STUDIEN ZUR KULTURKUNDE

MATTHIAS KRINGS AND EDITHA PLATTE

LIVING WITH THE LAKE

PERSPECTIVES ON HISTORY, CULTURE AND ECONOMY OF LAKE CHAD

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FLOODS, DROUGHTS, AND MIGRATIONS
THE EFFECTS OF LATE HOLOCENE
LAKE LEVEL OSCILLATIONS AND CLIMATE FLUCTUATIONS
ON THE SETTLEMENT AND POLITICAL HISTORY IN THE CHAD
BASIN

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> Denn Kanem, wie schon Makrisi sehr richtig bemerkt hat, ist ein sehr dürres Land, obwohl in alter Zeit eben des reicheren Anbaus und der größeren Pflanzenfülle halber auch der Regenfall hier jedenfalls viel stärker gewesen sein muß, als in gegenwärtiger Zeit. (Barth 1859–60, I: 499)

Abstract

Throughout the Holocene living conditions in the Chad basin have been strongly influenced by various transgressions and regressions of Lake Chad. In this article we concentrate on selected lake levels and climate fluctuations which had major implications for the settlement history during the later Holocene millennia. These are the ca. 287–290 m-transgression which ended around 3000 BP/1000 BC, the 285/286 m-level which was reached several times during the last 3 millennia, and finally oscillations during the last two centuries which are recorded in travellers and colonial reports as well as modern collections of environmental data.

The reconstruction and cartographic representation of the extent of these former lakes are based on the interpretation of detailed topographic maps, satellite images, various thematic and historic maps and the evaluation of a digital elevation model.

Geographical information is then compared with archaeological and historical data and the effects of the lake level changes on the settlement and political history are evaluated. It becomes apparent that human response to environmental change is multifaceted and complex. Although certain repetitive patterns are evident throughout recorded history (12^{th} century AD to present), the effects are very much dependent on the particular historic circumstances prevailing at the respective point in time.

Basic characteristics of the Lake Chad Basin

As a quick comparison of different maps and satellite images of Lake Chad easily reveals, one of the striking features of the lake is the marked variations of its extension in past and present. These oscillations are essentially caused by two factors: (1) the great north-south-extension of the lake's catchment area, reaching from the Sahara desert to the moist savannah belts with its variable climates, and (2) the mostly very shallow morphology of the lake basin (see figures 1 and 3). In particular the shallowness of the central parts of the south-western Chad Basin – with a difference of only about 10 meters between its lowest parts (bottom of the northern lake basin at ca. 276 m asl, m asl = meters above sea level) and the altitude of the divide between the south-western and north-eastern parts of the Chad Basin (ca. 286 m asl, northwest of Moussoro) – makes these flat areas very sensitive to climatic changes within the catchment area. In recent years also human impact on the environment, especially in relation to various irrigation projects (Chandler 2001), became increasingly consequential.

The effects of changing precipitation, evaporation, water input by rivers and human activities have to be considered in (1) different time scales, i.e. periods covering from millennial to annual variations during the Holocene (Thiemeyer, this volume), as well as in (2) different spatial dimensions, i.e. local, regional and zonal variants of the various phenomena.

The existence of water in the semiarid environment of the central parts of the south-western Chad Basin was always a key factor for human occupation in the region (Seidensticker-Brikay, this volume). Not only the lake's islands, its lacustrine fringes and riverine areas of its tributaries but also the adjacent lagoonal areas and clay plains (*firgi*, *yayrés* etc.) were zones of dense population concentrations. Especially for the areas south of Lake Chad this is well illustrated by the abundance of archaeological sites (see figure 3). The constantly changing environmental conditions in these habitats always required specific adaptive strategies. As many ethnic groups in the wider surrounding of the Chad Basin claim to have their origin (or an intermediate station during their migrations) in the Chad Basin, the dynamics in the natural history of Lake Chad are of much relevance for the reconstruction of the regional settlement history. This knowledge is also of basic interest for ongoing linguistic studies dealing with the distribution of languages and linguistic phenomena, e.g. Ibriszimow et al. (2001) and Brunk and Ibriszimow (2002), and with language contacts, e.g. Brunk, Ibriszimow and Sommer (in press) and Ibriszimow and Löhr (in press).

The major tools for the reconstruction of selected former lake levels and other relevant environmental features (see figures 1, 3 and 6) were a series of Russian military maps with the scale 1:500,000 – the only topographical map series which homogeneously covers the whole Chad Basin in sufficient detail – and a MODIS satellite image of the Chad Basin taken on October 21, 2001 (NASA-GSFC-MODIS web). We also used data from the digital elevation model GTOPO30 (USGS 1999) and from World Basemap (ESRI-bm). All further sources are cited in the text.

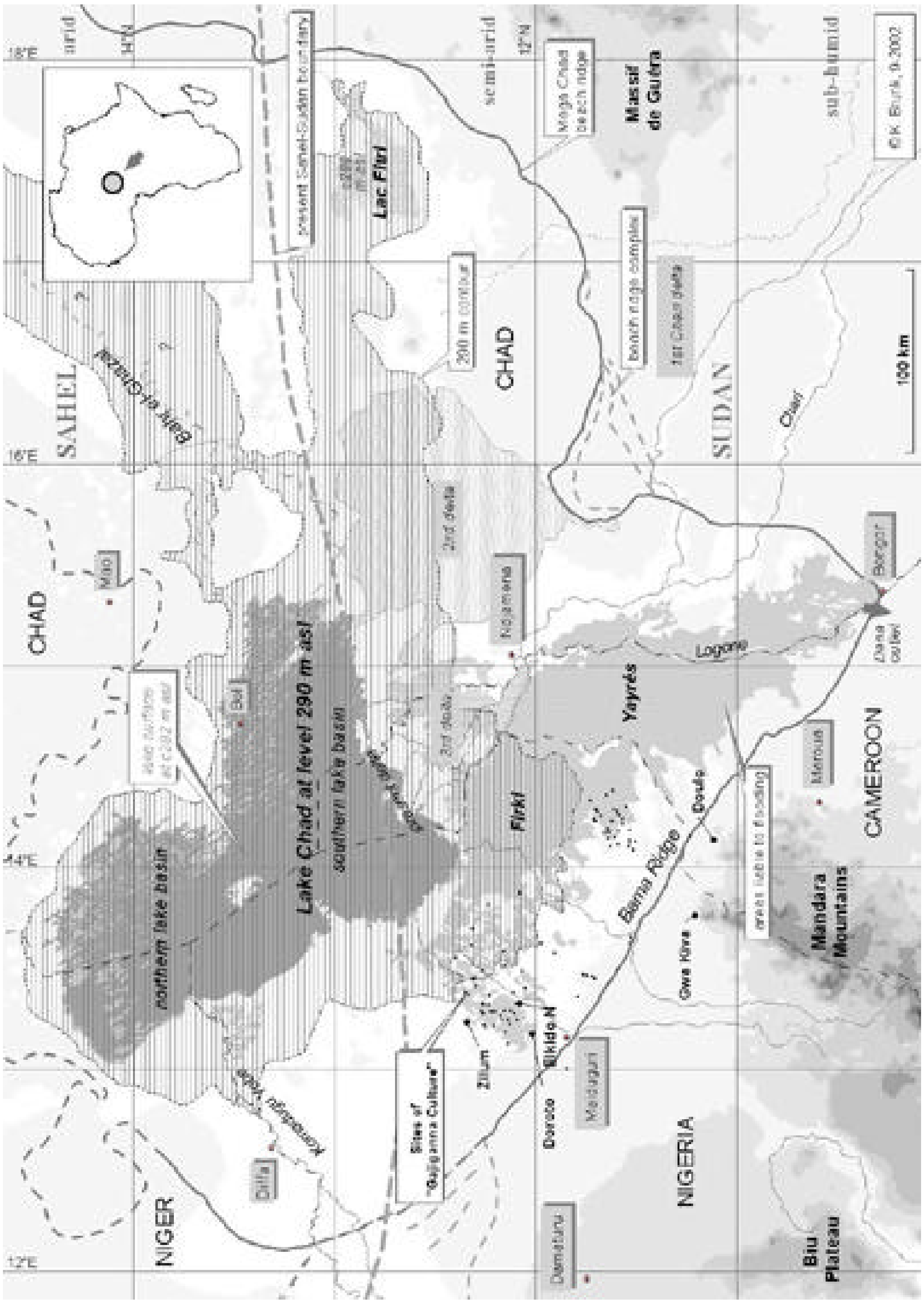

Fig. 1: South-western Chad Basin. Boundary of Mega Chad and extent of Lake Chad during maximum of Late Neolithic transgression.

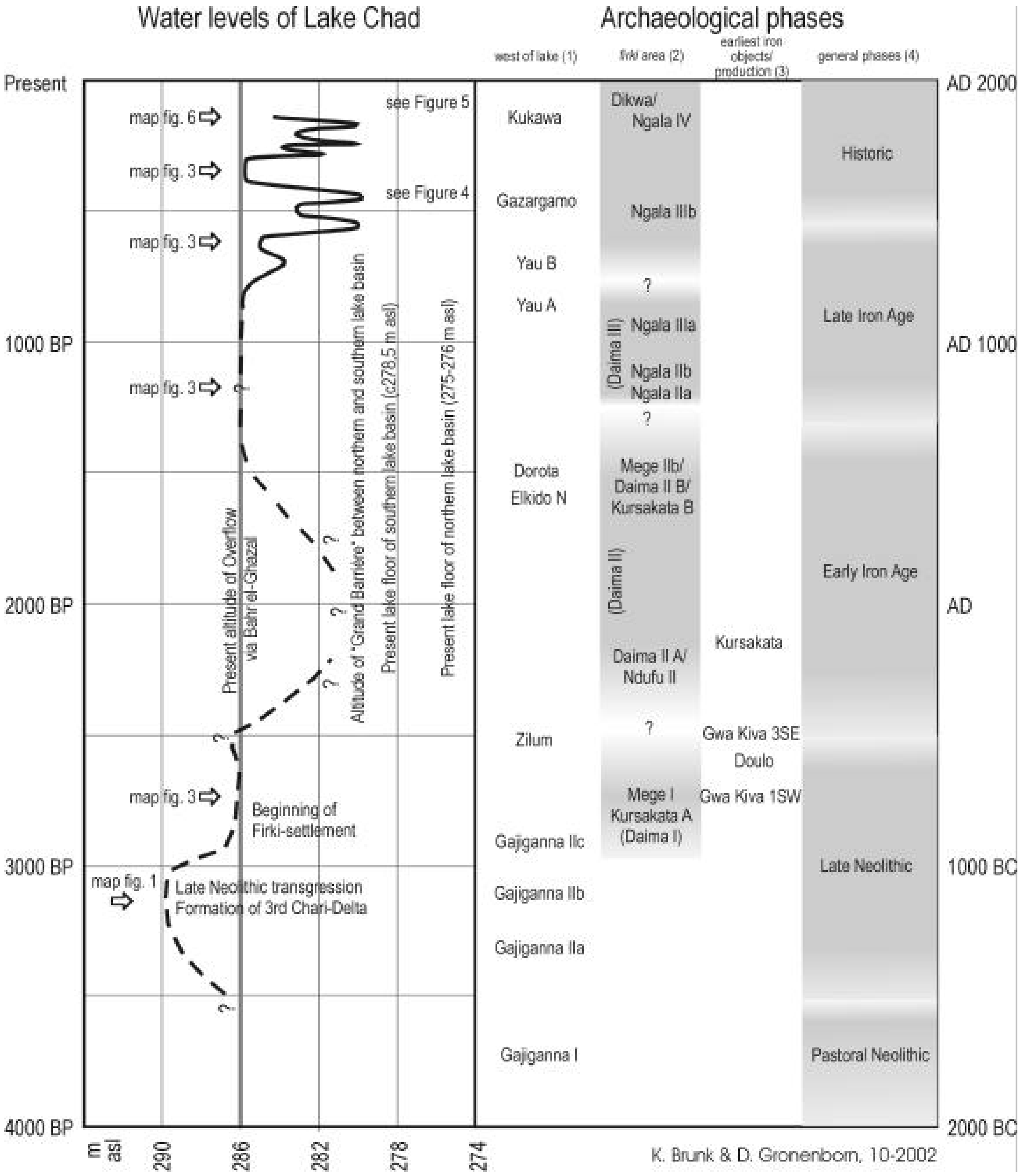

Fig. 2: Late Holocene levels of Lake Chad (approx.) and archaeological phases. Sources see footnote 2

Lake Mega Chad and the Late Neolithic transgression in the Chad Basin

The most prominent morphological feature demarcating the maximal extension of the so-called Mega Chad is a beach ridge complex[1] which surrounds the endorheic parts of the Chad Basin at an altitude of about 320–325 m asl (see figure 1) (Pias 1970a, Schneider 1994, Olivry et al. 1996, Thiemeyer 1997 and this volume, Morin 2000, Brunk and Ibriszimow 2002: fig. 5). The morphogenesis of its marginal landforms is linked with humid Holocene periods with very high water levels which occurred around 8500 BP (Nigéro-Tchadien III after Servant 1983) and a minor maximum at 6500–6000 BP (Nigéro-Tchadien V). The formation of the beach ridge complex – in Nigeria it is called Bama Ridge – was favoured by the existence of a lake outlet at ca. 325 m asl near Bongor (Dana outlet) where the water drained southwards to the Benue system. This outlet determined the maximum level during the highest lacustrine maxima at ca. 8500–8000 BP.

Lagoonal areas covering the adjoining floodplains of tributaries further extend this basin. The location of a canoe discovered in the floodplain of the Komadugu Gana near Dufuna at an altitude somewhat below 320 m asl indicates the position of the lagoon's shoreline some 8,000 years ago (Breunig 1995). It was at this lake level that a large delta (2nd Delta, fig. 1) was formed at the former mouth of the Chari river (Schneider 1967 in Olivry et al. 1996, Pias 1970a: 279f., b).

The water level of the lake during the mid-Holocene maximum at 6500–6000 BP has probably been somewhat lower and flat marginal areas have not been covered by water permanently – according to Durand (1982) and Fontes and Gasse (1991, both in Olivry et al. 1996: 44) the water level did not exceed an altitude of 300 m asl, and according to Morin (2000) it reached only 290 m asl.

Prevailing arid conditions from about 5400 to 3500 BP (Nigéro-Tchadien VI) first led to intermediate, later to rather low water levels and the reactivation of arid morphodynamics (formation of 3rd erg, Pias 1970a; "2. Dünengeneration" after Völkel 1988). Since approximately 4000 BP increased aridity forced the pastoral population in the southern Sahara and the Sahel zone to move to areas with better living conditions, i.e. sufficient water resources. Some of these "environmental refugees (…) penetrated as pioneers into the southern Chad Basin" (Breunig, this volume) and were founders of the so-called Gajiganna Culture, which existed close to marginal water pools southwest of Lake Chad from 3800 to 2800 BP (see figure 1) (Breunig et al. 2001, Breunig 2001, Breunig, this volume, Breunig and Neumann 2002).

1 Some sections have a terrace- or shelf-like morphology (Ghienne et al. 2002).

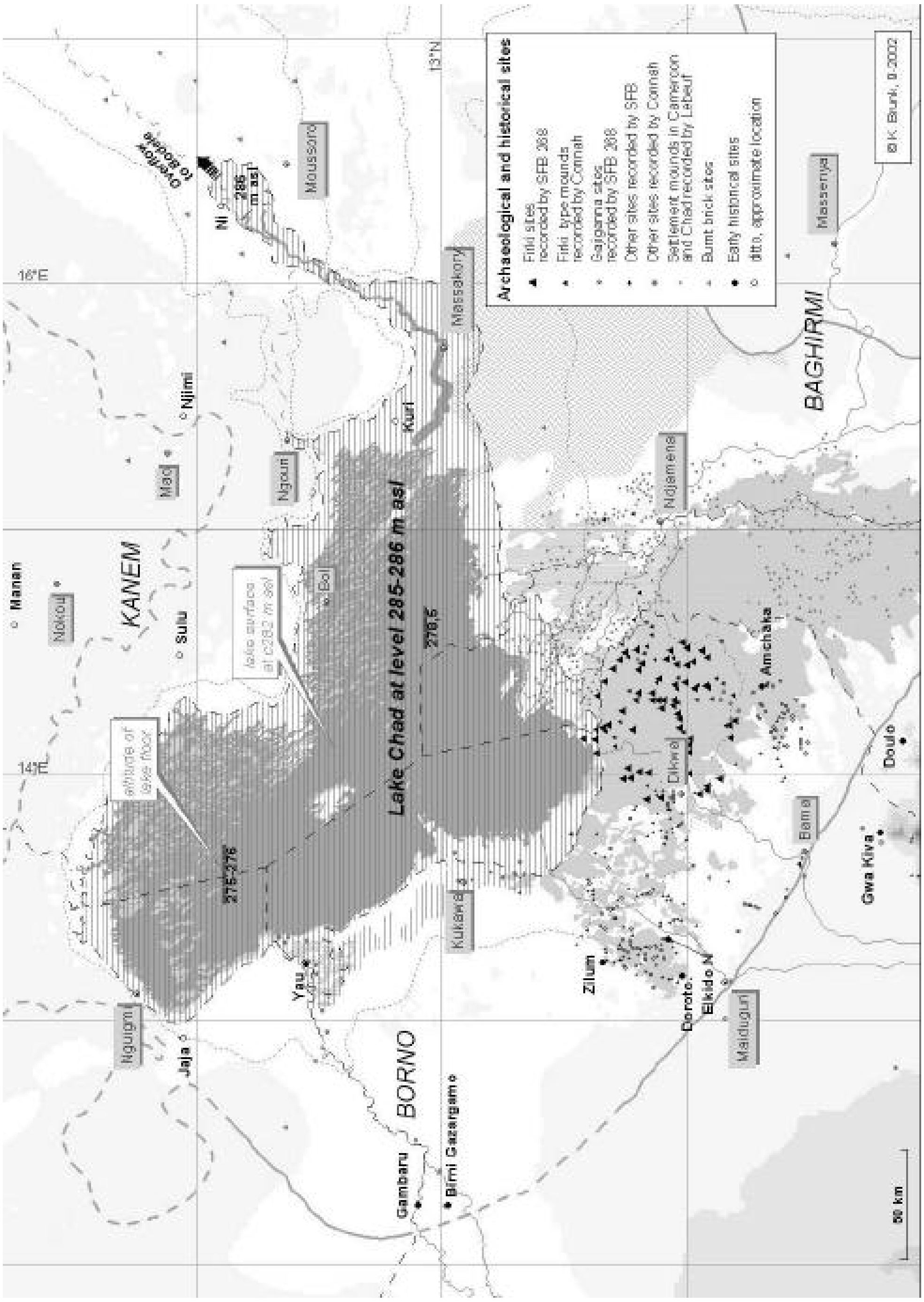

Fig 3 Lake Chad at water level of 285/286 m asl. Archaeological and historical sites in south-western Chad Basin

From about 3500/3200 to 3000/2800 BP the settlement area of these Late Neolithic bearers of the Gajiganna culture partially became restricted because of a new lacustrine transgression (Nigéro-Tchadien VII). Simultaneously the Chari formed a new delta (3rd Delta, NW of N'Djamena) west of the 2nd delta (Morin 2000). This last significant Holocene transgression, although much lower than the foregoing, reached an altitude of 287 to 290 m asl (Pias 1970a, Schneider 1994). The distribution of the sites of the Gajiganna culture (Phase II), which were settled during the same period (Breunig 2001), also confirms the extent of the transgression. Settlement in the so-called *firgi*-plains (the clay plains east and north of Dikwa which are today at an altitude of 286–288 m asl) was not yet possible because large areas were flooded. Here human occupation commenced only when the water retreated from its highest level after about 3000 BP (see below).

Within the southern part of the Chad Basin the area below the 290 m-contour line covers a surface of about 60,000 km². The aerial extent of the transgression as shown in figure 1 can only be traced in a few sections, e.g. with the help of satellite images (for instance in the area of the 2nd Delta and south of Lac Fitri). In the plains south of Lake Chad (including the *firgi* clay plains) the interpolated boundary often matches the extent of the lower-lying present-day seasonally flooded areas.

The early 3rd millennium BP (ca. 1000–500 calBC)

Until the beginning of the 3rd millennium BP the lake level had dropped from its Late Neolithic level to the altitude of a sill (north of Moussoro), which divides the north-eastern and south-western Chad Basins (see figures 2 and 3)[2]. Insufficient drainage of water from the south through the Bahr el-Ghazal valley to the northeast subsequently has led to the drying up of the Bodelé depression during the so-called "terminal lake stage" (*Endsee-Stadium* after Ergenzinger 1978: 19). Presently the overflow in the Bahr el-Ghazal valley lies at an altitude of 285/286 m asl (Maley 1981, 2000, Olivry et al. 1996: 46). As this area does not show clear signs of incision it seems likely that its altitude was not much lowered by erosion during the last three thousand years.

If the lake dropped below the 286 m-level its major tributaries (Chari/ Logone and Komadugu Yobe) had only to nourish the comparatively small south-western Chad Basin. Later high water levels in this region were limited to the altitude of this divide. Periods with largely constant water levels are a precondition for the development of coastal landforms. A conspicuous feature

2 Sources for figure 2: Water levels: Brooks 1998; Maley 2000; Morin 2000; Nicholson 1996: 63f.; Olivry et al. 1996; Schneider 1994. Sources for archaeological phases: 1). Connah 1981; Magnavita and Magnavita 2001; Wendt 1997; 2) Connah 1981; Gronenborn 2000; 2001b; Wesler 1999; Wiesmüller 2001; 3) Gronenborn et al. 1995; MacEachern 1996, 1997.

here is the frequent correlation of the 285/286 m transgression-line with the Ngelewa Beach Ridge which can be found along the western and southern margin of Lake Chad.

Figure 3 shows the approximate extent of Lake Chad at the 285/286 m water level; it covers a surface of about 35,000 km². In addition to this the high lake level also had its effects by backflow to the adjoining lagoonal areas and floodplains west and south of the lake. At least during humid periods in the Lake Chad region the seasonal flooding of these areas must have been higher, more extensive and of greater duration than today.

Exactly when this 285/286 m asl-line was reached can be determined with the help of archaeology and ^{14}C-dating. During the 20th century quite a number of sites in the region south of Lake Chad have been excavated, some of which have produced ^{14}C-dates for the period of initial occupation of this region (Connah 1981, Gronenborn 1998, Holl 1993, 1995). To establish the time frame for the onset of this process ^{14}C-dates from the various excavations in the area were calibrated by the OxCal Program[3] using the sequence method. According to this calculation the early Late Neolithic settlers should have established themselves on the *firgi*-plains between 940 and 830 BC at 68% confidence level or between 1050 and 820 calBC at the 95% confidence level (see figure 2).

An earlier date has been published by Holl[4] from the site of Deguesse in Cameroun which would indicate an age between 2050 and 1300 calBC for the earliest settlement of the area. Because of the large standard deviation this date has been omitted from the calculations, also no site in the Nigerian part of the study area has produced a similar early date. An initial settling of the Cameroonian area cannot however be ruled out, since the sandy soils there might have had elevations above the water level.

On the *firgi*-plains east of Dikwa most potential settlement sites should have been under water prior to about 1000 calBC as the clay bands underneath the cultural layers indicate. An exception may be the site of Kursakata (south of Ngala, see figure 6) where no solid clay band but only scattered clay nodules were found in the 1994 excavation (Gronenborn 1998: 231f.). Here, like at other locations in the *firgi*-environment, the initial location of the settlement mound was slightly elevated sandy islands. In the course of time the settlement mounds have grown several meters above the surrounding plains and floods could no longer endanger the settlements. Also the site of Ndufu may not have been flooded at all since no indications of clay bands were found, whereas the nearby location of Mege has a thin clay layer which was embedded between sterile sands and the lowest cultural layers (Gronenborn 1998: 235f.). Using altitude information from topographic maps we calculated the basal clay layer to be at

3 OxCal v.2.18 with calibration curve INTCAL98.14C.

4 Holl et al. (1991: 8): Ly-4177 3350±270BP, 68.2% confidence 2050–1300 calBC, 95.4% confidence 2400–900 calBC.

286 m asl which would then correspond to the 286 m water level which finally dropped at 1000 calBC or shortly thereafter.[5]

The earliest campsites in the *firgi*-area were not permanent, at least not occupied for several years as the Late Neolithic layers are intercalated by bands of sterile sand (Connah 1981: 93f., Gronenborn 1998: 235). Nevertheless somewhat solid habitation structures were erected as found at the site of Ndufu (Gronenborn 1998: 240) and Daima (Connah 1981: 240). Congregations of cattle and other bones at Daima (Connah 1981: 114) and Mege (Gronenborn 1998: 237) indicate that the subsistence of the inhabitants must have been based on cattle and sheep/goat (Lambrecht 1997), a hypothesis which is supported by layers of decomposed cow dung at Mege which should have been the remains of a cattle *kraal*-structure (Gronenborn 1998: 237). Aquatic resources were utilised extensively during the Late Neolithic occupation. Remarkably the intercalated clayey layers between the densely packed occupation layers at Mege produced the greatest amount of deep and shallow water species, whereas those layers with indications of more permanent occupation also contained species that lived in a marshy environment (Lambrecht 1977: fig. 111). Analysis of plant remains from Kursakata showed that general conditions during the first few centuries of the first millennium calBC must have been moister than afterwards (Klee, Zach and Neumann 2000). While at Kursakata there are some indications that *Pennisetum* was domesticated (Klee and Zach 1999), other plant remains from grasses (*Panicae*) and rice (*Oryza*) should have been obtained by gathering (Gronenborn 1998: 249, Neumann et al. 1996).

Generally Late Neolithic settlers should have been horticulturist-gatherers with a pastoral component. Probably their settlement system was not totally permanent during moister conditions with repeated floods, at least not on every site (Gronenborn 1998: 248f.). As shown by the sequence calibration, the Late Neolithic occupation of mounds in the *firgi*-area ended between 760 and 640 calBC (see figure 2)[6]. It is followed by a hiatus which extended anywhere from 110 to 350 ^{14}C-years, the subsequent early Iron Age occupation set in between 550 and 350 calBC. At Mege the upper Late Neolithic layers are composed of succeeding clay bands, some of which contain very little cultural material. Previously one of us (D.G.) had attributed these clay layers to a short term transgression phase (Gronenborn 1998: 250), during which extensive portions of the southern Chad Basin would have been flooded again. The background for this hypotheses was the appearance of broad clay layers at Mege. Such clay layers are equally existent in Daima (Connah 1981: 113) but because of their elevated position within the sequence, which can now be calculated at about 289 m asl, these layers cannot be attributed to a transgression since the water table would have had to rise about 3 m. However data from other regions

5 Unfortunately no absolute heights for the mounds were measured because GPS failed for three-dimensional calculations.

6 All further calculations are given at the 68% confidence level.

indicates dry conditions (Breunig and Neumann 2002) which led to the abandonment of many of the sites west of Lake Chad belonging to the Gajiganna tradition and to a concentration of the population in larger, nucleated and fortified settlements (Magnavita and Magnavita 2001).

After this terminal phase of the Gajiganna tradition the area west of the lake seems to have been abandoned for some time until it was resettled in the developed early Iron Age (Magnavita 2002). What exactly happened in the *firgi*-region south of Lake Chad is unclear. The anthropogenic clay layers and the appearance of deep water fish species within these layer do suggest wetter conditions, but a general and widespread transgression can be ruled out. Maybe, increased rainfall in the southern Sudan and Guinea zones led to a higher influx of water through the Shari and Logone, which then resulted in a slight elevation of the lake level. These moister conditions might have forced the population to elevate their habitation structures in order "to lift themselves out of the floods of the rainy season" (Connah 1981: 113). Another possibility may be that people practised a farming technique which required moist but not wet soils such as the so-called dry season *massakwa* technique (Kirscht 2001). This technique requires clayey soils where the water is stored for several months. If the *firgi* plains were flooded for a prolonged period they could not have been tilled, hence small elevated plots had to be used where the clay stayed moist but was not completely wet. Similar agricultural techniques with elevated fields are known for instance from the Maya lowlands but also from northern Europe in the form of the so-called Celtic Fields. Previous archaeological and historical evidence would date the first appearance of the technique and *sorghum* to the late Iron Age (Gronenborn 2001c) but recent evidence pushes the introduction of *sorghum* back to the earlier first millennium AD (Magnavita 2001). Detailed archaeobotanical examination of the respective layers at Mege is yet to be awaited but in any case, the artificial clay layers should also be considered as a specialized form of horticultural practices. Such constructions were not necessarily built at every site. Moreover, at Mege they date to the very end of the Late Neolithic occupation. It may thus well be, that these short term wet conditions occurred while the immediate environment of Lake Chad experienced a dry phase. Such a contradictory scenario is not unusual for the Chad Basin and also occurred in later periods, as will be shown below.

In any case, the environmental constraints led to an abandonment of the region. This hiatus between the Late Neolithic and the early Iron Age is clearly visible in Mege and Ndufu, both in changing pottery styles (Wiesmüller 2001) as well as in the sedimentation of cultural layers (Gronenborn 1998: 250). The 1965 trench in Kursakata also indicates a hiatus (Connah 1981: 95), while it is not directly visible in the 1994 trench. Neither the Daima sequence nor the Mdaga sequence in Cameroon give evidence of a continuity (Connah 1981: 81, Holl

1993: 343). As already mentioned above this hiatus lasted between 110 and 350 years.

Early Iron Age (ca. 500 calBC–ca. AD 700)

The earliest iron technology in the Chad Basin has been reported from several sites further towards the south, near the Mandara Mountains (Gwa Kiva and Doulo) where MacEachern (1996, 1997) was able to date slag and pieces of worked iron to the earlier first millennium calBC (see figures 2 and 3). Some of these dates are contemporaneous to the hiatus, so maybe part of the population of the *firgi* retreated towards southerly areas near the mountains while some remained in the vicinity of the lake but lived in more concentrated villages. As will be shown below, migrations to the south are generally the results of more severe and prolonged periods of aridity and are, for instance, attested for the great drought of 1913–14.

After the environment became dryer, the clay plains south of the lake were settled again and it became possible to maintain permanent hamlets or villages. The early Iron Age had set in (figure 2). One indication for the continuous occupation of sites is the burial place at Ndufu which should have started between 400 and 200 calBC and which had been occupied until the first century calBC, hence for at least 200 years (Gronenborn 1998: 240f.).

Increasing aridification led to lower lake levels at the end of the 1st millennium cal BC (Maley in Nicholson 1996: 63f.). According to Brooks (1998: 147) the centuries from ca. 300 BC to ca. AD 300 were mainly "a transitional arid period" before ecological conditions improved because of increased rainfall during the following centuries until about AD 1100.

The period from ca. AD 700 to 1800

The oscillations of Lake Chad during the last millennium BP have been summarized in a graph by Maley (1981, 2000). According to this graph (see figure 4-1 and 4-2) Lake Chad had a level of 285/286 m asl at the end of the first millennium AD (until 12th century) and again for many decades during the 17th century. The graph shows an amplitude of about 6 meters with a minimum near 280 m asl or below. If the water level drops below ca. 280 m asl the lake divides into two separate basins, the northern lake basin with Komadugu Yobe as the only tributary river and the southern lake basin with Chari and Logone as essential influxes.

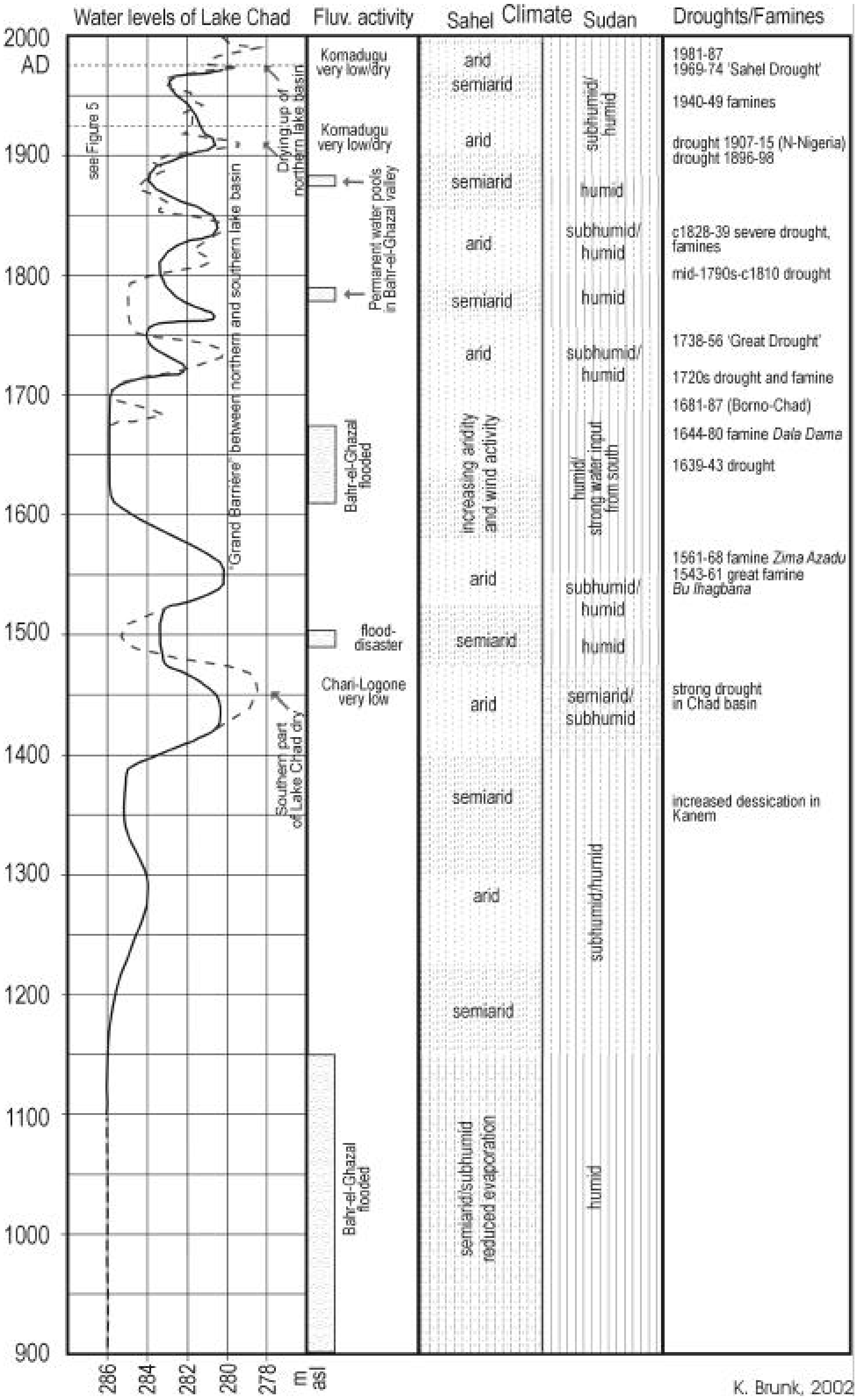

Fig. 4: Synopsis of Environmental Conditions, their Effects on the Population Historic Events and the Kanem-Borno Chronology during the last Millennium

General reaction of population	Historic events		Kan.-Borno chronology	
				2000 AD
evacuation of flooded villages southward migrations evacuation of flooded villages southward migrations southward migrations	Yerwa/Maiduguri Borno capital since 1907 "Deutsch-Bornu" from 1902-15, since 1916 British Division of Borno into Dikwa and Borno Emirate,1902 Rabeh defeated and killed 21./22.4.1900	B. PROV./STATE	Restoration of al-Kanimiyyin Shehus by French, Germans and British, since 1902 in 2 lines: Dikwa and Borno	
	Rabeh conquers Borno, 1893/94, new capital Dikwa Borno loosing control over trade routes, Zinder and Bagirmi virtually independent from Kukawa (1885)		Rabeh Z./Fadlallah 1893-1901 Sh. Bukar,Ibrahim,Hashim;Kiyari	1900
flood refugees, Kukawa residence moved to higher ground (1873) southward migrations	Withdrawl of Wadai (1846) Wadai invading Borno and sacking Kukawa Khawalme-Shuwa reach area SW of Lake Chad Inv. from Wadai (c.1804); new capital Kukawa (1814) Usman dan Fodio's jihad 1804-09: new Fulani emirates of Katagum, Gombe, Misau and Hadejia were carved out of Borno territory.		Shehu Umar 1837-53/1854-81 Shehu al-Kanemi 1809/14-37 Mai Ibrahim, Ali (-1846) M. Ahmed,Dunama/Ngileruma	1800
flood refugees southward migrations	conflicts with Agades, Damagaram declares independence, Bagirmi and Wadai reject overlordship, defeats in Mandara region Shuwa cross Chari and occupy Waalooje region Shuwa established SE of Lake Chad		M. Ali b. Hajj Hamd. (c.1747-92) M. Muham. b. Hamd. (c.1729-44) M. Dunama b. Ali (c.1696-1715)	1700
southward migrations Kreda tribe migrating from Borkou south to Kanem region flood refugees	Tuareg raiders (Agadez) cause large scale population movements in the north Borno reaches its greatest extent Tunjur overthrown by new Wadai sultanate Borno most powerful state in the Sudan, consolidation of frontiers Fulani nomads reach Darfur Idris assassinated during campaign against Bagirmi	BORNU	Mai Hajj Ali b. Umar (1639-77) M. Hajj Umar b. Idris (c.1619-39) M. Ibrahim b. Idris (c.1612-39) M. Muham. b. Idris (1596-1612)	1600
southward migrations	independent princedoms (Kotoko, Sao etc) south of Lake Chad subdued by Kanem-Borno Empire Partitioning of Kanem between Borno and Bulala Borno in confrontation with Songhai 1554/55 Hausa states (Kebbi c.1561), Tuareg, Kwararafa Sefawa invade Bulala state and recapture Njimi		Mai Idris Alauma 1564-96 Mai Ali b. Idris (1538-39) M. Idris b. Ali Katag.(1497-1519)	1500
flood refugees (in Chari delta) concentration of population around water holes in dried up parts of southern Chad basin southward migrations	1472 new capital at Birni Gazargamo, Borno Bulala, under Malik Abd al-Jalil, invade Kanem-Borno and drive out the Sefawa Shuwa in the area between Lake Fitri and Bahr el-Ghazal continued disputes and wars with Bulala		Mai Ali Gaji 1465-97 M. Uthman b. Kaday (1454-59)	1400
southward migrations	Salamat-Shuwa start invading Lake Chad area collapse of Kanem state Kanem under great pressure from the Bulala nomads from SE(Lac Fitri region)		Mai Umar b Idris (1382-87) M. Dawud b Ibrahim (1366-76) Mai Idris b. Ibrahim (1342-66) M. Abdallah b. Kaday (1315-35) M. Ibrahim b. Bir (1296-1315)	1300
	expeditions from Kanem to areas south of Lake Chad (Kaga region) expansion over non-Kanuri peoples, to the north up to Traghan Oasis,fierce resistance from people (So/Ngala) south of Lake Chad	KANEM	M. Kaday b. Dunama (1248-77) M. Dunama Dibalami (1210-48)	1200
	Njimi, NE of Lake Chad, capital of Kanem Kanem towns Manan and Njimi mentioned (c.1154) gradual transition from nomadism to sedentism		M. S. b. Abd Allah (1182-1210) M. Abd Allah b. Bir (1166-1182) M. Bir b. Dunama (1140-1166) M. Dun. b. Hummay (1086-1140)	1100
			Mai Hummay (1075-86), first Kanem ruler to convert to Islam in the 1080s(?) Duguwa Mais	1000
	center of Kanem/ (northeastern) Zaghawa in Bodele region	ZAGHAWA	foundation of Sefawa dynasty by Sayf b. Dhi Yazan	900

K. Brunk, 2002

The general climatic trend in the northern Sahel region during the last millennium is that of increased aridification (Nicholson 1996, Reichelt et al. 1992: fig. 4-1 and 4-2)[7]. As the comparison of changing lake levels with regional climatic variations during the same period reveals, both curves do not always show a good correlation, just as it seems to have been the case for the earlier 1st millennium BC. A bad correlation for example can be observed during phases when the most relevant climatic parameters (precipitation, cloud cover and evaporation) are very different between the catchment area (Sudan–Guinea-Zone) and the central parts of the lake basin (Sahel Zone). Such a constellation explains the contrasting situation which has occurred for example in the middle of the 15th century and in the later 17th century and possibly in the 7th and 6th century calBC: a high lake level (caused by wetter conditions in the southerly humid parts of the catchment area) was contemporaneous to arid climatic conditions in the Lake Chad environment.

As it was observed in recent years (see below) dry periods with very low water levels forced people to follow the receding water and settle on the dry lake floor. According to Maley 1981, 1989 (in Maley 2000) and Seignobos (1993) a similar situation occurred in the middle of the 15th century when the southern part of Lake Chad had dried out completely. A sudden rise of the lake level some decades later brought such devastating destructions in the Makari area that this event was preserved in the oral tradition of the affected Fulani/Fellata population.

These data allow a deeper insight into the multifaceted relationship between climate and human reaction to climatic events in general: During the 7th to 12th centuries AD, the early phase of what is generally termed the late Iron Age, climatic conditions must have been more favourable in the general *bilad al-sudan*. This can, for instance, be inferred from the written records which describe various settlements and the capital of the early state of Kanem to be lying in an area where no agriculture is possible today. In about 1269 the Granada-born geographer Ali Musa Ibn Sa'id, who in his famous geographical œuvre mentioned Lake Kuri (Lake Chad) for the first time, describes a "pleasure-ground" of the Sultan of Kanem, possibly located alongside or near

7 Sources fig 4: (1) former levels of Lake Chad (Maley 2000, with additional data – broken line – from Nicholson 1996, Olivry and Naah 2000; Tschierschke 1998), (2) references to observations of floods and fluvial activities of Bahr el-Ghazal and Lake Chad's major tributaries (Ergenzinger 1978; Nachtigal 1987, Nicholson 1996); (3a) generalized climatic tendencies in the Lake Chad region (Sahel zone) (Reichelt et al. 1992), (3b) derived climatic conditions in the catchment area of Lake Chad (Sudan–Guinea zone); (4) chronology of droughts and famines (Nicholson 1996; Watts 1983); (5) reported (partly derived) reactions of the population (Reichelt et al. 1992; Brooks 1998); (6) relevant historic events (Adeleye 1984, 1985; Barkindo 1985; Braukämper 1991; Catchpole and Akinjogbin 1983; Cohen and Brenner 1984; Crowder 1977; Hunwick 1985; Last 1985; Lavers 1980; Seignobos 2000a, 2000b); (7) chronology of selected Kanem-Borno rulers (based on Lange 1977 and Lavers 1993).

the Bahr-el Ghazal[8], with a garden where "pomegranates and peaches" were grown, as well as sugar-cane, grapes and wheat (Levtzion and Hopkins 1981: 188). The geographer Yaqut, writing during the 13th century but also using sources from the 10th century, mentions *Sorghum* and wheat as staple crops (Levtzion and Hopkins 1981: 171). It needs to be stressed at this point that both sources deal with an area where precipitation rates of 50 to 100 mm per year today hardly allow for any kind of agricultural activities at all (Maley 1981: 65f.).

This generally favourable period should have come to an end during the 13th century and conditions seemed to have been worst during the 14th century.[9] The decline can be followed throughout the northern parts of West Africa: for instance the trading port of Tegdaoust (Mauretania) becomes struck by impoverishment and for the Chad Basin the Syrian accountant al-Umari writes: "It is a land of famine and austerity. The worst qualities there predominate; its conditions, and the conditions of its inhabitants, are harsh" (Levtzion and Hopkins 1981: 260). This passage is certainly contradictory to the earlier sources which where written down less than 100 years before: Evidently the situation must have deteriorated considerably within a rather short period of time. Apart from environmental deterioration the inhabitants of Kanem were also faced with increased conflict with a neighbouring group, the Bulala. This conflict eventually led to the retreat from Kanem and to the prolonged search for a more secure place (Barth 1857–59, II: 33). Written sources mention that the ongoing conflict with the neighbouring Bulala was caused by a breach of pre-Islamic traditions by the governing Sultan of Kanem. This, so the official history, was the ultimate cause for the exodus from the former homeland.

Climate is not mentioned in any of the official records (Lange 1977: 76f.). However, climatic conditions north of Lake Chad might indeed not have been favourable as oral traditions collected by Platte and Kirscht (2000) mention cold winds and droughts for the time of the retreat. Arab sources as well as oral traditions specifically refer to the agricultural potential and the generally favourable condition of the floodplains of the Yobe valley to which the Sultan of Kanem and his court now felt attracted. Ibn Sa'id for instance writes: "It [Jaja] is characterized by fertility and abundance of the good things of life" (in Levtzion and Hopkins 1981: 188). Hence, the continuous desiccation might have been of substantial importance for the political decision-makers when ordering the abandonment of the homeland. Unfortunately, archaeology has yet failed to contribute to the picture as none of the early capitals have been securely localised on the ground (Gronenborn 2001a: 104f.).

During the 14th century the internal source, the king-list of Kanem-Borno, also mentions a series of raids against the pagan population south of Lake Chad (in Lange 1977: 75f.). Seemingly, the intention was not only to capture slaves,

8 Tentatively identified as the site of Ni (fig. 3) where assemblages of burnt bricks have been found (Gronenborn 2001a: 104f.).

9 Gronenborn (2000), Lamb (1977: 439), Maley (1981: 67f.), Reichelt et al. (1992).

but also to gain new territories. Because of the local heavy clay soils this area might have seemed more promising for agriculture than the regions north of the lake. Again, it might have been both the declining climatic or environmental conditions and the desire for territorial expansion which ignited the slave raids. However, the local population was able to fight off the intruders and eventually the campaigns came to an end after several rulers died in combat. Climatic conditions seem to have improved during the later part of the 14th century and the final retreat from Kanem of the Sayfuwa under Umar b. Idris (1382–1387) occurred during a transgression phase (figure 4). Still, though, many oral traditions do mention the unfavourable and cold winds while other traditions praise the agricultural potential of Borno and the Yobe-Valley (Platte and Kirscht 2000).

These events were followed by a period of severe droughts during the middle of the 15th century AD. Oral traditions of the first Fulani who migrated into the Chad Basin mention that the southern lake basin had dried up (Seignobos 1993). According to Reyna (1990: 47f.) a precursor of the Baghirmi state should have evolved around this time. He ascribed this process to the continuous pressure of the sultans of Kanem towards the south who again were forced by "climatic reversals". However the Fra Mauro map from 1459 clearly shows that by then Baghirmi already existed under its own name (Gronenborn 2000), hence a correlation between state formation in the eastern Central *bilad al-sudan* and climatic conditions as suggested by Reyna (1990: 47f.) cannot be proven with the data from the 15th century. The lake level rose again during the later 15th century (figure 4) and conditions might have been more favourable, also towards the north of the lake. Coincidentally, during this time the old capital Njimi in Kanem was recaptured by the sultans of Borno.

These favourable years were then followed by a period of drought with a low lake level (figure 4), which again was followed by a long and extensive period of a high lake level which continued almost throughout the 17th century and during which the 285/286 m shoreline was reached again. This corresponded to humid conditions until the 1630s which have also been documented for various other regions of West Africa and beyond (Nicholson 1976: 179, 1996: 68). Information from several king lists of the principalities south of Lake Chad pertain to possible Tuareg rulers which seem to have replaced local dynasties. In the case of Dikwa these Tuareg might be connected with the foundation of the town as a Borno dependency in a yet not successfully islamized environment (Lavers n.d., Gronenborn 2000). As will be shown below the southward movement of Tuareg groups is a regular consequence of desiccation and droughts which make the more northerly regions uninhabitable.

The onset of the humid phase corresponds to the beginning of the "Little Ice Age" in Europe (Grove 1988, Lamb 1995: 212f.).[10] In the chronicle this period of the later 16th century is remembered as a time of prosperity for Borno. It concurs with the reign of Mai Idris Alauma (1564–1596), who is remembered as one of the most charismatic and powerful leaders and for having achieved the successful consolidation of the expanding empire (Gronenborn 2001a, Lavers 1980, Lovejoy and Baier 1975: 573). This is remembered in the king list which was kept at the court: "He re-established the good order in the kingdom and the country prospered" (in Lange 1977: 80). Nevertheless, a series of droughts is reported for the middle of the 16th century (Gronenborn 2000), during which time military pressure towards the south had started again but now seems to have increased. It was not, however, before the end of the 16th century that the resistance of various local groups was finally destroyed in the course of several campaigns of Sultan Idris Alauma. No famines or droughts are reported for the period of his reign. The political aspirations of Idris Alauma also may have caused the southward migration of Fulani pastoralists since the late 16th century which have gathered since the 15th century in the Kaga region northwest of Dikwa.

Despite the high lake level several droughts are mentioned in the king list from 1639 to 1643, for the period between 1650 and 1670 (Lovejoy and Baier 1975: 570) and in the 1680s (Watts 1983), an indication that the climate in the Chad Basin is complex and that high lake levels do not necessarily indicate overall favourable conditions. Europe, at this time, is exposed to the most rigid period of the so-called "Little Ice Age" (Grove 1988). Several severe droughts and famines are reported for the 17th century throughout the *bilad al-sudan* (Lovejoy and Baier 1975: 573, Nicholson 1978: 9).

The empire of Kanem-Borno reached its widest extension during these years but came under increasing pressure from raiding Tuareg groups from Agadez (Lavers 1980). These raids became so intense that the Sultan of Borno decided to raise a counterattack in 1657. While traditionally historians have attributed these conflicts to the century-old tense relationship between farmers and pastoral nomads, raids might also have been intensified by droughts as this is well documented for later periods (Gronenborn 2000).

During the early 18th century the lake level drops sharply and a number of droughts are mentioned in various sources for the 18th century: the most severe droughts occurred during the 1720s, from 1738–56 (so-called "Great Drought") and in the 1790s (Nicholson 1996: 68, Watts 1983). Famines are reported for Senegambia and the Inland Niger Delta (Nicholson 1976: 9). The Borno chronicle (in Lange 1977: 81f.) notes several famines during the reigns of Mai Muhammad (1729–1744) and Mai Dunama (1744–1747). From then on the

10 Increased aridity is also confirmed for eastern Central Africa, see e.g. Robertshaw and Taylor (2000: 20).

lake level fluctuates but never reaches its former extension during the 17th century. During this time Borno comes again under pressure of Tuareg groups and a mass-migration of Tuareg from Agadez is reported for the year of 1790. This severe drought should have reached Borno shortly after 1793 (Lovejoy and Baier 1975: 574).

The last two centuries (AD 1800 to present)

The extend of Lake Chad became better known when the first Europeans (the Denham, Clapperton and Oudney expedition) reached Lake Chad in 1823 (Carmouze 1983) and henceforth hydrographical information was more reliable. Figure 5 shows the levels of Lake Chad as they can be deduced from reports and maps of the early explorers, the French missions during the first decades of the 20th century as well as the annual maximal levels of the succeeding gauge readings (Olivry 1996: 20f., 137f., 157f.).

Borno's political power had decreased in the 18th century. Constant internal conflicts within the multi-ethnic state had weakened the central government (Lavers 1980: 206f.). Borno was not powerful enough to withstand the Fulani *jihad* and in 1808 the old capital of Gazargamo was destroyed. Only with the help of an Islamic scholar, al-Kanemi, was it possible to drive the Fulani away and Borno remained independent (Brenner 1973). Al-Kanemi restructured the empire and re-aligned those provinces which had been breaking away under the former government. Particularly the area south of the lake was now subdivided into fiefs (Gronenborn 2000).

These early years of al-Kanemi's reign were overshadowed by another decrease in climatic conditions and several droughts are reported for the years between 1828 and 1839 (figure 5). Already some time before, these droughts must have hit the areas further north and the various Tuareg groups were forced to move southwards and preyed upon the lands of the Borno farmers, raiding for slaves as a substitute income, some settled in the lands of the Sudan zone, as reported for Kano (Lovejoy and Baier 1975: 568f.) but also indicated for Borno by the entry of "(*TUÂRIK*)" near Dikwa on the *Völkerkarte* of Nachtigal (1967: 440). This constant pressure and probably also the increasing desiccation led to the abandonment of large areas of northern Borno. Farmers migrated towards the south, where rainfall would still guarantee more steady harvests. These lands, politically already a part of Borno for about 500 years, were now infiltrated by what the traveller reports call "Borno colonies".[11]

During the 1850s to 1870s Lake Chad reached rather high levels above 283 m asl with the consequence that villages along its shores and islands were flooded. This "Grand-Tchad" (Tilho in Olivry 1996: 20) covered an area of

11 Barth 1857–59 (III: 253), Nachtigal 1967 (I: 543, II: 666).

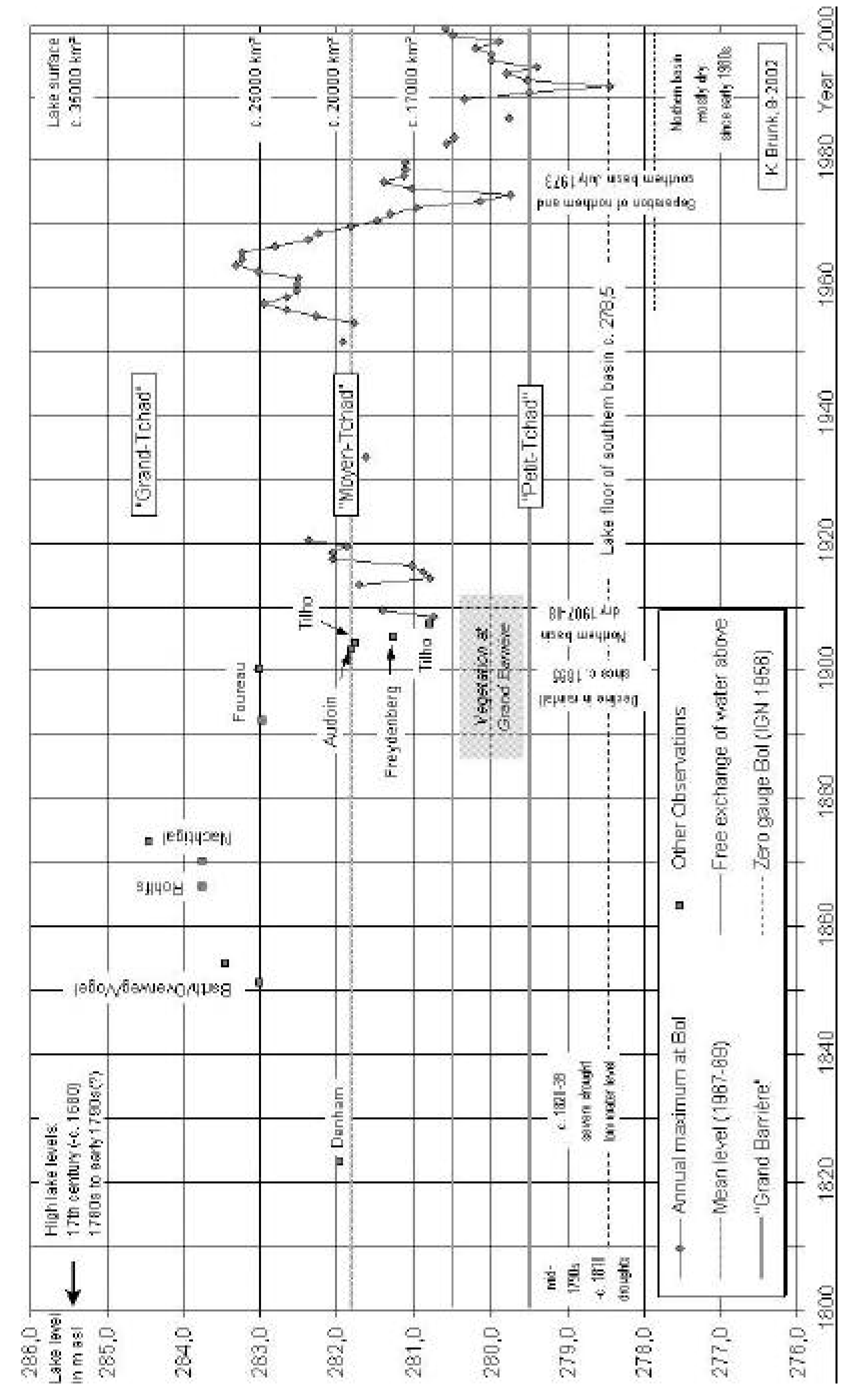

Fig. 5 Recorded water levels (annual maxima at gauge Bol) of lake Chad in the 19^{th} and 20^{th} centuries

about 30,000 km². Nachtigal (1967) probably has witnessed the highest lake levels since the beginning of the 19th century. According to the calculations of Bouchardeau (in Olivry 1996: 138f.) Lake Chad reached an altitude of 284.45 m asl in 1873. In the spring of this year Nachtigal (1987: 104) witnessed the initial attempts to build a new palace at a more elevated place near the capital of Kukawa. Increased encroachments of the lake at its western shore had led to repeated floods at the old location. A reconstructed section of the shoreline taken from Nachtigal's maps is shown in figure 6. It represents the situation during his journeys along the shore in the early 1870s and corresponds with a lake level of about 284 m asl. Furthermore figure 6 marks the maximal positions of the observed inundations of the Bahr el-Ghazal valley during the last two centuries (Bouchardeau in Olivry 1996). Because of anthropogenic manipulations (dams etc.) on the valley floor of the Bahr el-Ghazal there is not always a direct correlation between the extension of an inundation and the recorded water level of Lake Chad.

Towards the later half of the 19th century the lake level had risen again, and although droughts are mentioned by various European travellers, the climate seems to have been comparatively favourable. Borno, however, faced severe political problems again: weakened leadership and a collapse of trade contacts in the course of the world-wide political reaction against slavery. So it was really no surprise that the state fell prey to the expansionist ambitions of a Sudanic war-lord and slave trader Rabih b. Fadlallah (Rabeh) in 1893 (Gronenborn and Magnavita 2000, Hallam 1977, von Oppenheim 1902). He then, was replaced by the colonial government after 1900. A completely new situation had developed for the people around Lake Chad: political decisions no longer taken by their own governments, but were rather dictated by London, Paris or Berlin. Nevertheless the local climate and the oscillations of the lake continued to have profound effects on their day-to-day life. Because of the colonial administration and the scientific interest that most of the colonial powers had in this part of Africa, the amount of data available increases enormously.

The various hydrographical observations at the beginning of the 20th century and the first gauge readings (1908 and 1912–1919) show medium to low water levels during the first and second decade of the 20th century[12]. In 1905, 1907 and 1914 the lake level did drop below 280 m asl and the northern basin partly dried up in 1907–08 (Olivry 1996: 20f). This was the time of the drought period of 1907–1915 (figure 5).

12 Lake levels at about 282 m asl have been classified as "Moyen-Tchad", those below 280 m asl as "Petit-Tchad" by Tilho (in Olivry 1996: 20).

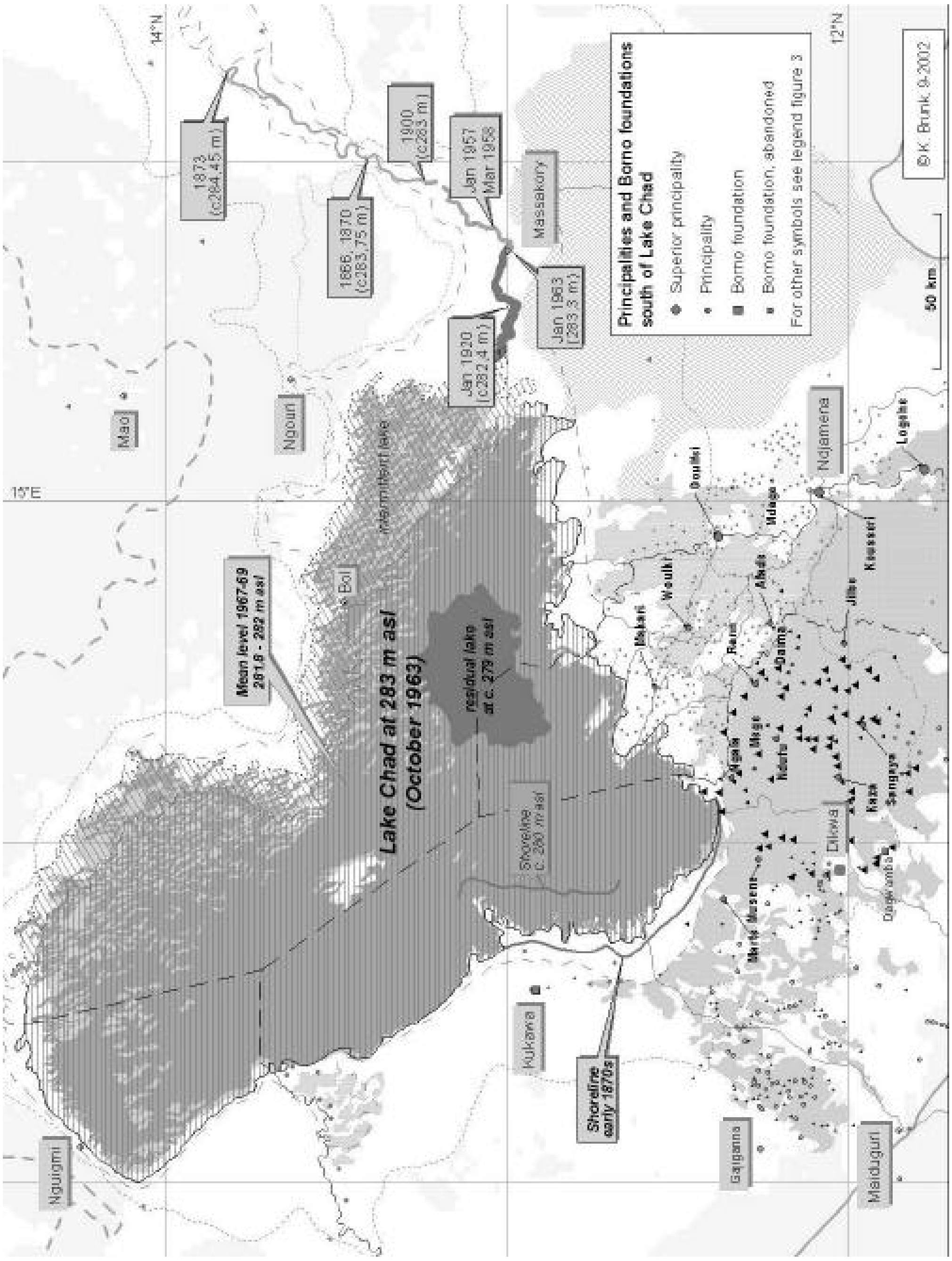

Fig. 6: Lake Chad at 283 m asl in October 1963, section of early 1870s shoreline (ca. 284 m asl) and inundations of Bahr el-Ghazal valley in the 19th and 20th centuries.

After three decades with only sporadic observations of Lake Chad a new epoch of recordings started with the 1950s. Repeated coverage by aerial photographs (since 1950/51) as the basis for various topographical maps, by satellite images (since 1963 and 1972/73) and altimetry (since the 1990s) and the (re-)establishment of gauges (since July 1953 in Bol), for the most part give a good hydrographical data basis (for further details see Olivry et al. 1996: 24f., 142f. and 217f., NASA-GSFC 2001, LEGOS 2001).

These data show rather high water levels (mostly above 282 m asl) from the mid-50s until 1966/67 with a maximum of 283.32 m asl early in 1963. Figure 6 displays the extent of Lake Chad a few decimetres below its 20th-century-maximum in October 1963 at an altitude of ca. 283 m asl and a total surface of about 25,000 km². The extent during the 1967–69 mean level – ca. 282 m asl – is shown as a grey background in figure 6.

The shrinking of Lake Chad during the Sahel drought since the mid-1960s lead to a first minimum in 1973/74 (below 280 m asl) and to the separation of the lake at the so-called "Grand Barrière" into two parts in July 1973. After a moderate recovery in the second half of the 1970s the water level, with the exception of a few years, fell again to very low levels in the 1980s and early 1990s. The northern lake basin was completely dry for most of the whole hydrological years (August to July) during the early 1980s to the 1990s. In the southern lake basin the water level dropped so low that continuous measurements at the Bol gauge were not possible for some years until 1993. Since the mid-1990s a gradual recovery can be observed – with a rise of the mean water level from about 279 m asl in 1993/94 to 280 m asl in 1999/2000 – and in 2001 the water level had reached an altitude where it again covers most of the southern lake basin, at least during its annual maximum.

The annual variations are superimposed by the seasonal changes of the water level with a minimum usually in July–August and a maximum in December–January. The amplitude of this oscillation fluctuates not only with the varying water input but also with the aerial extent of the lake. During a stage of "Moyen-Tchad" (ca. 281.8 to 282 m asl) the average interannual oscillation is between 0.6 and 0.9 m. The amplitude during periods with isolated lake basins ("Petit-Tchad") is more variable; in the southern lake basin it can reach more than double the above values.

The period with low water levels and partly dried-up lake floors during the last decades has lead to the migration of various groups from other parts of Nigeria and also other regions in West Africa who now settle on the former lake floor. However, rising lake levels of about 1 meter since the mid-1990s have forced many migrants to leave these areas again. A good illustration of the inherent anthropogenic processes at the south-western margin of Lake Chad is given in the studies of Platte (2000) and Franke-Scharf et al. (2000).

With these few and rather prominent examples we wanted to show how complicated the interrelation between climate, lake oscillations and settlement and political history has been in the Chad Basin. At a coarse resolution there does appear a general pattern: droughts and famines often led to southward pressure from pastoralist groups in the Sahara and the northern Sahel, a tendency which has been observed in many other parts of West Africa up to this day (e.g. Meier 1995, Riesman 1971, Spittler 1989a, 1989b). This pressure led to increased slavery, and eventually to the expansion of Islam and state level societies[13]. These empires then forced commercial slavery further south and the whole circle started again, often the societies under siege underwent shifts towards political complexity (Gronenborn 2000, 2001, MacEachern 2001).

On a finer resolution, though, it becomes apparent that this coarse pattern has many different and multifaceted components. As Robertshaw and Taylor (2000: 28) so rightly wrote, there is a general link between climatic changes and, in our case, lake oscillations, but these alone are "insufficient explanation[s] of [...] historical processes". Indeed, each event has to be analysed and interpreted in accordance with its particular circumstances. Nevertheless, in many cases, the political history of the empire of Kanem-Borno cannot be fully understood without a knowledge of the climatic and hydrographic conditions of the time.

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[13] Instructive, for instance, is the correlation of the conversion of the ruler of Mali and a period of continued droughts in the 11th century as reported by al-Bakr? (in Levtzion and Hopkins 1981: 80).

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