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Gone with water and wind: The threat to the earthworks of Altheim

Abstract

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Excavation photos of the earthwork of Altheim from 1914 show a fully-developed Luvisol (para-brown earth). In 2012, fieldwork recommenced at the site and revealed a second ditched enclosure as well as the serious impact of soil erosion: In the course of a century about 0.4 m of the ditch feature has been lost. In comparison with the total amount of erosion since the creation of the earthwork in the 37th/36th century BC the loss of soil material has dramatically accelerated during the past century.

Keywords: Soil erosion, loess, Luvisol (para-brown earth), para-rendzina, Altheim culture, Bavaria.

The Altheim earthworks (Saile *et al.* 2017) lie immediately south of a hilly area of Tertiary deposits, on the loess-covered upper terrace of the River Isar (Fig. 1). They are positioned at the mouth of the little Holzen valley, on the lower part of a slope stretching southwest to the Eichelbach. The loess in this area – from the Würm Glaciation – is strongly calcareous and reaches a mean thickness of two to three metres, or significantly more in places, as at the site of the earthworks. In the course of the Holocene, Luvisols (para-brown earths) developed on this material. Decalcification of the uppermost part of the loess led to the formation and vertical displacement of clay. This process resulted in the development of a markedly lighter-coloured Al horizon under the humus-rich topsoil. The underlying, darker Bt horizon displays a very clear prismatic structure.

Already at the time when the excavation trenches were laid out, the serious impact of soil erosion was evident from the truncated profiles of the humus-rich Luvisol. North-west of the test trench opened in 2013, a slope catena comprising twelve Pürkhauer cores reaching a depth of up to 1.8 m was laid out, extending from a low rise of the loess into the valley of the Eichelbach.

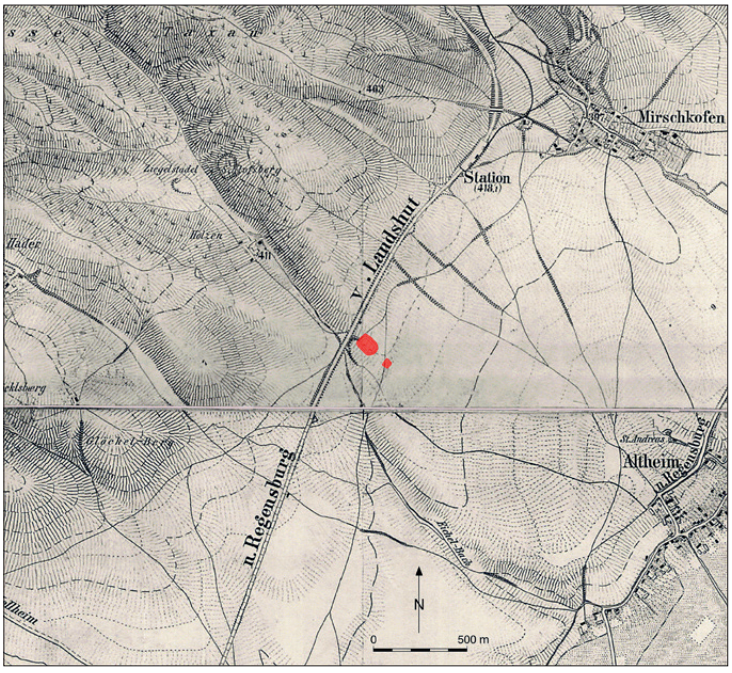

Fig. 1. Altheim, Markt Essenbach, Landshut District, Lower Bavaria. Location of the Altheim earthworks. The smaller earthwork II to the southeast of Altheim I is affected by a sunken path resulting in a seriously damaged southwest ditch (Map basis: Urpositionsblätter 530 Mirschkofen [1874] und 559 Landshut Ost [1876]) (Bavarian survey office, Munich)

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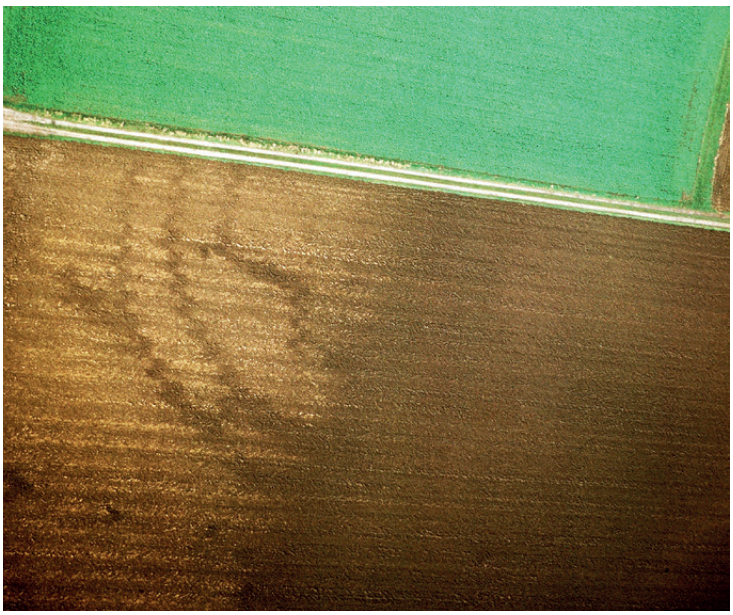

Fig. 2. **Altheim, Markt Essenbach, Landshut District, Lower Bavaria. Aerial photo of the southern part of Altheim I. Because of erosion, the Al and Bht horizons of the former Luvisol (para-brown earth) are absent. Currently there are para-rendzinas, and the humus-rich ditch fills are clearly visible in the light-coloured, calcareous loess immediately underlying the plough layer. As a result of cultivation, humus-rich material from the fill has been dragged in the direction of ploughing. Aerial photo taken 27.10.1987 by Otto Braasch (Bavarian State Department of Historical Monuments, aerial photography documentation, Archive No. 7338/039, Dia 5081-6) (Bavarian State Department for Historical Monuments, Munich)**

Whereas at the top of the rise and on the upper slope Luvisols with a thickness of over a metre could be observed, on the middle of the slope – corresponding to the south-western part of the earthwork – the calcareous loess appeared directly under the plough layer. Here, the whole of the Luvisol has been eroded, and para-rendzinas have developed (Fig. 2). Even if we consider a changing micro-topography since the Neolithic – and thus the varying depth of the lower boundary of the Bt horizon at the present day – we can estimate that there has been erosion of up to a metre or more in the course of the past 5,000 years. In particular, the part of the enclosure located closer to the Eichelbach has been very strongly affected by erosion.

On several excavation photos from 1914, fully-developed Luvisols can be identified in the sides of the middle ditch (Fig. 3). Even in the absence of a scale, the approximate thickness of the horizons and the depth of the ditch excavated at that time can be calculated from the stature of the excavation worker (roughly 1.7 m) and the shovel that he is holding (1.5 m). The Ap horizon could have had a thickness of about 0.3 m, the Al horizon could have been about 0.2 m thick and the Bt horizon below it could have been about 0.5 m thick. Accordingly, the total thickness of the soil could have been about a metre. The depth of the excavated ditch can be reckoned as being about 2.3 m, whereby we can add to this a further 0.2 m that was not excavated at the time (Fig. 4). A century later, the thickness of soil cover has been reduced to 0.6 m. The Ap horizon – 0.3 m thick, as before – is directly underlain by a Bt horizon that now has a maximum thickness of only 0.3 m. No Al horizon is present any longer. The depth of the ditch no longer reaches about 2.5 m, but rather only about 2.1 m. Thus, in the course of a century about 0.4 m of the ditch feature has been lost through soil erosion. In comparison with the total amount of erosion since the creation

Fig. 3. **Altheim, Markt Essenbach, Landshut District, Lower Bavaria. View to the northwest from the middle ditch I North, excavated in June 1914 in the eastern part of earthwork I. Clearly identifiable in the outer side of the ditch, from top to bottom, are: the dark Ap horizon, the lighter Al horizon and the dark Bt horizon, which have developed from the loess. Distinction of the soil horizons, showing the Munsell colour notation, by R. Schmidt**

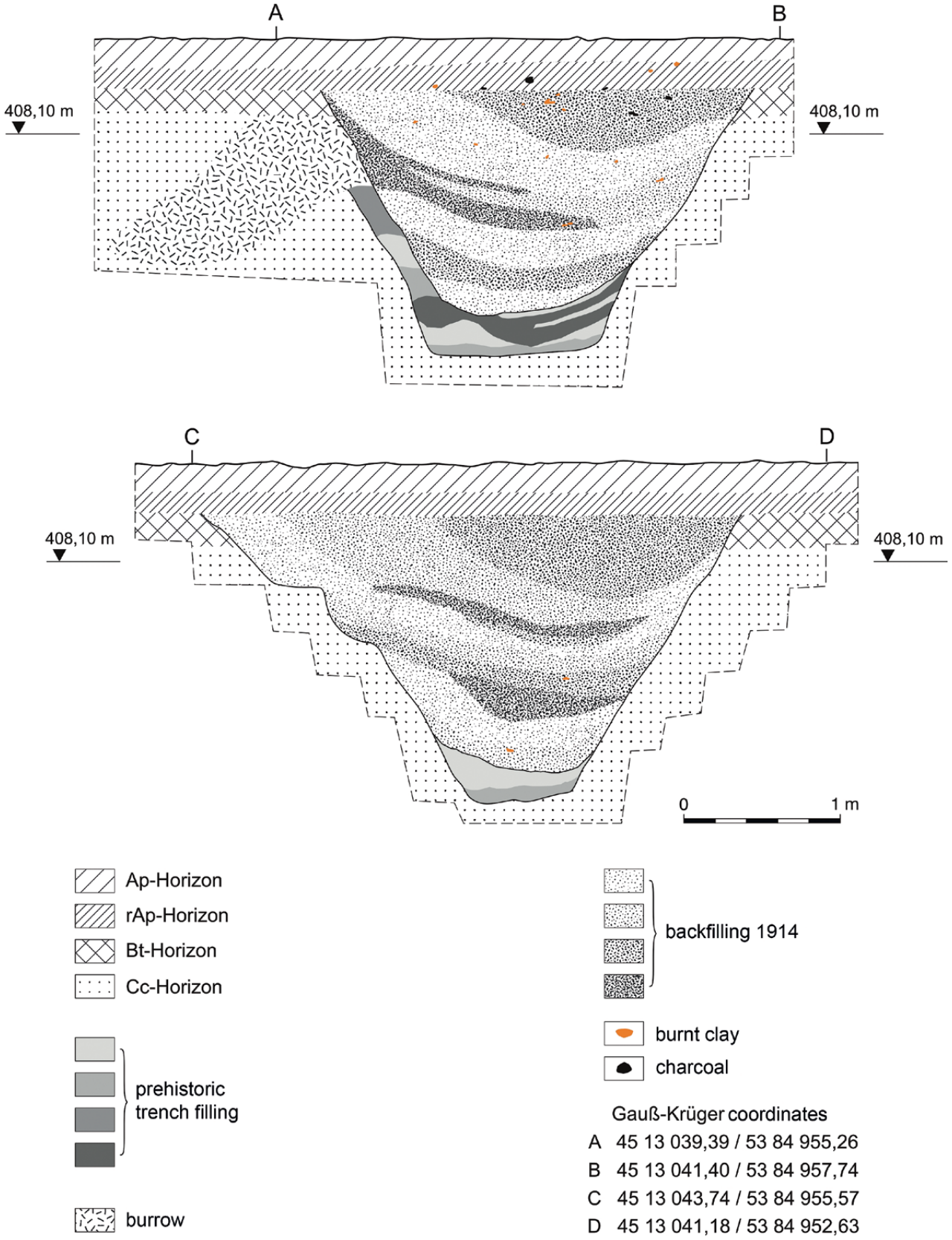

Fig. 4. Altheim, Markt Essenbach, Landshut District, Lower Bavaria. The ditch profile in 2014 in the area of the middle ditch I North that had been excavated in 1914. (prepared by H. Marx)

of the earthwork, the loss of soil material has dramatically accelerated during the past century.

A loss of 0.4 m of soil in the course of the last 100 years corresponds to a rate of erosion of 4 mm per annum. This value significantly exceeds the rate considered desirable at the present day, namely a maximum of 1 mm per annum. Only under these conditions can the potential of biotic productivity and the soil type be sustained despite agricultural land use, if the soil parent material is sufficiently thick. However, contradicting these concepts, Arno Semmel already noted two decades ago that in areas under the plough essentially no soil formation takes place, and it is thus inappropriate to assume a rate of soil formation of one millimetre per annum (Semmel 1995 and see also Mosimann 1998). If current land use continues at Altheim, less than another century will pass before the Bt horizon – which makes good crops possible due to its nutrient-rich clay minerals – completely disappears. It is hardly conceivable that the lower boundary of the Bt horizon will shift deeper during this time period, especially considering that this is a calcareous environment. Thus, not only is the monument in danger, but also soil fertility is under acute threat. The threat to the cultural monument could be significantly reduced by long-term use of the area as pasture.

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