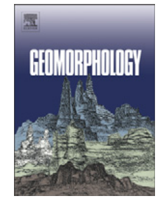
Geomorphology 122 (2010) 274–282

Contents lists available at ScienceDirect

Geomorphology

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



Landscape history and man-induced landscape changes in the young morainic area of the North European Plain — a case study from the Bäke Valley, Berlin

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ARTICLE INFO

Article history:
Received 12 May 2008
Received in revised form 10 February 2009
Accepted 16 June 2009
Available online 17 July 2009

Keywords:
Landscape history
Quaternary
Holocene
Man-induced changes
Medieval time

ABSTRACT

The Bäke creek valley is part of the young morainic area in Berlin. Its origin is related to meltwater flow and dead-ice persistence resulting in a valley with a lake–creek system. During the Late Glacial, the slopes of the valley were affected by solifluction. A Holocene brown soil developed in this material, whereas parts of the lakes were filled with limnic–telmatic sediments. The excavation site at Goerzallee revealed Bronze Age and Iron Age burial places at the upper part of the slope, as well as a fireplace further downslope, but the slope itself remained stable. Only German settlements in the 12th and 13th centuries changed the processes in the creek–lake system: the construction of water mills created a retention system with higher ground water levels in the surrounding areas. On the other hand, deforestation on the till plain and on the slope triggered erosion. Therefore, in medieval time interfingering organic sediments and sand layers were deposited in the lower part of the slope on top of the Holocene soil. The new soil which formed on top of these sediments was transformed by ploughing until the 19th century. In 1905/06 the lower part of the slope was reshaped by the construction of the Teltow Canal, following the valley of the former Bäke creek. Finally, the whole area was levelled by infill after World War II.

1. Introduction

The investigation area is part of the young morainic area of the North European Plain and is located on the Teltow till plain in the southwestern part of Berlin. This till plain is confined by the Warsaw–Berlin ice marginal spillway to the north, the Havel river lakes to the west, the Nuthe–Nieplitz–Notte lowland to the south, and the Dahme lowland to the east (Fig. 1). The main features of the relief were formed or reshaped about 22 000 BP by the Weichselian ice sheet and its meltwalters. The till plain itself was originally structured by some end-moraine features, branched meltwater channels and partly aligned dead-ice hollows. In the latter, organic Late Glacial to Holocene infills have repeatedly been found (Pachur and Schulz, 1983).

The research area is located at the slope of a small meltwater channel paralleling a minor ice retreat marginal position (Pachur and Schulz, 1983; Böse, 1989). Dead-ice blocks, buried in this meltwater channel, were melting during the Oldest Dryas/Bölling transition, and lakes came into existence in the deepest depressions (Böse, 1995; ages according to Litt et al., 2001). In addition, the slopes of the meltwater channel were affected by periglacial gelifluction processes, thus partly reshaping and smoothing the slopes.

The Bäke creek, tributary to the Havel river, flowed in a westerly direction through these lakes, called Teltower See, Schönower See, and Griebnitz See. Machnower See belonged to the same valley system but was located in a minor northern branch, and its outflow was tributary to the Bäke creek (Fig. 2).

1.1. The influence of humans since medieval time

The Bäke creek meandered strongly during the Holocene and was embedded in wetlands in which fens were formed (Brande and Hühn, 1988). Substantial human intervention in the fluvial system is evidenced by the construction of three water mills in High Medieval time. The “Mittel-Mühle” (middle mill) between the villages of Teltow and Kleinmachnow is mentioned in a document of 1289, and is still recognisable today as a mill location. The two other mills were located at Schönower See and close to the village of Kleinmachnow, respectively (Fig. 2). These mills were barrages and led to water retention in the creek, inducing a rise in the ground water level of the surrounding areas followed by increasing wetness in the adjacent low parts of the valley. The village closest to the excavation site is Giesensdorf on the east bank of the Bäke valley, first mentioned in 1299. In the 19th century it became part of Lichterfelde, and then of Berlin. The Lake “Der Teich”, also mentioned on maps as “Lichterfeldsche See,” was obviously a shallow, temporary lake. On some maps of the 18th and 19th centuries it is missing or marked as a drained lake

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doi:10.1016/j.geomorph.2009.06.026

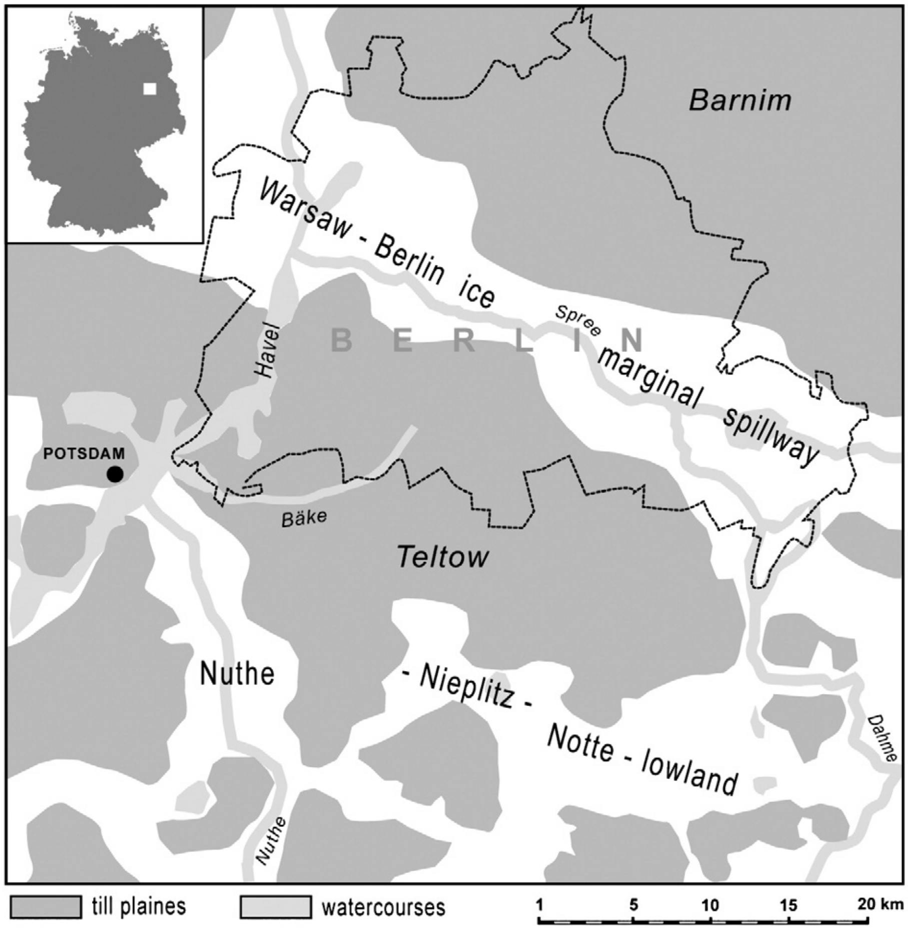

Fig. 1. Location of the Bäke creek in the Berlin-Potsdam area. Dashed line indicates the boundary of Berlin.

(Rach, 1988; p. 108–109 (map details), Preußische Kartenaufnahme, 1831,1835).

Between 1901 and 1905, the limnic and fluvial situation in the valley was completely changed by the construction of the Teltow Canal for inland navigation: Teltower See was transformed into a harbour area, and the former Schönower See disappeared completely owing to filling; the Machnower See was reshaped by the construction of a lock (1902–1909, enlargement 1938–1940, new enlargement currently under construction) at its western outflow (Pachur and Röper, 1987). Since that time, the Bäke creek has no longer existed as a continuous watercourse.

2. Field and laboratory methods

Representative profiles of the archaeological excavation between Goerzallee and Ortlerweg in Berlin—Lichterfelde were studied with sedimentological and palaeobotanical methods for reconstructing landscape evolution at different time slices. The profiles and trenches in the planar excavation field were described after the surface had been carefully cleaned. The profiles were studied in detail in six example sections. A first granulometric designation was done in the field; 33 samples were taken from well determinable horizons of which granulometric analyses by sieving were performed in the laboratory. The carbonate content was tested in the field by 9.9% HCl (Bär and Böse, 1998; Bär, 1999). The results related to the landscape development will be summarised in this paper.

Pollen samples were taken mainly from the soil horizons and the limnic or telmatic deposits and also from a sediment core (Fig. 9, core a). Pollen analyses were made for dating and palaeoecological reconstruction, using a reference pollen diagram (Brande et al., 1990) from a tributary depression to the Bäke valley and others (e.g. Brande, 1985), correlated with the Berlin palynological chronozones (Brande, 1996).

The results of drillings for foundation soil analyses (Baugrund- und Gründungsgutachten, 1997) at the study site, as well as a 15 m sediment core from the former Teltow Lake were also taken into consideration by the reconstruction of the varying processes in time.

Age estimates of the archaeological site, based on radiocarbon dating, are published by Wagner in Heide (1998) and Wagner (2000).

3. Description of the investigation site in the landscape

The Bronze and Iron Age archaeological sites excavated in 1996/97 (Hauptmann and Schöneburg, 1998; Heide, 1998; Wagner, 2000) were located on the right margin of the Bäke valley at the bay of the former Teltower See. The bay was originally dammed by a natural sandy protrusion (Fig. 3), extending from northeast to southwest, from the course of the Bäke creek (Berlin-Steglitz und Umgebung, 1850; Geologische Übersichtskarte von Berlin (West), 1971; Geomorphologische Karte der Bundesrepublik Deutschland 1:25.000, GMK Blatt 13, 1983). The influence of running water here was therefore only indirect.

The location of the excavation site described in this paper belongs to a transitional zone between erosion in the upper parts of the slope and accumulation on its lower parts and in the bay. These processes were very active during the Late Glacial periglacial phase. During the Holocene, several-metre-thick limnic deposits accumulated in the bay before it developed into a peat bog.

To the west of the trenches, topographically in higher positions, the Iron Age urnfield was excavated, but no traces of a settlement have been detected in this specific area until now, though Iron Age

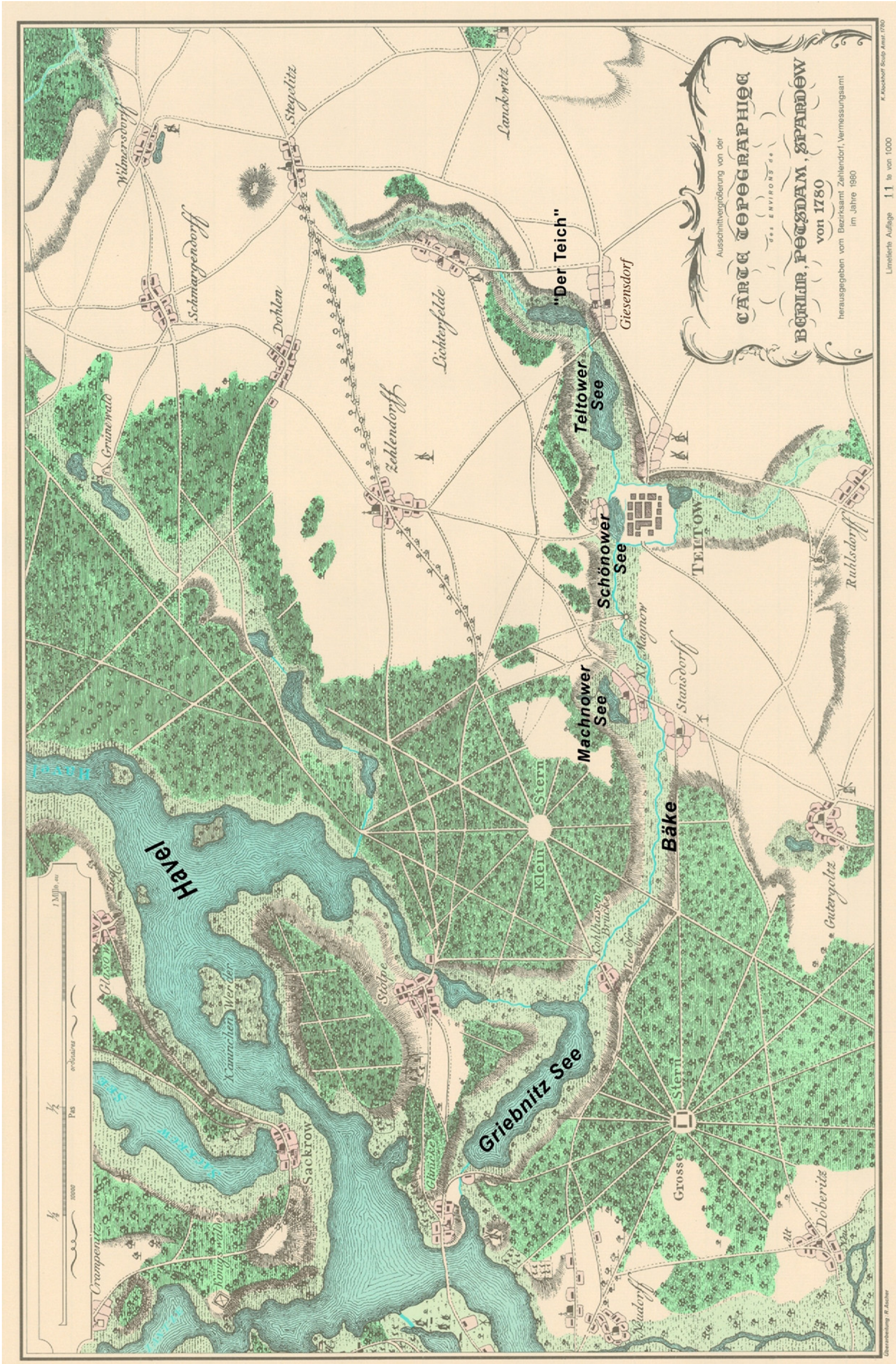

Fig. 2. Topographic map of 1780, modified.

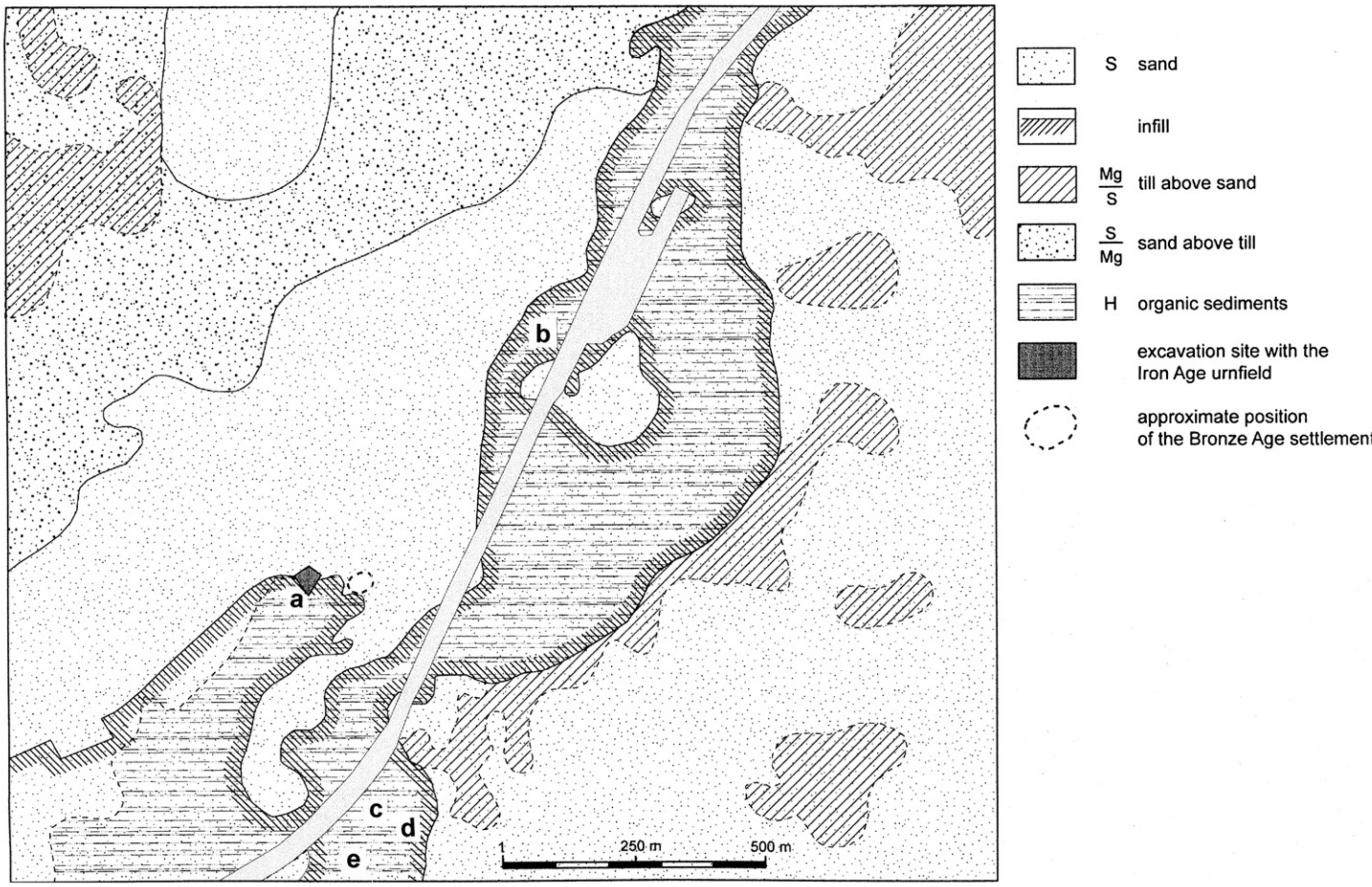

Fig. 3. Geological sketch of the envrironment of the archaeological sites and the drillings (a–e, cf. Fig. 9) based on: Geologische Karte von Berlin 1:10.000, Blatt 404, Berlin 1968).

settlements have been found in other places along the Bäke valley. Further east, at the northern edge of the sandy protrusion, remnants of a Bronze Age settlement have been found (Heide, 1998).

Human influence since medieval time has changed the relief during several distinct phases. The most recent changes in relief are linked to the construction of the Teltow Canal when limnic calcareous and sandy soil material was deposited here, levelling the surface. Additional infill with rubble after World War II was not the subject of this investigation.

4. The sedimentologically investigated profiles

4.1. Profile 1

At the topographically uppermost exposures, the quasi-natural surface below the most recent infill is located in the former erosional part of the slope at about 39 m (Fig. 4). This surface is characterised by a soil with a 30-cm thick plough horizon. The area was under agricultural use until the second half of the 19th century. Already at that time ploughing led to finds of prehistoric urns at the uppermost part of the slope at about 39.2 to 39.4 m.

Beneath the plough horizon, the profile shows 30 cm of non-calcareous medium sand with some fine sand. By contrast, the underlying fine-sandy medium sand is calcareous, like the underlying coarser sands from 116 cm below the soil surface downwards. The whole sediment sequence is unlayered.

However, in another profile (Fig. 5) at the eastern edge of profile 1 at 38.6 m already the originally much more differentiated relief is documented by a second fossil soil below the plough horizon. This soil is very clearly visible owing to its organic content, and pollen analysis revealed that it had formed the surface until medieval time. Afterwards it was covered by colluvia in which the plough horizon developed later on (Figs. 5–7).

4.2. Profile 2

This profile is the most informative part of the excavation, located obliquely on the slope (Fig. 6). Diversification of the sediments was clearly visible. Under the most recent infill the 50 cm thick plough horizon (Ap) could be traced along the whole section, inclining southwestwards in accordance with the former relief. Below the plough horizon, in the uppermost northeasterly part of the section, a sandy layer only a few centimetres thick is developed, but it increases in thickness up to 50 cm in the southwest. It is a slope deposit which had levelled the relief to a certain extent.

Below this sand layer is an interbedded stratum of dark brown organic material and light mineral layers. The pollen spectra of the organic layers refer to the High Medieval time. Below these stratified sediments another fossil soil with the characteristics of a gleyic arenosol is preserved; according to the pollen record, it was formed before medieval time (Fig. 6). Observations indicate that it corresponds to the lower fossil soil mentioned in Section 4.1. This lower soil developed in a sandy, unlayered matrix (diamict). A fireplace with some charcoal and soot-blackened stones was enclosed in this sediment, 40 cm below the organic soil horizon. According to the sedimentological and palynological record, the fireplace must have been placed in a small hollow dug by humans, as no traces of an older soil in the corresponding position have been found; the organic content varies between 0.8 and 0.7% in the diamict, whereas the fossil soil on top has 2.4% (Bär, 1999).

Drillings below revealed material about 3.3 to 4 m of layered fine and medium sands on top of a till. A further fossil soil has not been detected.

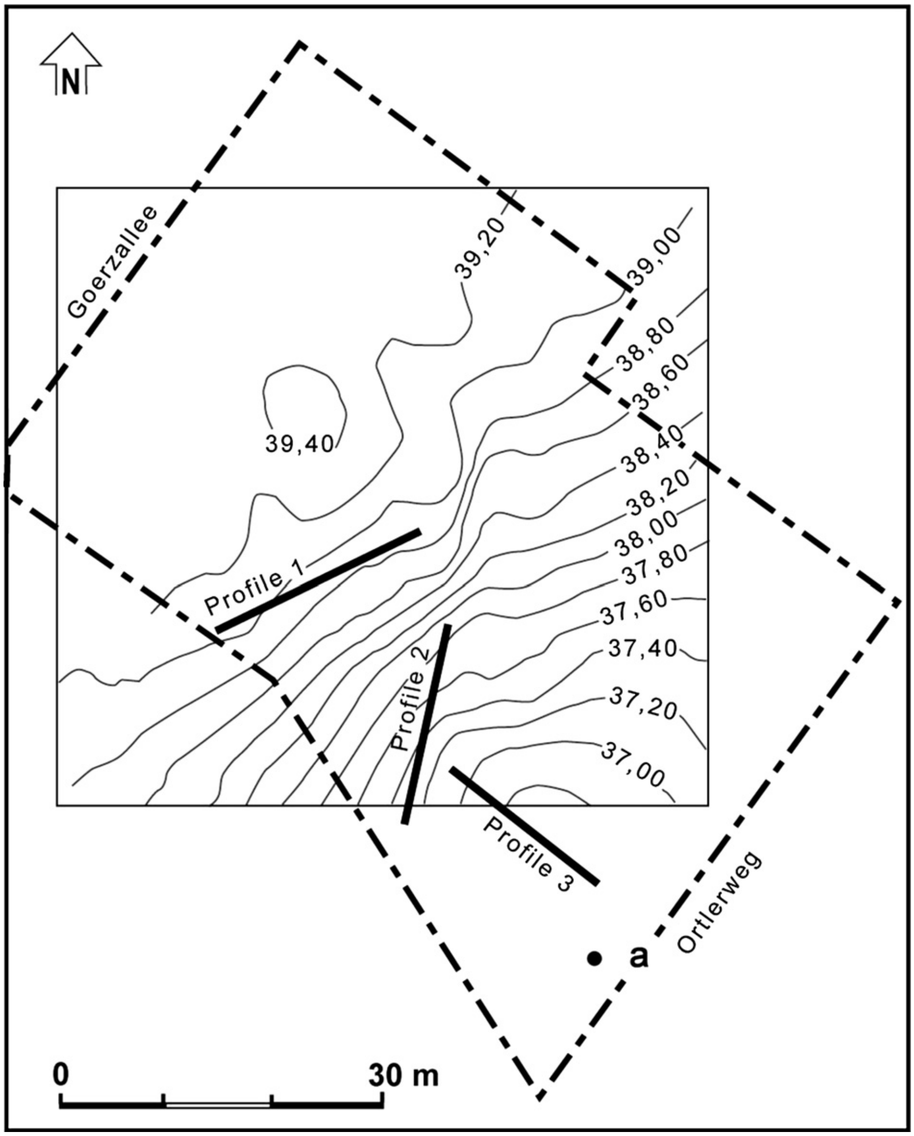

Fig. 4. Former topography, prior to recent infill, of the excavation site and the situation of the described profiles (based on data from Peter Schöneburg) and sediment core a (pollen analysis).

4.3. Profile 3

Profile 3 (Figs. 4 and 7) follows the inclination of the original natural surface from the till plain to the former bay of Teltower See. Interbedded organic and minerogenic material as described above was also found in this section, the individual layers increasing in thickness.

In the middle part of the section, the uppermost organic layers are partly disturbed by protuberances of sand (Fig. 8). Those features are related either to more or less the synsedimentary disturbances by cattle in a wet environment or to the density compensation in saturated material during infilling.

Beneath this medieval sediment sequence and further downslope the different layers merge into one, which is the Holocene soil formed up to the medieval time.

In the lowest position, the colluvium is underlain by an organic sequence which was formed in the wetlands of the Bäke valley:

- 5 cm of peat with medieval pollen spectra,
- 5 cm of decomposed peat with silty fine sand. The material is carbonised, free of pollen, and has been burnt,
- 10 cm of sand with few organic admixtures, possibly resedimented during the medieval time,
- 5 cm of sandy anmoor which was formed from Subboreal to Older Subatlantic time. This was a phase with increased precipitation, reduced temperature and natural wetland-forming processes.

Older organic layers have not been found, but a till was identified at 32.5 m asl.

The adjacent part of profile 3 shows a 2 m broad disturbance by a channel-like structure filled with sands and muds with shell remnants (Fig. 8). This disturbance represents the infill of fluvio-limnic material as a result of the excavation of the Teltow Canal in the first decade of the 20th century. The material directly overlies the Holocene soil; all medieval sediments have been removed.

5. Evaluation of the results

According to the interpretation of the previous drillings, the Bäke valley follows a depression or valley originating in the Penultimate Glacial Stage, the Saalian glaciation. In some places, Eemian peat — a

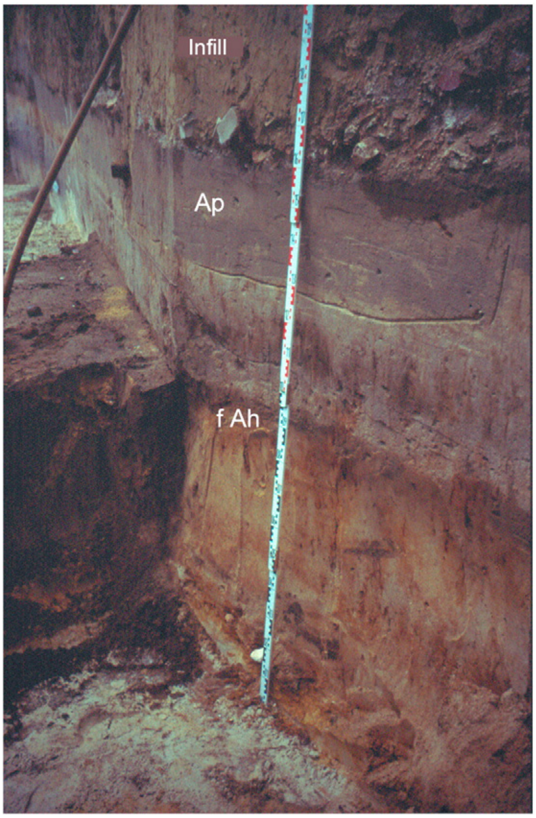

Fig. 5. Profile 1. Below the post-World War II infill lies the plough horizon (Ap) on top of the colluvial sands. These are underlain by the fossil Holocene soil (fAh), which formed the surface until medieval time. The fireplace is embedded in a diamict of which a pollen analytical sequence was taken at the left margin on the photo.

Fig. 7. Profile 3.The profile with remnants of the plough horizon under the artificial abrasional surface. Below the plough horizon is the medieval sand accumulation; below these sands lies the medieval peat horizon. In the background the artificial infill is visible (details see Fig. 8).

filling of the Last Interglacial — has been found (Brande, 1980; Pachur and Schulz, 1983; Böse, 1989). The Weichselian inland ice deposited fluvioglacial sands and a till cover but preserved the main features of the preexisting relief. Subglacial meltwaters used the lowlying area, and during the phase of downmelting, dead ice broke into the subglacial meltwater channel, thus preserving the deepest parts during the subaerial meltwater flow.

Permafrost and sparse vegetation characterised the landscape after downwasting of the glacier. The periglacial conditions favoured heavier surface runoff of snow meltwater and rainwater because infiltration was impeded by the sealing permafrost. In spring and summer, the active layer was subjected to gelifluction due to temporary oversaturation. These processes are recorded in a core from the deepest part of the Bäke valley, where bedded sands, with layers of coarse sand, pebbles and boulders (Pachur and Schulz, 1983), are evidence of a strong runoff.

The differentiated Late Glacial climate history was best preserved in the up-to-20-m thick limnic sediments in the adjacent bay of Teltow Lake (Pachur and Schulz, 1983; Pachur and Röper, 1987). The Oldest Dryas (13 800–13 670 BP) is represented by a silty mud (Brande in: Pachur and Schulz, 1983, p. 56). During the following interstadial Bölling-Alleröd complex (13 670–12 680 BP), including the Laach tephra (12 880 BP) as a distinct marker horizon, the solution of carbonates in the glacial material increased, resulting in the deposition of a calcareous mud. The Younger Dryas (12 680–11 590 BP) is documented by a silty mud owing to colder climatic conditions with increased minerogenic transport from the slopes. The corresponding sediment at the excavated slope is considered to be the unbedded sandy loamy layer with isolated cobbles (diamict).

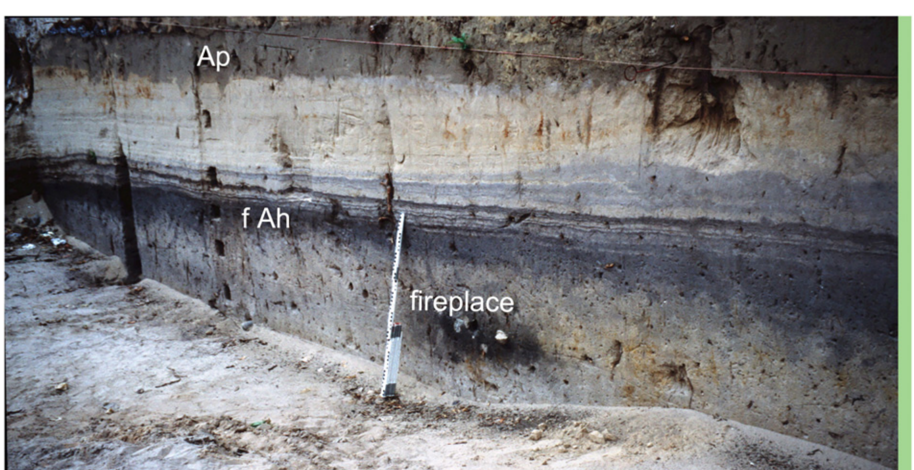

Fig. 6. Profile 2, detail. The 19th century plough horizon (Ap) is located below the 20th century infill, the interbedded stratum of medieval time being clearly visible. The fossil humic horizon (fAh) was the Holocene surface until medieval time. This soil developed in a diamict, in which the fireplace is embedded.

Fig. 8. Profile 3, detail of Fig. 7.

This development is confirmed by the palynological record of a sediment sequence from the Siepegraben (Brande et al., 1990), 3.5 km west of the excavation area, a tributary depression to the Bäke valley.

The following Postglacial is characterised by calcareous muds which were formed up to the Older Atlantic, about 8 000 BP. Some horizons include detritus, which is attributed to the naturally changing course of the Bäke creek. Traces of the pre-Neolithic landuse or settlements have not been identified in this area. Nevertheless the Bronze Age and Iron Age settlements along the Bäke valley further north of the excavation site (Heide, 1998), which are not located at a lake shore, give evidence of the existence of the Bäke as a creek during the Holocene. Moreover, the Bäke valley has a continuous inclination from the source to its mouth in the Griebnitz Lake of about 4 m. The deeper part of Teltow Lake remained an open water body throughout the Holocene until the construction of the Teltow Canal. Overgrowing peat formation started due to the water depth from the early Atlantic to Subboreal time (Fig. 9, a–d), while on the margins of the valley

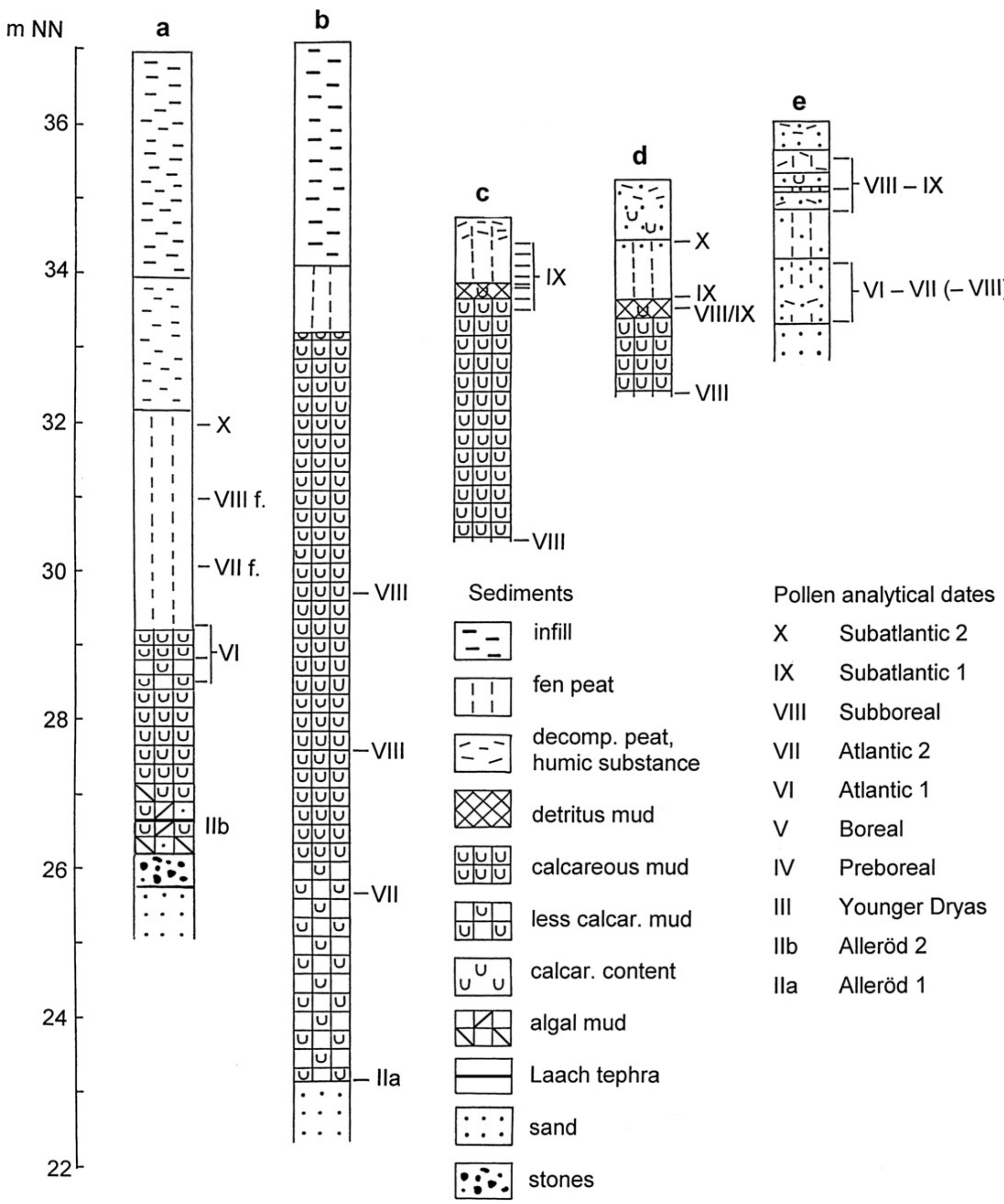

Fig. 9. Sediment cores with pollen analytical dates. Site positions see Figs. 3 and 4, b–e from Brande (1983).

paludification took place only in the later Holocene (Fig. 9,e). Some peat was dug until the 19th century, peat cuts being documented on old maps (Berlin-Steglitz und Umgebung 1850 (1969); Geologische Karte von Preußen und benachbarten Bundesstaaten Blatt 44/36 Teltow, 1910). Therefore the disturbance of the peat surface at the excavation site cannot be excluded, and the surface does not represent the end of the peat growth. Both the 2 m of mud above the peat (Fig. 8) and the infill are young sediments related to the construction activities in the 20th century.

Near the excavation site, the peat growth started during the Younger Atlantic at about 7000 BP (Fig. 9, core a). During the time of the Iron Age burials, revealed in the excavation, this bay of the Teltow Lake had already been overgrown by peat. It is strongly decomposed and therefore free of pollen, but belongs to the phase of the documented post-Neolithic landuse. However, this peat is free of sand or silt, which in terms of landscape evolution means that neither slopewash nor aeolian transport from the nearby area affected peat growth; the land surface was obviously stable at that time. It cannot be excluded that the fireplace in profile 2 (Fig. 6) was installed during an ongoing colluvial phase, but no ceramics, higher carbon content, or pollen have been found in this diamict, which is completely unlayered in contrast to the younger colluvial sediments. Moreover, corresponding material did not reach the lakeshore between the Bronze and Iron Age, as the drillings prove. Therefore the diamict has not been classified as a Neolithic to Bronze Age colluvium as observed about 3 km NNE on the margin of the Bäke valley at a younger Bronze Age settlement by Brande and Hühn (1988, p. 24) or by Schatz (2000, p. 97) in a different archaeological site in NE Germany, or by Stahr et al. (1983) in a Holocene colluvium in Berlin. The onset of considerable medieval impact has also been documented by Küster et al. (2008) in the young morainic area of NE Germany. Differentiated erosion through time is presented by Dreibrodt and Bork (2006, p.126) from the Belauer See (lake) in North Germany. The times of increasing agricultural activity were distinguished by geochemical methods such as potassium input into the lake, but little minerogenic material was transported even during the Neolithic to Bronze Age. Only during the Iron Age was increased colluvial material deposited, but the maximum was attained here also during medieval time.

These results support the hypothesis of a comparably low erosion rate in NE Germany during prehistoric time (Schatz, 2000, p.103). The fireplace of the Bronze Age in profile 2 and some other fireplaces at the excavation site are embedded in a sandy diamict. It is tentatively interpreted as Late Glacial gelifluction material, on top of which the Holocene soil has developed.

In summary, the sediment sequence at the archaeological excavation site (Fig. 10) comprises a basal layer of Weichselian till documented in drillings, overlain by meltwater sands. On top of them is a periglacial diamict in which Holocene soil formation took place, predominantly undisturbed until medieval time. Local interference such as fireplace digging during the Bronze Age and urn burials in the Pre-Roman Iron Age was "healed" by a new soil formation in places with a direct lateral connection to the Holocene soil.

With the onset of High to Late Medieval German settlements connected with forest clearing, intensified agriculture, and the

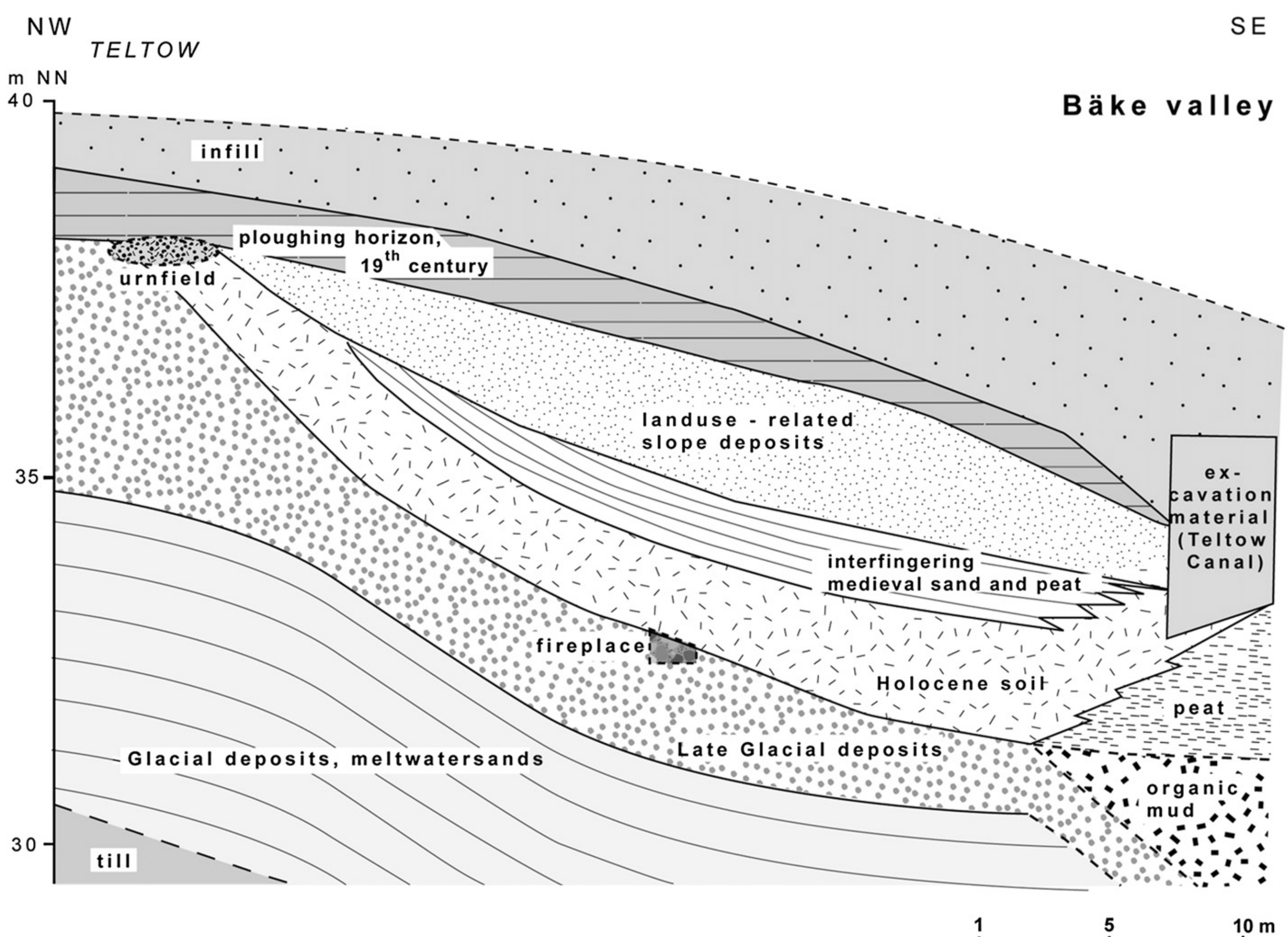

Fig. 10. Idealised profile of the sediments of the slope from the edge of the Teltow till plain to the Bäke valley (concept by M. Böse, R. Bär, A. Brande and M. Müller).

construction of mills in the Bäke creek, two interacting processes changed the environment: first, the rise of the water level in the creek and the groundwater level in the adjacent areas. A rise of the water level during that time has been observed throughout Western and Central Europe owing to the combination of climatic and human impact and fits in locally with the general medieval landscape changes (Bork et al., 1998, pp.185f, pp.221f). The floods provoked the sedimentation of the humic layers. The second process is related to the slope by erosion, transport and sedimentation of light coloured minerogenic materials. This new surface later became more stable again and was used for agriculture before being covered by recent infill.

6. Conclusions

High to Late Medieval German influence in the Berlin area not only generated considerable processes in the Bäke valley but could also be detected in various places. Rising groundwater levels mainly related to water mills are known at various places in the Havel river system (Böse, 2002; Brande, 1988; Driescher, 2003). Forest clearing on the till plains, which had been almost free of settlements and agriculture during the preceding Slavic time, enhanced erosional processes by slopewash, resulting in the formation of small valleys and corresponding alluvial fans. On the other hand, wind blown material has played a considerable part in landscape changes: cover sands, sand covering peat bogs, and even dune formation transformed the relief in higher, edaphically dry positions (Böse and Brande, 1986, 2000; Böse, 2002; Böse et al., 2002). Thus the results from the archaeological excavation site can be seen in a broader context of relief changes as consequences of extension and variation of landuse processes in medieval time.

Acknowledgements

Thomas Hauptmann, the head of the archaeological excavation, and Peter Schöneburg enabled us to conduct the field studies accompanying the archaeological investigations and gave detailed information as well as documents helpful for our interpretation. Marion Müller and Rainer Bär contributed with their field work, grain size analyses and discussions of the results presented here.

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