Lyell, 1834) but the continued appearance of the loess section in Principles meant that he had a lasting influence. After the 5th edition, there was more of an emphasis on very fundamental questions but the spreading and circulation of the earlier editions ensured that loess became universally known.

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Fig. 1. Charles Lyell in 1836, by J.M.Wright (National Portrait Gallery London). At that time the current edition of the *Principles* was the 4th, published in 1835.

2. The Rhine loess

There are loess deposits in many parts of the world, but in the Rhine region there was that happy coincidence of interesting deposits and interested investigators. There was also the happy coincidence of Charles Lyell arriving in Heidelberg on his honeymoon- and finding Bronn and Von Leonhard in residence there. It is no surprise that loess investigation begins in the Rhine region (see Jovanovic et al., 2014).

The Rhine is a loess river (see Smalley et al., 2009) which means that the river played a critical role in the formation of the loess deposits. The deposits had a moment of fame via a passing mention in 'The Origin of Species' by Charles Darwin:

"We have evidence in the loess of the Rhine of considerable changes of level in the land within a very recent geological period, and when the surface was peopled by existing land and fresh-water shells."

Charles Darwin 1859

Darwin's view of the Rhine loess would have been much influenced by the ideas of his friend Lyell. They were both very concerned with vertical movements of the land, and of course the relevant theory of loess deposit formation in 1859 was Lyell paradigm 2, gradual deposition from water.

Fig. 2 is a sketch map of the distribution of the Rhine loess, taken from the loess map of Europe by Grahmann (1932). The association of the loess with the river is clearly shown. The region demarcated on the map is the area of the map from Bailey (1962 p.76) which indicates places associated with Lyell (Fig. 3).

The material for the Rhine loess appears to originate in the Alps and be carried to the north by the river. It is then blown a short distance inland and forms the characteristic deposits. A sequence for the formation of the Rhine loess at Kaiserstuhl has been

outlined by Smalley et al (1973) and the general interaction of rivers and loess material was considered by Smalley et al. (2009).

3. The Principles of Geology

In 1830 the first volume of the 'Principles of Geology' was published by John Murray in London (Lyell, 1830). This was the beginning of a long publishing saga; twelve editions of the Principles would be published in Lyell's lifetime and it encompassed a major part of the evolving debate on the nature of geology and the nature of the forces shaping the earth. This was a major work and it tends to be discussed in relation to its effect on geological development (see Bailey, 1962; Wilson, 1972; Secord, 1997), but in its pages, as a sort of minor theme, is some material relevant to the development of studies on loess.

The publication of volume one would turn out to be one of the great bibliographical moments in geology, overseen by John Murray who would oversee another great moment in 1859 when he published the *Origin of Species* by Charles Darwin. Volume One was the geology book taken by Darwin with him on the voyage of the *Beagle* (and Volume Two reached him in Rio de Janeiro).

Vol.1 was published in January 1830, and vol.2 followed in January 1832. A second edition of vol.1 appeared in 1832, and then in January 1833 a second edition of vol.2. The first edition was completed with the publication of vol.3 in May 1833, and now the loess story begins. Lyell went to Bonn in 1832 to marry Mary Horner and they went on to Heidelberg where H.G.Bronn and Karl Caesar von Leonhard were on hand to demonstrate the loess. Lyell must have been aware of loess from his conversations with Hibbert but it seems possible/likely that his first proper look at the material was during this 1832 visit to Heidelberg.

He writes to his sister Eleanor:

"Next day, the 19th [July 1832], to Carlsruhe, making a delightful detour on the road, up a small valley leading from the plain up into the Odenwald hills, where I went to see a singular deposit, called 'loess' provincially, filled with recent species of land shells, and which is peculiar to the Rhine valley, found at Bonn, Strasburg, and hundreds of intermediate places."

Vol.3 was being prepared at this time and it proved possible to insert a section on loess (chapter 11, p.151–3). Vol.3 is dedicated to Roderick Impey Murchison and in the preface Lyell makes a brief mention of his encounter with the loess:

"In the summer of 1831 I made a geological excursion to the volcanic district of the Eifel, and on my return I determined to extend my work to three volumes, the second of which appeared in January 1832. The last volume has been delayed till now by many interruptions, among which I may mention a tour, in the summer of 1832, up the valley of the Rhine, when I examined the loess (vol.iii, p.151) ..."

The 1832 Rhine valley visit provides the material for the loess section in vol.3. Lyell describes the loess and offers the opinion that it was deposited, suddenly, from a flood. Vol.3 was published in May 1833, and that completed the first edition. The loess occupied a few pages in the discussion of the newer Pliocene formations towards the end of vol.3, but because of the great success and large distribution of the book this was sufficient to carry news of loess around the world. It might be argued that it set the first paradigm for loess deposit formation: sudden deposition from a large flood.

"If we could suppose the waters of a great lake like that of Constance [Bodensee] to have been suddenly let free by an

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