## ARTICLE IN PRESS

Quaternary International xxx (2016) 1-18

Contents lists available at ScienceDirect



Quaternary International

journal homepage: www.elsevier.com/locate/quaint

## Late Pleistocene loess of the Lower Rhine

### Wolfgang Schirmer

Department of Geology, Heinrich Heine University Düsseldorf, Wolkenstein 24, D-91320 Ebermannstadt, Germany

#### ARTICLE INFO

Article history: Available online xxx

Keywords: Loess Solcomplex Coarse silt index (CSI) Rhine Interglacial Complex Ahr Interstadial Complex Event stratigraphy

#### ABSTRACT

From the Lower Rhine a compiled 25.7 m thick Late Pleistocene loess-paleosol sequence is differentiated into five lithostratigraphic units: the Rheingau Member (MIS 5), the Keldach Member (Weichselian Early Pleniglacial, GS-21.1-18, MIS 4), the Ahrgau Member (Weichselian Middle Pleniglacial, MIS 3) and the Hesbaye and Brabant Members (Weichselian Late Pleniglacial, MIS 2). It correlates well with climate fluctuations known from ice cores and deep-sea cores. The sequence was continuously sampled by 335 samples. It cuts through all essential layers and soils of the Late Pleistocene Upper Loess Formation. A continuous coarse silt index (CSI) curve shows a maximum in the Hesbaye Member (31-24 ka b2k) indicating the strongest wind conditions during the early Late Pleistocene. Further CSI highs lie in the Keldach and early Brabant Members, CSI lows are found the early and middle Rheingau Member (GI-25 -?GI-22), the Jackerath-Spenrath Soils within the deeper Keldach Member (?GI-20-19), the early Ahrgau Member (GI-17-GI-12) and finally in the Elfgen Soil (GI-2) at the base of the Brabant Member. The organic carbon culminates in the Titz Humus Zone, presumably at the end of GI-21, indicating scanty oxidation during the following cold Lower Weichselian Pleniglacial period. The Garzweiler Solcomplex forming a prevailing period of soil formation between 130 and 78 ka BP (MIS 5e-a) is considered as interglacial complex (Rhine Interglacial Complex) continuing the style of the older interglacial complexes of MIS 7, 9 etc. The Ahr Interstadial Complex (MIS 3) is seen as immature complex of warm phases with fabric of the interglacial complexes. – Author's suggestion: The Rhine Interglacial Complex covers MIS 5e -a and restricts the Weichselian Glacial to MIS 4 through MIS 2. This procedure follows the style of the older interglacial complexes.

© 2016 Elsevier Ltd and INQUA. All rights reserved.

#### 1. Introduction

In the area of the Lower Middle Rhine and the Lower Rhine a compiled Pleistocene stack of an up to 55 m thick loess-paleosol sequence shows a distinct subdivision by solcomplexes and by sedimentological discordances (Fig. 1). Therein the Late Pleistocene loess comes up to 25.70 m thickness and exhibits 20 fossil terrestric soils (see inset) and at least 15 gelic gleysols. This Late Pleistocene loess stack, lithologically called Upper Loess Formation, is subdivided by discordances and fossil soils into five members representing the time periods Rhine Interglacial Complex (bracketing Eemian interglacial and Weichselian Early Glacial), Weichselian Early Pleniglacial, Weichselian Middle Pleniglacial, and lower and upper Weichselian Late Pleniglacial. As the most detailed loess

*Abbreviations:* CSI, Coarse Silt Index for the pelite grain size relation 63–20μm/ <20 μm; GI, Greenland Interstadial; GS, Greenland Stadial; ka b2k, kilo years before 2000 AD.

*E-mail address:* schirmer@uni-duesseldorf.de.

http://dx.doi.org/10.1016/j.quaint.2016.01.034 1040-6182/© 2016 Elsevier Ltd and INQUA. All rights reserved. record in Germany it gives hints for comparison of local terrestric climate fluctuations with the orbital climatic course (Schirmer, 2000a,b).

The Rhine Interglacial Complex (Schirmer, 2002a:18) encompasses the Eemian interglacial and the following warm climate variations, the MIS 5e—a. The Early Weichselian Pleniglacial corresponds to MIS 4, the Middle Weichselian Ahr Interstadial Complex to MIS 3, the Late Weichselian Pleniglacial to MIS 2.

#### 2. Regional setting

The area encompasses the slopes of the German Middle and Lower Rhine and the German-Dutch-Belgian Rhine-Maas plateau (Fig. 2). Thus, it represents the eastern part of a loess area with a similar stratigraphic loess-paleosol sequence, which extends from northern France (Antoine, 2002) through Belgium (Haesaerts et al., 2011) and the southern Netherlands (Meijs, 2002, 2011) to the German Rhineland. The loess basin of the Lower Rhine and Maas (40–200 m a.s.l.) is surrounded by the raised Rhenish Shield of 2

## **ARTICLE IN PRESS**

W. Schirmer / Quaternary International xxx (2016) 1–18

	-		Surface Soil						
	~~~~~~	1	Surface Soil Laacher See Te Mendig Soil	ephra			2bk		1
5 -		2.2	Gustorf Soil Leonard Soil Elfgen Soil Belmen Soil	Eben	selian niglacial	Brabant Member	ka	c	2
10 -	+ + + + +	+ Eben D.	Kesselt Layer   Zo Eltville Tephra Erbenheim Soils 2		Weichselian Late Pleniglacia	Hesbaye	Mb	Jpper Lo	
_		5.2 6 7777 777 777 777 777 777 777 777 777	Discordance 1 Sinzig Soils Remagen Soils	3	Middle Pleniglaci Ahr colcomple	Ahrgau	Mb	ess Forma	3
20 -		14 17 19 19 21	Kaiskorb Soils 1-4 Spenrath Soil Jackerath Soil Titz Soil	1 V	Veichsel Early Pleniglac Garzweile	Keldach ial	59 Mb 78	tion	4
	******	25	Holz Soil Pesch Soil		olcomple	Rheindau	Mb		5
- 30			Erbach Soil Bruchköbel Soils			Wetterau		Low	6
		WD	Wetterau Disc Katzem Soil	ordand	re		!	er	
-			Tenholt Soil Erkelenz Humi	is Zon		Gillgau I		- [	
			Erkelenz Soil Terheeg Soil Rheindahlen S Wickrath Soil		Erft- SC	Limburg	Mb	oess F	7
40 -	000000000000000000000000000000000000000	MD	Mülgau gravel Mülgau Discol Gindorf Humus	rdance		Mülgau	Mb	orma	8
_			Gindorf Soil Reisdorf Humu Reisdorf Soil		Rur-	Kützgau		tion	?9
50 -			Wockerath Soi Geldern gravel Venrath Soil			Geldern	Mb		?10
m	· · · · · · · · · · ·		Lövenich Soil Niers gravel ba Baal Soil	and	Niers SC	Jülich M	b		?11 MIS
-			Kuckum Soil			W. Schi	rmer	20	)14
	Ah	humus humus zone				peckled gelic prey patches r			
	Bth	greyzem: Bth horizon				rey gelic gley omogeneous		ey	
	Bt	luvisol: Bt horizon	<u>新</u>	泛	s	eworked oil sediment			
	Bw	cambisol calcic cambis	ol			oess, solifluic olluvial loess		ess	

Fig. 1. Rhine loess record. – Eben D. = Eben Discordance, GI = Greenland Interstadial, Igl. = Interglacial, ka 2bk = ka before AD 2000 (ages after Rasmussen et al., 2014). KD = Keldach Discordance. Mb = Member, SC = Solcomplex. Modified after Schirmer (2010).

Please cite this article in press as: Schirmer, W., Late Pleistocene loess of the Lower Rhine, Quaternary International (2016), http://dx.doi.org/ 10.1016/j.quaint.2016.01.034 Download English Version:

# https://daneshyari.com/en/article/5114130

Download Persian Version:

https://daneshyari.com/article/5114130

Daneshyari.com