

Camels in Asia and North Africa

Interdisciplinary workshop on their significance in past and present

5th – 7th October 2010
Austrian Academy of Sciences
Dr. Ignaz-Seipel-Platz 2,
1010 Vienna, Austria



OAW
Austrian Academy
of Sciences



Institute for
Social Anthropology



Institute of
**Population
Genetics**



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of
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Pauline Charruau, Andre Gingrich, Johann Heiss, Maria-Katharina Lang, Lukas Lipp, Verena Loidl, Gabriele Rampf, Laura Soyer, Christian Warta

Pamela Burger & Eva-Maria Knoll
(Concept and Organization)



FWF



ZUM SCHWARZEN KAMEEL



Programme

Tuesday, 5th

<i>Registration</i>	08:15 – 09:00
<i>Welcome, Introduction & Keynote</i>	09:00 – 10:00
<i>1st Session</i>	10:00 – 11:00
<i>Coffee Break</i>	11:00 – 11:30
<i>2nd Session</i>	11:30 – 13:00
<i>Lunch Break</i>	13:00 – 14:30
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<i>4th Session</i>	16:30 – 18:00
<i>Reception & Poster Session</i>	18:00 – 21:00

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Eva-Maria Knoll (Vienna)

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The Camel as a Boundary Object? Encounters Between Different Knowledge Cultures

Ulrike Felt

From the 1960s onwards we can observe a growing call for interdisciplinarity, always accompanied by important tensions: between the growing aspiration for specialization on the one hand, and the expectation for more cross-disciplinary collaboration in knowledge production on the other.

Using the notion of boundary objects as an analytic tool, this talk will explore the potential of crossing disciplinary gazes and engaging with different forms of knowledge about a common object of epistemic desire: in this case, the camel. Boundary objects are in this sense scientific objects, which „inhabit several social worlds [...], adapt to local needs and the constraints of several parties employing them [and are] robust enough to maintain a common identity across sites.“ (Star & Griesemer 1989)

What conditions are needed to develop boundary objects as a possibility to think and create innovations across different knowledge cultures - this will be a focus of this presentation.

Notes

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Ulrike Felt

Department of Social Studies of Science,
University of Vienna, Austria
ulrike.felt@univie.ac.at



Tuesday, 5th

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Genetic Origin and Domestication of Old World Camels

Pamela Burger & Pauline Charruau

When and where did modern camels evolve? This question of evolutionary history and domestication of dromedary (*Camelus dromedarius*) and Bactrian camels (*C. bactrianus*) reached the field of molecular genetics only recently. Traditionally, fossil records are used for tracing ancient demography. Within Old World camels the split between dromedaries and Bactrians was dated at 5 million years (myr) before Common Era (BCE), i.e. significantly later than estimated by phylogenetic studies (8 myr). Although fossils provide invaluable information they are limited and it is difficult to assess if there was substantial continuity between ancient and modern camels. Based on archaeological data the domestication of dromedaries took place in the Southeastern part of the Arabian Peninsula, 4000-5000 BCE. The originally assumed and eponymous center of origin for two-humped camels in Bactria (today's Afghanistan, Turkmenistan) has been replaced by possible domestication center(s) in Western Asia, 5000-6000 BCE.

Genetic data collected from today's camel populations give us insight into ancient demographic events, since they have left imprints in their genetic profiles. Basically, two main hypotheses are followed: The multiregional hypothesis suggests that modern camels evolved directly from ancient wild forms in several different locations in the Old World. The single origin model defines a specific population – a separate one for each (dromedary and Bactrian camel) – that underwent domestication followed by demographic expansion. To test these hypotheses we use mitochondrial DNA (mtDNA) inherited solely from the mother and nuclear DNA transferred by both parents to the offspring. Preliminary results of dromedary mtDNA analysis show the selection of one successful mitochondrial genotype, which is present in half of the investigated animals worldwide. The recently described high genetic differences between wild (*C. ferus*) and domestic Bactrian camels exclude the wild camel as direct ancestor of its domesticated relative. A monophyletic (single) origin of the domestic Bactrian camel has been suggested.

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Pamela Burger

Institute of Population Genetics and Research; Institute of Wildlife Ecology
University of Veterinary Medicine Vienna, Austria
DOC-Scholarship of the Austrian Academy of Sciences 2002-2004
pamela.burger@vetmeduni.ac.at

Pauline Charruau

Institute of Population Genetics and Research; Institute of Wildlife Ecology
University of Veterinary Medicine Vienna, Austria
pauline.charruau@vetmeduni.ac.at



Tuesday, 5th

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Camels of Arabia and Camels of Turan: Two Distinctive Pathways to Domestication and Two Different Types of Impact

Maurizio Tosi

Overland bulk transports across Eurasia and the Middle East became a reality only when camels were harnessed as beasts of burden, between the early third and the late second millennium BCE: this was rather late in the trajectory of socio-economical evolution, considering that efficient networks of long-distance exchanges had been efficiently consolidated since Neolithic times, as a post-Pleistocene adaptive trend. Cultures were linked and enriched by the movement of goods and ideas. Prestige objects, cultivars, domestic animals and rare materials for ornaments and instruments had been travelling over land and across the sea between the extremes of the Old World. Knowledge travelled as well, as we realize how rapidly games or means for divination, rituals and technical innovations were shared across an expanding oikumene. Trade and exchange existed well before the camels came in use, but what changed after their embedment in human society was the fact that people could live out of the standards of agricultural dependence.

Considering that a two-hump Bactrian camel can carry an average of 120-150 kg and a dromedary up to 100 kg, camels made possible not only the transfer, stocking and marketing for large amounts of goods, but also they disclosed to populations living under scarcity in marginal lands an alternative way of life and accumulation based on mobility and trade instead of settlement and hierarchy.

Combining archaeological evidence mainly from Turkmenistan, Afghanistan, Baluchistan and Eastern Arabia, the paper will compare the evolutionary pathways determined by the domestication of the Bactrian camel and the dromedary north and south of the Indo-Iranian divide. Both processes, however, offered the opportunites to egalitarian societies to expand their tribal alliances. This led to interactions with oasis development to carve a way of life outside the constraints of urban nucleation. In the long run the camel herders developed the means for global dominance: the Arabs in the South, the Turks and Mongols in the North.

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Maurizio Tosi

Institute of Archaeology
University of Bologna, Italy
maurizio.tosi@tiscali.it



Tuesday, 5th

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Ancient Distribution and Potential Centres of Domestication of Old World Camels

Hans-Peter Uerpmann

There is very little confirmed knowledge on the early history of Old World camelids. The following abstract is based on hypotheses derived from insufficient data, and largely represents a personal interpretation of the available evidence by the author:

From their centre of evolution in western North America the ancestral forms of Old World camels entered NE-Asia during cold phases of the Pleistocene when falling sea-levels periodically created a land-bridge between Alaska and Siberia. It seems likely that the one-humped form arrived in the dry zones of East and Central Asia during the Middle Pleistocene, from where it spread to Southwest Asia and North Africa. Probably the two-humped form arrived during a later glacial period, occupying the deserts and desert-steppes of Asia from north-east to south-west – thus apparently replacing the one-humped form in this part of the world.

During the Upper Pleistocene one-humped camels seem to have occurred in the deserts of North Africa, the Levant and Arabia. Two-humped camels certainly existed in the dry areas of Central Asia from Mongolia and Southern Siberia in the east to Bactria in the west. Their occurrence in SE-Russia and on the Iranian Plateau seems likely but requires confirmation.

Apparently domestication of the two-humped form preceded that of the dromedary and may first have happened in Bactria and/or Eastern Iran from where the domestic form spread west to Mesopotamia and beyond. There is only scarce information on this process, which apparently occurred during the Early Bronze Age.

The wild one-humped form or wild dromedary seems to have lost the African part of its habitat in the Early Holocene due to phases of moister climate. It survived in the Arabian deserts where the exact areas of its first domestication still have to be identified. The domestic dromedary was, however, widespread in Arabia and its neighbouring areas from the 1st millennium BCE onwards. From there it was re-introduced to North Africa as a domestic animal and also spread to the neighbouring parts of Southwest Asia, where it partially replaced the domestic two-humped camels.

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Hans-Peter Uerpmann

Institute of Pre- and Protohistory and Mediaeval Archaeology
University of Tübingen, Germany
hans-peter.uerpmann@uni-tuebingen.de



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The Meeting Between the Bactrian Camel and the Dromedary Camel in Central Asia

Bernard Faye & Gaukhar Konuspayeva

The two large domestic camelids, the one-humped dromedary (*Camelus dromedarius*) and the double-humped Bactrian camel (*Camelus bactrianus*) are living in two distinct areas of the old world. Their respective distribution areas, however, are overlapping in a few countries such as Iran, India, Afghanistan, but Kazakhstan is the place where the practice of hybridization is more common. Although they are classified into two different species, dromedary and Bactrian indeed are interfecund.

Historically, the hybridization between the two species was associated with the Silk Road in order to obtain animals combining the robustness of the Bactrian and the endurance of the dromedary and to have one animal adapted to very diverse weather conditions. Nowadays, the objective of hybridization is the improvement of milk production, the dromedary having a higher potential than the Bactrian, but being less adapted to the cold climatic condition at winter time.

There exist different hybridising ways according to the number of the hump of the genitor. Basically, in Kazakhstan two schemes are distinguished: the Kurt-nar way (dromedary female x Bactrian male) and the Kez-nar way (Bactrian female x dromedary male). Then, two types of crossbreeding are implemented: absorption or alternative. The hybridizing has important consequences on the behaviour and physiology of the animals.

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Bernard Faye

CIRAD-ES, Agricultural Research for Development
Montpellier, France
faye@cirad.fr

Gaukhar Konuspayeva

Al Farabi Kazakh National University
Almaty, Kazakhstan
konuspayevags@hotmail.fr



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Who Came First in the Suleiman Mountain Region – Dromedary or Bactrian?

A. Raziq Kakar

Camel came a bit late in the register of animal domestication. One opinion holds that for the dromedary this took place in the Yemen (some 3200 years back). The Bactrian camel is believed to have been domesticated in the historic town of Bakhdi in Zoroaster's time, some 2200 years back. It is believed that before the introduction of the dromedary camel in Bakhtaria by Muslim preachers, only Bactrian or Bakhdi camel were found there. Many tribes of old Aryan origin were nomads and the Pakhit (today's "Pashtoon") were used to travel with their animals from Pamir to the Suleiman mountains as their winter settlement. In excavation of Persepolis (Iran) and Gandhar (Sawat) only statues and images of Bactrian camels were found.

Suleiman Mountainous Region (SMR) is a natural barrier between the Indian subcontinent and the Persian plateau. It divides the Indian subcontinent and the Persian plateau into northern and southern sections. Muhammad bin Qasim first introduced the dromedary camel in Sind province of present day Pakistan. Therefore, Sind is known as the door of Islam into the subcontinent. The dromedary camel then extended to other parts of the subcontinent, especially to the famous Great Indian Desert (Rajasthan, Cholistan and Thar).

The present SMR, Khurasan, Balochistan, and Afghanistan all were part of the great Bakhtaria Empire in the Zoroaster period. Historic Bakhtaria was the homeland of Zoroaster and Bakhdi or Bactrian camel was their unique religious camel. The introduction of the dromedary camel is surely linked with the Arab Muslims preachers. The Bactrian camel had been crossed with dromedaries to produce vigorous camels for heavy duties. Thus the Bactrian camel of the region changed to the dromedary. Today the breeds of the dromedary camel found in the southern part of Bakhtaria (Southern Afghanistan, Northwestern Pakistan and Iran) have some blood from the Bactrian camel. Genetic studies are needed to know the exact reality of the dromedary camel found in the region.

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A. Raziq Kakar

Society of Animal, Veterinary and Environmental Scientists (SAVES)
Quetta, Pakistan
raziq2007@gmail.com

Projektteam:

Muhammad Younas, Faculty of Animal Husbandry, University of Agriculture, Faisalabad, Pakistan
Muhammad Yahya, Livestock and Dairy Development Department Balochistan, Quetta, Pakistan



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Chinese References to Camels in Africa and the Near East (Tang to mid-Ming)

Roderich Ptak

Next to horses, the camel in China is one of the better-studied themes in the animal history of East Asia. Already in the 1950s Edward H. Schafer summarized the material which he was able to collect at that time. This concerns a broad variety of textual sources, pictorial evidence, and a selection of archaeological objects from different periods. With the exception of a few rare cases, most of these documents deal with the Bactrian - and thus with the area of northern China and the overland routes to Central and West Asia.

But China was also connected to the “Far West” by sea. From the Tang period onwards, commercial exchange with maritime Southeast Asia and the Indian Ocean world began to expand rather rapidly. In the following centuries, the two ports of Quanzhou and Guangzhou became the Middle Kingdom’s principal doors to these distant lands.

Maritime exchange encouraged Chinese geographers and literates to produce a number of ethnographic and other works with short descriptions of various locations in the areas of modern Iran, on the Arabian peninsula and along the shores of Africa. These accounts also mention camels, usually dromedaries. The present study is intended to summarize these references, one by one, to comment on different views, and to address philological and other relevant problems. In each case the historical setting will be outlined as well.

By and large, the paper will proceed chronologically. It ends with the voyages of Zheng He (early 15th century), in the course of which Chinese ships reached the coasts of modern Somalia and Kenya. The ethnographic accounts of later periods, when Chinese trade was again confined to the area of Southeast Asia, are of little interest here, because they rarely provide new aspects on the fauna of the territories around the Persian Gulf, the Arabian Sea and the Red Sea.

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Roderich Ptak

Institute of Sinology

Ludwig-Maximilians University, Munich, Germany

ptak@lrz.uni-muenchen.de



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Simulations of Population Ancestry of the Two-humped Camel (Camelus bactrianus)

Alexandra Trinks

The domestication of the two-humped camel (*Camelus bactrianus*) promoted unprecedented progress in cultural and economic development for ancient human civilisations in the steppes of Eurasia. Time and place of the origin of domestication of these animals remain unresolved, however, as only few references are available in this field of research.

Therefore a 460bp hypervariable fragment of the mitochondrial DNA (*mtDNA*) control region was analysed in 12 bone samples of *Camelus bactrianus* from Late Bronze and Early Iron Age sites in Uzbekistan and Siberia. In a subsequent population genetic analysis sequences of aDNA-samples were compared to 122 modern domesticated Bactrian camels from China and Mongolia, 8 modern samples of domesticated camels from German and Austrian zoos, as well as to 20 modern wild camels (*Camelus ferus*) from Mongolia.

Intra- and inter-population genetic diversity showed that the extant wild camels are neither the ancestors of the prehistoric camel population, nor of modern domesticated two-humped camels. On the contrary all domesticated populations showed a high homogeneity as low nucleotide diversity-values as well as low F_{ST} -values demonstrate. The results of the palaeogenetic analysis lead to the assumption of a single domestication centre rather than multiple ones, because of the high homogeneity between Bronze/Iron Age samples from Uzbekistan and Siberia, as well as modern domesticated camels from China and Mongolia.

For future work, different demographic scenarios have to be modelled and tested. It remains to be shown whether the observed differences between wild and domestic camels can also result from genetic drift in a continuous population.

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Alexandra Trinks

Palaeogenetics Group

Institute for Anthropology, University of Mainz, Germany

a.trinks@gmx.net

Projektteam:

Pamela Burger, Institute of Population Genetics and Research; Institute of Wildlife Ecology, Univ. VetMed Vienna, Austria

Norbert Benecke, German Archaeological Institute, Berlin, Germany

Joachim Burger, Palaeogenetics Group, Institute of Anthropology, University of Mainz, Germany



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Breeding and Riding Camels in Arabia: A Cultural History

Walter Dostal

This presentation is based on my practical introduction into camel-riding which I received as a guest of Shaykh Abdullah b. Salim of Kuwait. Subsequently this enabled me to investigate the archeological remains of camels, by asking questions such as: where can one sit on a camel? Which way of sitting is possible? Which seat gives the best riding position? Which seat is the oldest one in use?

This investigation shows that in Arabia the camel's crupper provided the earliest main riding position. The change to use the hump then provided a main developmental step in the history of camel riding. This is proven by archeological findings for the second half of the first millennium. In the following periods we can observe the cultural influence received by the nomads through their contact with other more complex civilizations. These contacts primarily took place in the advanced regional civilizations of what today is northern Arabia. By contrast, for southern Arabia the archeological remains reflect the perseverance of older practices, and thus a certain conservative trend among camel-riders there. In sum, these results prove an overall, bipartite historical constellation of socio-economic phenomena among Bedouins: there were two main groups, i.e. the so called proto-Bedouins from southern Arabia and the full-Bedouins in the north of the Arab Peninsula.

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Walter Dostal

Institute for Social Anthropology
Austrian Academy of Sciences, Vienna
via eva-maria.knoll@oeaw.ac.at



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Camels in South-western Arabia: Ethnographic Observations from the 1980s

Andre Gingrich

Ethnographic fieldwork allows the close observation of daily practices of camel-raising, and of their embeddedness in socio-cultural contexts. This presentation will summarize some first-hand ethnographic evidence from south-western Arabia in the early 1980s. The ethnographic examples were studied in the two main eco-zones where camel raising continued to maintain some practical relevance during those years: the more arid parts of the coastal lands along the Red Sea shores (Tihamah), and the steppe and desert transitional zones towards inner Arabia (Najd). The examples will be presented along three main topical dimensions:

- (i) Modes of Cognitive and Linguistic Classification (Qualities of stock and breeding; distinctions of age, health and temperament)
- (ii) Modes of Practical Usage (Mills and wells, furrows and meadows)
- (iii) Modes of wider Symbolic Associations (Stars, petroglyphs and demons)

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Andre Gingrich

Institute for Social Anthropology
Austrian Academy of Sciences, Vienna
andre.gingrich@oeaw.ac.at



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Between Myth and Reality: Camel-specific Terminology in Arabic

Stephan Procházka & Veronika Ritt-Benmimoun

In both popular and scientific works on camels it is frequently maintained that the Arabic language possesses hundreds, thousands or even ‘countless’ words for camel. The outstanding role camels have played for millennia in the daily life of the Arab Bedouin, no doubt, has resulted in a rich terminology regarding this animal. The question is, however, to what degree the enormous amount of camel-specific terminology found in lexicographical works of Classical Arabic has ever reflected the linguistic reality of a given individual or tribe.

Based on classical works such as the *Kitab al-Ibil* by al-Asma‘i we shall re-check the Classical data with the terminology as used by camel breeding tribes in today’s Tunisia. In particular, we shall examine the words for the camel in general, terms for camels in different ages and terms for specific colours.

Our main hypothesis is that – besides the language of poetry with its countless metaphors and epithets – the conspicuous richness of camel-specific terminology in Classical Arabic can be explained by the fact that the Arab lexicographers collected words from many different tribes who certainly spoke different dialects. Thus, if we look at the Arabic language zones (Sprachraum) as a whole, both Classical and Modern Arabic may in fact have thousands of lexemes related to the camel; but the number of words actually used in a limited region or among a single tribe most possibly has never exceeded that used by the Bedouins of Southern Tunisia in our times.

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Stephan Procházka

Department of Near Eastern Studies
University of Vienna, Austria
stephan.prochazka@univie.ac.at

Veronika Ritt-Benmimoun

Department of Near Eastern Studies
University of Vienna, Austria
veronika.ritt@univie.ac.at



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The Saharan Dromedary as a Sign – A Semiotic Analysis

Anja Fischer

Imuhar nomads (Tuareg) are living in one of the most extreme environments in the world. The groups discussed here are highly specialized dromedary and goat breeders in the Algerian part of the Central Sahara.

Hierarchies within Imuhar are rarely based on gender per se (men over women), but rather on seniority and on positions inside/outside a certain lineage. The ‘red Ferrari’ of the nomads is the white long-legged male dromedary (*ebeididj*). Women like men among Imuhar nomads are raiding such white dromedaries. Thus the *ebejdidj* is not only a symbol of heterosexual masculinity, but a sign of social prestige. The paper addresses the question under what circumstances, what ecological settings, cultural backgrounds and historical trajectories the image of Saharan dromedaries is formed.

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Anja Fischer

Department of Social and Cultural Anthropology
University of Vienna, Austria
afischer@imuhar.eu



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Conservation Management of the Wild Bactrian Camel in Mongolia

Adiya Yadamsuren & Enkhbileg Dulamtseren

The last critically endangered Wild Bactrian camels (*Camelus ferus*) throughout the world consist of three to four isolated populations found along the Mongolian-Chinese border and in the Central Asian (sub-) deserts Taklamakan, Arjinshin mountain, Lob lake and Altai Inner Gobi. In 1975 the Great Gobi 'A' Strictly Protected Area (GGSPA "A") was established in Mongolia to implement a broad conservation plan of the unique Gobi ecosystem and its rare flora and fauna such as the Wild camel and the Gobi bear. Subsequently, the Lob Nur Wild camel Conservation National Natural Reserve in Xinjiang (Uigur Autonomous Region) and the Wild camel conservation Natural Reserve in Annanba (Gansu Province) were established in China.

At present, around 460 Wild camels dwell in the GGSPA "A" within a homerange of 27,000-29,000 km², while another approximately 470 individuals are found in the Lob Nur Natural Reserve at Xinjiang. The core habitat of Wild camel near Arji Xian Mountain, Gansu province has been badly hit by water shortage. The movement patterns of the Wild camel populations vary according to seasons: around Arjin mountain, Kumtage desert, southern shore of Lob lake, Akike valley, and Kuluk tage mountain. Despite the good biological reproduction rate of Wild camels in these regions there are plenty of strong limiting factors like extremely dry climate, scarcity of water resources, predators, and especially human impact.

It is essential to raise the conservation awareness on both regional and national levels in order to (i) conduct permanent monitoring and in-depth genetic research of Wild camel populations, (ii) establish a trans-boundary national park with a corridor for Wild camel movement between isolated habitats, (iii) take bio-technical measurments, and (iv) improve legislations and socio-economic aspects to mitigate human impact. These measures should be taken to implement successful conservation management of the last remaining Wild camel populations in Central Asian deserts.

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Adiya Yadamsuren

Institute of Biology
Mongolian Academy of Sciences, Ulaanbaatar
ya.adiya@gmail.com

Enkhbileg Dulamtseren

Wildcamel Protection Foundation
Mongolia
camelproject@gmail.com

Projektteam:

Yuan Lei, Lob Nur Wild Camel National Nature Reserve, Xinjiang, China



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China – Status of the Critically Endangered Wild Bactrian Camel

Lei Yuan & John Hare

Since the establishment of the Lop Nur Wild Camel National Nature Reserve in 2002 there have been seven wild Bactrian camel surveys carried out in the Desert of Lop and the Gashun Gobi by the Wild Camel Office of the Xinjiang Environmental Protection Bureau to establish the status of the critically endangered wild Bactrian camel. The findings from the surveys show that the wild Bactrian camel, though facing many threats, is surviving in the heartland of the Reserve and not, as far as can be judged, declining. The threats to the wild Bactrian camel's future survival will be delineated. The recent sighting of wild Bactrian camels outside the protection of the Reserve in the Taklamakan desert to the east, and the steps to be taken to try to give the herd full protection, will also be outlined.

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Lei Yuan

Lop Nur Wild Camel National Nature Reserve
Xinjiang, P.R. China
iceyuanlei@126.com

John Hare

Wild Camel Protection Foundation
Benenden, UK
harecamel@aol.com



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Habitat Use and Movement Pattern of Wild Bactrian Camels in Mongolia

Petra Kaczensky & Chris Walzer

The range of the wild Bactrian camel (*Camelus ferus*) has become severely reduced to only three locations world wide: two in China (Lop Nur and Taklamakan desert) and one in Mongolia (Great Gobi A SPA). The population is listed by IUCN as critically endangered and there remain an estimated ~600 animals in China and between 350 to 1,950 in the Great Gobi A Strictly Protected Area (SPA) in south-central Mongolia.

There are great knowledge gaps concerning the ecology of the wild camels. Data on population dynamics, behaviour, habitat use, and movement patterns is scarce. Collecting such information is ever more important because human pressures for pastures and water on the edges of the Great Gobi SPA and in its buffer zones have substantially increased since the early 1990s and are believed to have lead to significant habitat degradation in some areas.

Between 2002 and 2008 we followed 7 wild camels equipped with satellite telemetry for 11 to 378 days and a total of 3,398 locations. The total ranges covered by individual camels were in excess of 7,000 km² for the 4 animals followed for at least 100 days, with the largest covering 17,395 km². None of the animals ventured beyond the borders of the SPA. Preliminary analysis of habitat selection with binominal generalized linear models suggests that wild camels show a weak preference for saxaul (*Haloxylon ammodendrum*) dominated areas, but do not select for areas of higher productivity or areas closer to permanent water points.

Notes

Petra Kaczensky

Research Institute of Wildlife Ecology
University of Veterinary Medicine Vienna, Austria
petra.kaczensky@fiwi.at

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Chris Walzer

Research Institute of Wildlife Ecology
University of Veterinary Medicine Vienna, Austria
chris.walzer@fiwi.at

Projektteam:

Richard Reading, Department of Conservation Biology, Denver Zoological Foundation
Henrik von Wehrden: Research Institute of Wildlife Ecology, Univ. VetMed Vienna; Institute of Biology / Geobotany and Botanical Garden, Martin-Luther-University Halle-Wittenberg, Germany



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The Detection of Hybridization Between Wild and Domestic Bactrian Camels

Katja Silbermayr

The survival of the remaining wild Bactrian camel (*Camelus ferus*) populations in China and Mongolia is threatened due to habitat loss and hybridization with the surrounding domestic Bactrian camel (*C. bactrianus*) populations.

In our study we aimed to differentiate the wild from the domesticated Bactrian camel using molecular markers. The mitochondrial DNA (mtDNA) has a high mutation rate which makes it a suitable marker for the genetic analysis. Thus, we examined an 808 bp long fragment of the mitochondrial genome in 50 Bactrian camels (wild=16, domestic=33, hybrid=1). We identified six mitochondrial types corresponding to one wild and one domestic cluster and calculated a sequence divergence of 1.9% between the two clusters. Based on the detection of 13 fixed mutations we developed a diagnostic restriction fragment length polymorphism assay. Through differences in the length of the amplified fragment it was possible to separate wild from domestic camels. However, since mtDNA is transferred from the mother to its offspring we were not able to detect maternal hybrids in the wild population. Thus, we applied 11 newly isolated and 9 published microsatellite loci on 70 animals including wild (n=20), domestic (n=45) and hybrid (n=4) Bactrian camels, dromedaries (n=3) and alpaca (n=1).

We identified one hybrid among the wild Bactrian camels and confirmed the clear separation (post. prob.=1) between the wild and the domestic Bactrian camel population as already seen in the mitochondrial DNA analysis. We conclude, that wild and domestic Bactrian camels represent two genetically different taxa and that hybridization can be detected.

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Katja Silbermayr

Institute of Animal Breeding and Genetics
University of Veterinary Medicine Vienna, Austria
katjasown@gmail.com

Projektteam:

Pauline Charruau, Institute of Population Genetics and Research; Institute of Wildlife Ecology, Univ. VetMed Vienna, Austria
Pablo Orozco-Terwengel, Institute of Population Genetics, University of Veterinary Medicine Vienna, Austria
Enkhbileg Dulamtseren, Wild Camel Protection Foundation, Mongolia
Chris Walzer, Research Institute of Wildlife Ecology, University of Veterinary Medicine Vienna, Austria
Pamela Burger, Institute of Population Genetics and Research; Institute of Wildlife Ecology, Univ. VetMed Vienna, Austria



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Poster Session

A Photoessay on Dromedary Camels in the Nigeria-Niger Corridor

A.M. Abdussamad¹, D.J.U. Kalla² and S.A. Maigandi³

1) Department of Animal Sciences, Livestock Production Systems Group, Georg-August Univ., Goettingen, Germany; a.abdussamad@stud.uni-goettingen.de

2) Animal Production Programme, School of Agriculture and Agricultural Technology, Abubakar Tafawa, Balewa University, Bauchi, Nigeria

3) Department of Animal Science, Faculty of Agriculture, Usmanu Danfodiyo University, Sokoto, Nigeria

The one – humped camel (*Camelus dromedarius*) is a multipurpose domestic livestock. It is well adapted to the harsh conditions of the arid and semi-arid zones and therefore thrives where other livestock species do not. The dromedary camel is versatile and its ability to survive and perform in the harsh, arid and semi – arid areas of the world have earned it a good reputation amongst pastoralists in tropical Africa and Asia.

Camel keeping is a common activity in the Nigeria-Niger border areas. It can be said that Nigeria and Niger experience seasonal influx and outflux of camels. While Nigeria has its own sedentary camel herds, its camel population at certain periods of the year varies due to the transhumant activity of pastoralists originating from Niger who are the producers of this resource.

During a field visit to Nigeria and Niger between July and September, 2010 different aspects of camel production were captured by the use of photography. The significance of these pictures for camel research and development in Nigeria is highlighted.

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Adulteration of Camels Milk Marketing in Khartoum City, Sudan

¹Alshareef, S.H. and ²Mustafa, A.B

1) African City of Technology, Khartoum, Sudan

2) University of Juba, Khartoum, Sudan

A Study was conducted to determine camels' milk adulteration in Khartoum city, twelve samples of milk randomly from different vendors in Khartoum city. Four Samples from each locality were tested for physic-chemical (acidity, fat content, density, formalin and starch). The study showed that, some variation in fat content, density and acidity when compared with control. In addition samples that may be due to adulteration by skimming, addition of water and skimmed milk, increase of ambient temperature or due to wide variation of physic-chemical composition of camel milk due to several factors such as, feeding system, yield, stage of lactation, water availability, reproductive status. Results show that no adulteration was observed using formalin or starch to camels' mills.

Camel, How Shall I Call You ?

De Cupere Bea¹ and Van Neer Wim^{1,2}

1) Royal Belgian Institute of Natural Sciences, Brussels, Belgium, bdecupere@naturalsciences.be, wvanneer@naturalsciences.be

2) Katholieke Universiteit Leuven, Laboratory of Animal Biodiversity and Systematics, Leuven, Belgium,

Numerous camelid bones have been collected during the excavations at the Castle of Aqaba (Jordan, 13th – 20th century AD) and at the town of Apamea (Syria, Late Roman to Middle Islamic period). Based on the osteomorphological differences that have been described in the literature to distinguish the two-humped or Bactrian camel and the one-humped camel or dromedary, most of the archaeological material can be identified as dromedary, as could be expected from the geographical distribution of the two species. In addition, a few bones resemble the Bactrian camel both in morphology as in size. However, several bones display the morphological characteristics of dromedary but are very large and fall outside the 'normal' size range of dromedary. These specimens may either represent castrated animals or hybrids. Using modern reference collections, osteometrical data of Bactrian camel and dromedary are explored, the influence of castration on the size of the camels is considered and new morphological criteria are established to further aid in the identification of these camel bones.

Identification of Structural and Quantitative Heteroplasmic mtDNA Genomes Due to a Compound Tetra- and Hexa-nucleotide Microsatellite Locus in the D-loop of Genus Camelus

Xiaohong He¹, Jianlin Han^{1,2}, Yuehui Ma¹

1) Key Laboratory of Farm Animal Genetic Resources and Utilization of Ministry of Agriculture, Institute of Animal Science, Chinese Academy of Agricultural Sciences (CAAS), Beijing, China; 2) International Livestock Research Institute (ILRI), Nairobi, Kenya h.jianlin@cgiar.org

There are about 250 thousands of domesticated Bactrian camels distributed in 1.1 million km² of semi-deserts in Inner Mongolia Autonomous Region, Xinjiang Uygur Autonomous Region, Qinghai Province, Gansu Province and Ningxia Hui Autonomous Region in China, of which 68% of Chinese camels are found in small number in rangelands in the east and in large number (100 thousands) in semi-deserts in the west of Inner Mongolia and 20% in almost every administrative counties in the vast areas of Xinjiang. To investigate the genetic diversity of the Chinese camels using the most polymorphic mtDNA marker, the control region or the D-loop, their complete DNA sequences were targeted. However, a very complicated compound tetra- and hexa-nucleotide microsatellite locus consisted of tandem repeats of 'ATAC' or 'GTAC' and 'GTACAC' or 'GCACAC' in random combinations in a fragment of 224 to 274 bp flanked by 1 or 2 'GCACCC' blocks in its 5' end and 2 'ACGC' blocks in its 3' end and located between the conserved sequence blocks 1 and 2 in the D-loop was identified in 26 camels sampled from Gansu, Inner Mongolia and Qinghai. Alignment of our data with homology region of the available complete mtDNA genomic sequences of one dromedary, four domesticated and three wild Bactrian camels deposited in the GenBank confirmed our observation that was not noticed and reported in previous studies (Yasue et al. 2001; Cui et al. 2007; Ji et al. 2009) with the exception of annotation of only 'CACGTA' tandem repeats in the dromedary sequence (Huang et al. 2007). This locus can further lead to the formation of both structural and/or quantitative heteroplasmic mtDNA genomes with sequences in different combinations of the tetra- and hexa-nucleotide repeats and in different copy numbers, therefore making the generation of quality complete D-loop sequences for phylogenetic or diversity analysis impossible.



Improvement of the Keeping Quality of Raw Camel's and Cow's Milk by Lactoperoxidase Enzyme System

Ibtisam E. M. El Zubeir

Department of Dairy Production, Faculty of Animal production, University of Khartoum, Khartoum North; Ibtisammohamed@hotmail.com

The present study is a trial to increase the efficiency of the keeping quality of raw milk by the activation of the lactoperoxidase enzymes system (LPS) that was recommended by FAO. Fresh raw milk samples from both bovine and dromedary milk were obtained from University of Khartoum farm during the period of May 2010. The activation was done 2 hours later after the morning milking and the milk samples were divided into LPS activated and control samples. Then the preservation of the samples was done under room (37° C) and refrigeration conditions (8° C). All samples were subjected to some quality tests (Standard plate count, acidity and clot on boiling) during the storage period. The LPS treated milk samples from camel showed better keeping quality and longer shelf life than cow's milk both at room (10 vs. 3 days) and refrigerator (14 vs. 9 days), compared to non treated milk samples stored at room (2 days and 6 hours) and refrigerator (10 and 3 days), respectively. The obtained data are compared favoritlity with the control samples stored at the refrigeration condition. This supported the previous recommendation that the LPS is an efficient method for preservation and prolonging the shelf life of raw milk under tropical hot environment that lack the refrigeration facilities. Because camel milk showed superior quality compared to cow's milk as was indicated from the measurement, camel communities' herders in arid and semi zones should be involved in the field application of LPS in order to encourage them to collect and utilize their valuable camel milk. It is also recommended that the governmental and private institutes to initiate the collection centers equipped with the technical facilities in order to enhance the processing and trade of the non utilized milk from camel and other species animals in Sudan.

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Is There a Two-hump Stage in the Dromedary Embryonic Development?

C. Knosp¹, J. Kinne, N.A. Wani, U. Wernery² and J. Peters³

1) Institut für Veterinary Anatomy LMU-München; cknosp@lmu.de

2) Central Veterinary Research Laboratory Dubai

3) Institut für Palaeoanatomie und Geschichte der Tiermedizin LMU-München

It has been postulated that the one-humped (Arabian) dromedary and the two-humped (Bactrian) camel originated from a single ancestor. Consequently the dromedary was considered a breed of the two-humped camel, based on an anatomical study by Lombardini (1879), who described a reduced second hump-like structure in fetal and adult dromedaries. To resolve this lingering issue, we analysed 72 fetuses of dromedaries, one of a Bactrian camel, and two of so-called tulus, i.e. Camel dromedarius x Camel bactrianus hybrids. In contrast to the situation in two-humped camels, we never did observe any rudimentary second cranial hump in the dromedary fetuses or calves. No hump-like structure could be detected in any of the dromedary fetuses with a crown-rump length below 22 cm. In older fetuses the hump extended at its base from the 10th thoracic to the 5th lumbar vertebra, approximating the position of its homologue in the adult camel. This finding suggests a separate ancestry of both camelid forms.

Marketing and Export of Gedarif Camels from Eastern Sudan

Abdalatif¹, Y. M., Mustafa², A. B., and Salih³, A.M.

1) Ministry of animal resources, Gedarif State, Gedarif, Sudan

2) University of Juba, P.O.Box 12327 Code 11111 Khartoum, Sudan

3) University of Khartoum, Faculty of Animal Production, Shambat, P.O.Box 13317 Khartoum, Sudan.

yousifnama@yahoo.com, ayman_balla@yahoo.com

This study was conducted in Gedarif area, east Sudan from Oct., 2005 up to Aug., 2008. The research aim was to estimate camel marketing and export according to age, sex and breed. A well designed questionnaire was prepared, by which 153 camel herders and owners were to be addressed. The results reveal that the marketing system is governed by many factors. The annual off-take is 3-4%. The annual growth rate is estimated at 6-7%. As far as marketing camel is concerned, sold camel include young males, usually old or unproductive camel and female that are sold to meet urgent cash needs. Camel owners start spending money in buying crop residues to feed their camels and by buying drugs and veterinary services. In 2002- 2007, there is a great activity of camel export. In recent years, the prices of exported camels were increasing continuously. In this study, we show that high taxation is the most common problem affecting camel marketing and export in Gedarif State. It is seen that camel production in Gedarif area has become a profitable enterprise.

Mitochondrial Evidence for Panmixia in the Global Population of Camelus Dromedarius

Charruau Pauline^{1,2}, Orozco-terWengel Pablo¹, Nowotny Norbert³, Walzer Chris², Schlötterer Christian¹ & Burger Pamela^{1,2}

1) University of Veterinary Medicine, Institute of Population Genetics, 1210 Vienna, Austria

2) University of Veterinary Medicine, Research Institute of Wildlife Ecology, 1160 Vienna, Austria

3) University of Veterinary Medicine, Clinical Virology Group, Institute of Virology, 1210 Vienna, Austria

The dromedary, or Arabian camel, is one of the most important domesticated species in North Africa and South West Asia. This species supplies humans living in inhospitable environments with milk, meat, wool, fuel, shelter, capital and transportation. Like most domesticated species, different breeds are known for each locality but few of them have been described. Due to the economic interest in this species a few genetic surveys have been carried out focusing on particular national breeds and attempting to define genetic variability or gene(s) of interest that characterize these populations. Nevertheless, little is known about the genetic history and ancestry of the “Ship of the Desert”.

In this project, we aim to investigate the genetic diversity of dromedary populations covering their global distribution range. The ultimate goal is to better understand the domestication process the dromedary has passed through.

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Nutritive Value of Some Natural Pasture for Feeding Camel in Butana Area, Eastern Sudan

Khadiga Abdel Ati, Heba Alamin, Abdel Nasir Fadel Elseed

Faculty of Animal Production, University of Khartoum; khadigaatti@yahoo.com

The nutritive value of natural pasture plant was evaluated at the end of the rainy season in Butana area around Abo-dlig city. Thirteen pasture plants species were collected, five of which were grasses (as *Cyperus rotundus*, *Aristida adscensionis*, *Panicum coloratu*, *Dactyloctenium aegypticum* and *Sehima ischaemoides*) and forbs (as *Ipomea sinensis*, *Indigofera hochestetteri*, *Sesbania aribica*, *Digera alternifolia*, *Corchoris clitorius*, *Tribulus terrestris*, *Crotalaria senegalensis*, and *Solanum dubium*).

Chemical analysis of the samples showed significant differences ($P < 0.05$) in Dry matter, Crude Protein (CP), Ether Extract (EE), NDF, ADF and Ash content. Grasses contained CP ranged between 5 - 15%, however, CP of forbs ranged between 9 – 23 %. The NDF content of grasses species was (52.44 - 81.16%) while for forbs species it was (45.41-77.39%). The ADF content, however, ranged between (30.86-46.09%) for grasses and (30.88-65.67%) for forbs.

In vitro digestibility of organic matter of grasses ranged between 46.51 -67.23%, while forbs ranged between 58.8-74.63%.

The content of Macro-minerals (Calcium, Phosphorus, Potassium, Sodium and Magnesium) is relatively high. The grasses content ranged from (0.290- 1.150%), (0.050- 1.110%), (0.590- 2.305%), (1.955- 0.155) and (0.105- 1.120%) respectively, while the forbs content ranged from (0.380- 4.950%) for Ca, (0.071 -0.705%) for P, (0.825- 2.635%) for K, (0.115- 0.865%) for Na and (0.155- 1.060 %) for Mg.

The content of Micro-mineral in pasture plants species (Copper, Iron, Manganese, selenium and Zinc.) ranged from (0.011- 1.173ppm) - (0.44- 5.87ppm) - (3.47-22.41ppm)- (0.003-2.04ppm) and (0.028-1.75ppm).

Socio Economic Perspective of Camels in Pakistan

Arshad Iqbal

Department for Livestock Management, University of Agriculture, Faisalabad, Pakistan, aiqbal_uaf@yahoo.com

In Pakistan livestock being a major sub-sector of agriculture is contributing more than 11 % to the national GDP. It comprised camel of about 1 million heads (dromedaries mostly) belonging to 20 recognized breeds. They are primarily raised for work followed by their functions for milk, meat, recreation, fibre etc. Pakistan occupies the world's 5th position in camel populations, and possesses 23 % of the camel population of Asia.

Brella and *Marechha* are the well recognized camel breeds for milk and draught purpose respectively. Camels are the mainstay of nomadic and pastoral subsistence in arid/semi arid regions. Pastoralists often belong to the poorest economic stratum, many are illiterate. Four camel production systems exist viz. migratory or nomadic; transhumant/semi migratory, sedentary or household pastoralist. Camel has been reported to produce about 12 kg milk/day under ordinary feeding management conditions. However this production ranges from 5-40 litres/day under different conditions. Camel milk serves as a staple food for some camel owning societies. Camel milk products (Lassi / sour milk, cheese, yogurt, a pudding type locally called *Phirri*) are also prepared. Camel hair is used for making rugs, ropes, carpets, blankets etc. Camels are slaughtered for meat purpose with varying frequency on the occasion of religious and non-religious festivals. The production and breeding pattern of camel is quite traditional and very much associated with the season and feed supply. The breeding male(s) are usually farm produced. Bull selection is made on its performance based on the memories of camel owners. Camel breeding activity (rut season) is mainly associated with severe winter. Pakistan is the largest camel market in Asia. Cholistan (District Bahawalpur), Mangrota camel fair (District Dera Ghazi Khan) and Sibbi fair (Balochistan) are probably the principle trading centres. Usually the males are sold to meet domestic needs. Camel trading in Cholistan is largely benefit of Saudi Arabia and the Middle East. In general, trading is done in periodical markets. These markets may be either exclusively for camels or in combination with other livestock species. The camel is a model option as dairy, meat producer and work animal among all farm animals owing to its superb adaptation abilities in the era of global warming.

The Rule of Camels in Saudi Arabian Life

Saeid Basmaeil

Department Animal Production, College of Food and Agricultural Sciences, King Saud University, Saudi Arabia

Kingdom of Saudi Arabia established in 1932 (2,149,690 sq km) it contains the world's largest continuous sand desert, the Empty Quarter (647,500 square km). Saudi Arabia's population (estimate 2010) 27,316,000

The one- humped camels (about 900,000 head) play a significant role in Arabian life, since 1400 years ago. It is used in traveling methods in desert. It is called the "ship of the desert." Carrying tents, equipment, women and children. The camel is a valuable commodity, Camel beauty pageants, is held all over Saudi Arabia in which camels are judged on their looks. The camels used for many purposes in the daily life; it was chief source of food, raw materials, transport and wealth. They drank the camel's milk, feasted on its meat, fashioned rope from its wool, made shields and water buckets from its skin, bound wooden saddles together with its sinews, burned its droppings as fuel, and turned milk and urine for medicines.

Bedouin of Arabia, who depend almost entirely on their camels, they consider camel herd as a source of prestige, capital and wealth. The camel herders moving according to a regular seasonal pattern, migrating more freely in order to take advantage of widely dispersed and erratic grazing and water resources.

The largest Camel Market in Riyadh and Buraydah, where people buy Camels for milk and meat, and for racing or for their beauty. The wealthy Saudi camel owners arrange parties in the desert to spend time with their favorite camels. The death of Almost 2000 Camels from a mysterious disease. King Abdullah ordered payments of about \$5,330, for every camel that died from eating the contaminated feed.

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Camels in the Archaeological Record of Ancient Mesopotamia

Cornelia Becker

During the 3rd and 1st millennium BCE, Mesopotamia has seen the rise and downfall of a famous civilization: that of the Assyrian. During the “First Golden Age” of their history (2400 BCE to 612 BCE), Assyrian people dominated politics, warfare, economy and trade in this area and far beyond. Camels were, among other animals, important in establishing and maintaining this power.

A variety of archaeological sources can provide information on this topic, such as the depictions of camels on bas-reliefs, stelae and cylinder seals, their representation in the form of terracotta figurines, written records on cuneiform tablets and not least data from bone material excavated from Assyrian sites.

It is the aim of this paper to present an overview on all these sources and compare them in respect of their complementary character and validity, as far as the occurrence of *Camelus bactrianus* and *Camelus dromedarius*, their quantities and their specific use in Mesopotamia are concerned.

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Cornelia Becker

Institute for Pre-historic Archaeology
Freie Universität Berlin, Germany
cobecker@tedat.fu-berlin.de



Tuesday, 5th

Wednesday 6th

Thursday, 7th

Palaeogenetic Analysis of Animal Domestication in South West Asia

Eva-Maria Geigl

Based on archaeological and archaeozoological data, the dromedary, the emblematic animal that allowed humans to conquer the hostile deserts of Northern Africa and Southwest Asia, is supposed to have been domesticated at the end of the second millennium on the Arabian Peninsula. Many questions, however, remain. To overcome the limits of the various approaches used to answer these questions, a multidisciplinary study is required. Only when light is shed from various angles will we be able to solve the enigma of the domestication process(es) of dromedaries in Southwest Asia. The palaeogenetic approach, i.e., the analysis of DNA preserved in archaeological bone, and comparison of the genetic data obtained from these bones with those obtained from extant dromedaries, should be used to tackle the phylogeography of dromedaries prior and after their supposed domestication.

The palaeogenetic analysis of archaeological bone from dromedaries will suffer mainly from the poor preservation of DNA known to render this type of analysis very difficult. Poor DNA preservation is a characteristic of archaeological bone preserved on the Arabian Peninsula: this brings about major methodological difficulties for their palaeogenetic analysis that present a serious threat to the authenticity of the results. My group has a decade of experience in the palaeogenetic analysis of archaeological faunal remains from Southwest Asia, which I intend to share with the audience. We have developed a series of methods to overcome most of these methodological difficulties, which I will present.

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Eva-Maria Geigl

Institute of Epigenomics and Paleogenomics; Institute Jacques Monod
CNRS, Paris, France
geigl.eva-maria@ijm.univ-paris-diderot.fr



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Wednesday 6th

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Evolutionary History of Indigenous Arabian Peninsula Camel (Camelus dromedarius) Populations

Faisal Saleh

Domestic one-humped or Arabian camels *Camelus dromedarius* are a major livestock genetic resource for the Arabian Peninsula. At least ten breeds are recognized, although the genetic status of these populations remains largely unknown.

Five hundred and seventy-one blood and hair samples were collected from unrelated camels representing all common camel types in the Arabian Peninsula. The aim of this study is to

- (i) unravel the genetic history of domestication of dromedary camels and subsequent dispersion across the Arabian Peninsula,
- (ii) unravel the breed/population history through the study of their genetic relationships and diversity, and
- (iii) understand the local adaptation of dromedary to their environments.

In order to achieve these objectives analysis of sequences variation of mitochondrial DNA control region, genotype data of microsatellite loci and polymorphism at candidate coat colour genes will be performed. Software for population genetic analyses of molecular marker data will be used to estimate various diversity measures and genetic distances, and infer population structure and clustering patterns. The results obtained will provide evolutionary insights on the history and local adaptation of the Arabian Peninsula dromedary and contribute to the design of breeding strategies for the conservation of dromedary genetic diversity and the improvement of their productivities.

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Faisal Saleh

Department of Public Health and Animal Welfare, College of Veterinary Medicine and Animal resource, King Faisal University, Saudi Arabia; Institute of Genetics, School of Biology, The University of Nottingham, UK; NERC Biomolecular Analysis Facility – Sheffield, University of Sheffield, Department of Animal and Plant Sciences, UK
faisalvet@hotmail.com

Projektteam:

Joram Mwacharo, Institute of Genetics, School of Biology, The University of Nottingham, UK
Olivier Hanotte, Institute of Genetics, School of Biology, The University of Nottingham, UK



Tuesday, 5th

Wednesday 6th

Thursday, 7th

Archaeozoology of Camels in South-eastern Arabia

Margarethe Uerpmann

During the last decade studies on faunal remains from archaeological excavations in Southeast Arabia provided solid facts to ongoing discussions about the history of camels in that part of the world. According to these results camel bone-finds from Neolithic to modern times almost exclusively represent the dromedary or one-humped camel. Only in the Parthian period we see the occurrence of hybrids between the one-humped and the two-humped form, giving indirect evidence for the two-humped camel as well.

From the territory of the United Arab Emirates there are now numerous finds of wild dromedaries from the Neolithic period and from the Bronze Age. Rare finds of the wild one-humped Arabian camel can still be identified in Iron Age contexts. Their taxonomy needs clarification.

From the Iron Age onwards there are indications for the use of domestic dromedaries at a number of archaeological sites in Southeast Arabia. Their importance for the people is underlined by the appearance of camel figurines. Reliable data concerning time and location of dromedary domestication can not be presented at this moment because of the lack of stratified sites and because preservation of organic material is generally poor in the desert areas. Difficulties in direct radiocarbon dating of archaeological camel bones from Southeast Arabia are also impeding a convincing solution of the “camel problem”.

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Margarethe Uerpmann

Institute of Pre- and Protohistory and Mediaeval Archaeology
University of Tübingen, Germany
margarethe.uerpmann@uni-tuebingen.de



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Camel Tombs in Al-Fau, Saudi Arabia

Said F. Al-Said

No abstract available

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Said F. Al-Said

College of Tourism and Archaeology
King Saud University, Riyadh, Saudi Arabia
sfsaid@yahoo.com



Tuesday, 5th

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Genetics of Chinese Bactrian Camels

Han Jianlin

There are about 250 thousands of domesticated Bactrian camels distributed in 1.1 million km² of semi-deserts in Inner Mongolian Autonomous Region, Xinjiang Uygur Autonomous Region, Qinghai Province, Gansu Province and Ningxia Hui Autonomous Region in China. Among them, 68% of Chinese camels are found in small number in rangelands in the east and in large number (100 thousands) in semi-deserts in the west of Inner Mongolia and 20% in almost every administrative counties in the vast areas of Xinjiang.

To investigate the genetic diversity of the Chinese camels using the most polymorphic mtDNA marker, the control region or the D-loop, their complete DNA sequences were targeted. However, a very complicated compound tetra- and hexa-nucleotide microsatellite locus consisted of tandem repeats of 'ATAC' or 'GTAC' and 'GTACAC' or 'GCACAC' in random combinations in a fragment of 224 to 274 bp flanked by 1 or 2 'GCACCC' blocks in its 5' end and 2 'ACGC' blocks in its 3' end and located between the conserved sequence blocks 1 and 2 in the D-loop was identified in 26 camels sampled from Gansu, Inner Mongolia and Qinghai. Alignment of our data with homology region of the available complete mtDNA genomic sequences of one dromedary, four domesticated and three wild Bactrian camels deposited in the GenBank confirmed our observation that was not noticed and reported in previous studies (Yasue *et al.* 2001; Cui *et al.* 2007; Ji *et al.* 2009) with the exception of annotation of only 'CACGTA' tandem repeats in the dromedary sequence (Huang *et al.* 2007). This locus can further lead to the formation of both structural and/or quantitative heteroplasmic mtDNA genomes with sequences in different combinations of the tetra- and hexa-nucleotide repeats and in different copy numbers, therefore making the generation of quality complete D-loop sequences for phylogenetic or diversity analysis impossible.

Notes

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Han Jianlin

Chinese Academy of Agricultural Sciences
Beijing
h.jianlin@cgiar.orf

Projektteam:

Xiaohong He, Institute of Animal Science, Chinese Academy of Agricultural Sciences (CAAS), Beijing
Yuehui Ma, Institute of Animal Science, Chinese Academy of Agricultural Sciences (CAAS), Beijing



Tuesday, 5th

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The Camels in Pre-Modern Mongol Sources

Lkhamsuren Munkh-Erdene

The horse and not the camel enjoys the role of representing the quintessential animal symbol in pre-modern Mongolian history. Nevertheless the camel is given a remarkable presence in many Mongolian historical sources, beginning with the “Secret History of the Mongols”. In particular, camels frequently are referred to as means of penalty payments in Mongol law codices between the late 16th and the early 18th century.

After outlining some main references to camels in Mongolian historical sources, this paper will focus on pre-modern Mongol legal codices and the use of camels as penalty payments.

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Lkhamsuren Munkh-Erdene

Institute for Social Anthropology,
Austrian Academy of Sciences, Vienna
lkhamsuren.munkh-erdene@oeaw.ac.at



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The Tears of the Camel: Reflection on Depictions and Descriptions of the Camel in Mongolian Culture

Maria-Katharina Lang, Vienna

The film-documentary *The Story of the Weeping Camel* was nominated for an Oscar in the category Best Documentary in 2004. In this paper I shall reflect on the background of the story and its symbolism narrated in the film, and also draw a connection to Austrian research history.

The Austrian collector and researcher Hans Leder witnessed the effects of sounds on camels in 1892. As one of *The Five Animals* the camel holds an important place in Mongolian society. This is expressed in various ways: camels were a tribute between Mongolia and the Qing Dynasty, they played a role in the expansion of the Mongolian empire, they serve as riding animal – but not only for human beings – and music is performed especially for camels.

Descriptions and depictions of camels (as some presented in this paper) may contribute to the understanding of the meaning of this animal in Mongolian society, history and culture.

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Maria-Katharina Lang

Institute for Social Anthropology
Austrian Academy of Sciences, Vienna
maria-katharina.lang@oeaw.ac.at



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The Camel and its Symbolism in the Daily Life of the Mongols with Focus to their Folk Songs

Otgonbayar Chuluunbaatar, Vienna

For the survival of a society characterised by nomadic traditions, animals are a key element. In such communities, a symbolism evolved which directly relates to this feature of their existence.

It is little known that for Mongolians, the performance of music, and especially chanting, was an indispensable factor for livestock breeding itself. Second to the horse, the camel (*temee*) is the most relevant animal motive in Mongolian folklore. In legends, parables, metaphors, ritual songs and everyday folk-songs, as well as in modern literature, the camel has its established place. In all of these, knowledge pertaining to the camel or its significance for Mongolians is often also conveyed. Accordingly, the prominent role of the camel is reflected not only in a historic symbolism, but also in that of the current state.

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Otgonbayar Chuluunbaatar

Institute for Folk Music research and Ethnomusicology
University of Music and Performing Arts, Vienna
mongolischdolmetscher@yahoo.de



Tuesday, 5th

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Caravans from South Arabia: Roads and Organization

Johann Heiss, Vienna

The once famous, so-called “incense road” led from the southwest of the Arabian Peninsula to the eastern Mediterranean coast. My presentation will focus on its course on the southwestern corner of the peninsula. There, it consisted of a web of ways each with their own characteristics regarding the possibilities of travel and trade.

To travel with a big caravan on these roads necessitated the maintenance of a high level of organization quite different from that used on other ways. One had to distribute strains on men and animals in a fair way. Additionally, one had to assure that every man and every animal received his/its share of water at a well.

The south Arabian author al-Hamdani, who lived in the 10th century, elaborated on some parts of the “pilgrim road”, as he calls the strands of the former incense road in south Arabia, whereas in another book he described the structure of a Yemeni caravan travelling north, dwells on the differences to Iraqi caravans, and thereby reveals a fascinating and complicated level of the organization of camel usage.

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Johann Heiss

Institute for Social Anthropology
Austrian Academy of Sciences, Vienna
johann.heiss@oeaw.ac.at



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Economic Significance and Traditional Management of Dromedaries in Syria

Darem Tabbaa

The number of camels in Syria decreased dramatically during the last 30 years. Primarily this is due to dispense with it as a means of riding and transport, after the spread of cars amongst rural asphalt roads, which reached the country in all cities. The number of camels in Syria was in the year 1922 250.000, and in the year 1938 about 77.200 and in the year of 1954 106.000, and the year 1958 about 62.900, and then the number decrease to not more than 22.000 nowadays.

Camels in Syria are dromedaries with a single hump, mostly the *Shamyeh* which spread in the country steppe. It is characterized by the small head, long neck and the heavy upper lip by which it touches the food before eating. The weight ranges between 650-783 kg in males and between 574-680 kg in females. The Iraqi *Alkhowar* dromedary spread in Deir Azzor steppe and in Al Jazeera of Syria.

The *AlJodiyeh* dromedary existed in the Palmyra steppe and the Syrian *AlHamad*, and it is characterized by big bones and a big body. It was used for carrying and transporting. They spread in Syria with *AlNajdi* dromedary which is characterized by it's big size, with *AlTyhyeh* dromedary which is of Sudanese origin, and with Egyptian dromedaries. Historically, Syrians were the first who crossbred the dromedary with Bactrian camels, and the first who crossed the American desert. More details are given about the economic significance and traditional management of camels in Syria in this paper.

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Darem Tabbaa

Faculty of Veterinary Medicine,
Al Baath University, Hama, Syria
spana@net.sy



Tuesday, 5th

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Camel Urine in Arab Heritage (Folk Medicine)

Abdulsalam A Bakhsh

In camels and owners, there have been mutual benefits since ancient eras. Camel characteristics have been mentioned in the Holy Quran since 1431 AH.

Beside milk, urine has attracted great significance in term of folk medicine. Females in deserts had used she-camel (before puberty) urine to wash their heads for treating infection. New discovery of its biochemical effect resulted in ointment formation, which proved good biological action on stomach and skin illnesses. The presentation will show different aspects of the use of camel urine in folk medicine.

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Abdulsalam A Bakhsh

Department of Clinical Studies, College of Veterinary Medicine and Animal Resources
King Faisal University, Al-Ahsa, Saudi Arabia
abakhsh@kfu.edu.sa



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Camel-Trekking: The ,Authentic‘ Tourist Experience in the Sahara

Ines Kohl

In the 1970s Sahara-tourism evolved and countries like Morocco, Tunisia, Algeria, Niger, and Mali became the aim of adventurous travellers, who crossed and explored the Sahara with 4-wheel drives. In the 1990s Libya’s political opening added to a new destination in desert tourism. At the same time approaches of environment-friendly and sustainable tourism emerged, and contributed a new segment of desert-tourism in the Sahara: Camel-Trekking.

In the eyes of tourists short-time trekkings with camels became a much more authentic travel experience than going by 4-wheel cars. They evoked the impression of “authentic” movement in the Sahara, like nomads and caravaniers.

In this presentation I will refer to the preconceptions and stereotypes tourists have on camels and the differences between nomadic journeys and the ‘authentic’ tourist attraction.

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Ines Kohl

Independent Researcher
Vienna
kohlspross@hotmail.com



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What Camel Eat: A Study in Arabic Ethnobotany

Daniel Martin Varisco

The importance of the camel in the history of the Arabian Peninsula extends to the multiple references to camels and all things associated with camels in the Arabic language. In this study I examine the diet of camels as documented from the earliest Arabic lexical and botanical texts, as well as relevant evidence from contemporary ethnographic research on camel pastoralism.

Two of the most important historical sources are in the *Kitâb al-Nabât* (Book of Plants) genre by Abd al-Malik al-Asmâ'î (828 CE) and Abû Hanîfa al-Dînawarî (896). These two scholars, widely quoted in later lexical and scientific sources, classify plants according to indigenous views of descriptive characteristics, with a pragmatic emphasis on distinguishing plants useful for camel grazing from those considered to be dangerous to camels or that have no dietary value.

I survey this early Arabic classification system and specify the specific plant names mentioned, as well as any details available about their value in the diet of camels. To the extent possible, I attempt to match the Arabic plant names with scientific nomenclature, based on linguistic, ethnographic and botanical analyses available. Information can be found on plants considered suitable for milk production, specific illnesses caused by eating certain plants, dietary choice, suitable grazing times according to the season, and a variety of aspects related to the long established system of grazing and feeding camels.

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Daniel Martin Varisco

Department of Anthropology
Hofstra University, New York, USA
daniel.m.varisco@hofstra.edu



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Bacterial Community of the Dromedary Camel (Camelus dromedarius) Rumen

Rafat Al Jassim

Rumen contents from 12 wild dromedary camels in Australia were collected immediately after slaughter and analysed for bacterial diversity. Additional rumen contents from six camels were collected and cultured in a pre-reduced basal medium 10 (BM10) that was enriched with different fibre materials [i.e. filter paper (FP), cotton thread (CT) and neutral detergent fibre (NDF)] to investigate the effect of fibre type on the rumen fibre degrading bacteria. Genomic DNA was extracted and the bacterial 16S rRNA gene was PCR amplified. Clone libraries were constructed and a total of 267 clones were randomly selected, sequenced (1250 to 1450 bp), and used to construct a phylogenetic tree. Analysis of the 267 sequences revealed that 55.1% (147 clones) may represent several new species (< 97% similarity), 36% (96 clones) may represent a new genus (< 93% similarity) and 9.4% (25 clones) may fall into a new family (< 85% similarity). Moreover, an additional 300 sequences (100 sequences representing each fibre type) were also analysed. Results revealed that 40% to 57% of the clones derived from the enrichments (FP, CT, NDF) may also represent several new strains (99.5-98% similarity). At the phyla level, the *Firmicutes* were the most abundant bacteria in both studies followed by the phylum *Bacteroides*.

Our studies have presented important information on the bacterial diversity of the camel forestomach, the first such comprehensive study ever reported. By using the cellulolytic enrichment media, it provided unbiased information about population of the fibre-digesting bacteria that may have been suppressed in the rumen. The use of 16S rRNA gene clone libraries in the present study has uncovered many novel and non-culturable species that represent a large proportion of the bacteria in the forestomach of wild dromedary camels in Australia.

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Rafat Al Jassim

School of Animal Studies
University of Queensland, Gatton, Australia
r.aljassim@ug.edu.au

Projektteam:

Anjas Samsudin, School of Animal Studies, University of Queensland, Australia
André-Denis Wright, Department of Animal Science, University of Vermont, USA.



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The Informal Camel Milk Marketing Sector in Kenya and Somalia

Mario Younan

The importance of camel milk as an important source of nutrients for pastoralist communities in semiarid regions, in particular in Kenya and Somalia, is well documented. Its superior keeping quality, as compared to cows and goat milk, makes it possible to transport and trade camel milk over long distances. Due to the increasing market demand for camel milk, which is largely driven by urbanised and other sedentary ex-pastoralist communities, camel milk has become an important commodity in Kenya and in Somalia. Income generated by pastoralist households from sales of camel milk ranks second only to the income from sales of livestock.

Camel milk marketing in Kenya and in Somalia is almost 100% informal. The sector is dominated by milk women, running informal microenterprises. These women belong to pastoralist communities, but have lost their traditional livestock based livelihoods. In many cases they struggle to make a living in urban and peri-urban environments. Sales of camel milk often represent the main and quite often the only source of income to these female-led households.

This paper provides an overview of the sector, its limitations and potential. It also takes stock of past and current interventions in the region, aimed at strengthening the camel milk sector and at improving incomes of camel milk producers and other actors along the camel milk value chain.

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Mario Younan

Kenyan Agricultural Research Institute (KARI)
Nairobi, Kenya
marioyunan@gmail.com

Projektteam:

David Miano Mwangi, Kenyan Agricultural Research Institute (KARI), Nairobi, Kenya



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Issues Related to Camel Racing and Prohibiting Substances

Kelly Wilson

Camel racing is a popular sport in the Middle East. It acts as a method of retaining traditional skills and lifestyles as well as distributing oil wealth to the poorer Bedu people. However, like in all competitive sports doping is an issue. In the UAE, winning camels are subjected to a drug testing program and currently a zero medication rule is adopted. If a camel fails the anti-dope testing severe penalties are imposed on the owner and trainer.

As the drug testing evolves and detection limits are lowered due to the use of more sophisticated equipment, the question needs to be asked – at what concentrations do drugs cease to have an effect? Complicating this question is that it appears that drugs used for therapeutic purposes are not metabolized as quickly in camels as they are in horses, and thus have longer detection times. This suggests that many of the known detection times for drugs in horses cannot be applied to camels. Very little research has been done on drug metabolism in camels, especially compared to the vast number of studies in horses.

This paper will give some examples of drug metabolism studies conducted in the Racing Analytical Laboratory at the Management of Scientific Centres and Presidential Camels, which will illustrate the problems involved in drug testing racing camels.

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Kelly Wilson

Department of the President's Affairs, the Management of Scientific Centres and Presidential Camels
United Arab Emirates
kjl@live.com.au

Projektteam:

Allen M Stenhouse, Andrew Marty & Alex Tinson, Department of the President's Affairs, the Management of Scientific Centres and Presidential Camels, United Arab Emirates



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Excursion to Schönbrunn Zoo



The world's oldest zoo is located in the Habsburgs' former imperial summer residence of Schönbrunn Palace in Vienna as a unique combination and blending of culture and nature.

Since 1452 animals were on display outside Vienna's city wall; in 1552 this also included for the first time an elephant. By 1752 the first bawns were built at the zoo's present location in the spacious garden of the Imperial Schönbrunn Palace.

At first this Menagerie was designed to serve the exclusive entertainment of the empress, the emperor and their guests. Yet in 1778 the Menagerie was opened up for the wider public. In 1828, the first giraffe caused such a sensation that security forces were needed to deal with the enthusiastic crowd. Such precautions were not necessary again until 2008, when a record number of visitors hoped to get a glimpse on a new born Panda Bear.

Today more than 500 partially endangered animal species have a home and a sheltered survival space in the Schönbrunn zoo. The zoo especially emphasizes public education and breeding programs. Its far-reaching aim is to ensure the protection of nature and the conservation of species in their natural habitat.

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Start 9:00 Main Entrance

Subway U4 (Green Line): Station „Hietzing“ and a 5 min. walk

Meeting Points (optional):

- 1) 8:15 Hotel Post, Lobby
- 2) 8:15 Vetmeduni, Main entrance
- 3) 8:15 Research Institute of Wildlife Ecology, Savoyenstraße 1

Ends around noon (12:00 o'clock)



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List of Participants

Abdlatif, Y.M.	Ministry of Animal Resources, Sudan	yousifnama@yahoo.com
Abdelaati, Khadiga Abbas	Faculty of Animal Production, University of Khartoum, Sudan	khadigaatti@yahoo.com
Abdelrahim, Sayied Ahmed	Department of Wilde Life, University of Juba ,Khartoum, Sudan	aymanssw@hotmail.com
Abuagla, Daffalla Abdelrahim Ahmed	Faculty of Animal Production, University of Khartoum, Sudan	abuaagla20@yahoo.com
Abunikhaila, Abdelmoneim Mukhtar	Faculty of Animal Production, University of Khartoum, Sudan	abunikehila@hotmail.com
Abdussamad, Muhammad	Georg-August University, Göttingen, Germany	a.abdussamad@stud.uni-goettingen.de
A Bakhsh, Abdulsalam	College of Veterinary Medicine and Animal Resources, King Faisal University, Saudi Arabia	abakhsh@kfu.edu.sa
Al Busadfah, Khalid Ahmed	College of Veterinary Medicine and Animal Resources, King Faisal University, Saudi Arabia	kbusadah@kfu.edu.sa
Al-Eknah, Marzook Mohammed Saad	College of Veterinary Medicine and Animal Resources, King Faisal University, Saudi Arabia	maleknah@kfu.edu.sa
Al Jassim, Rafat	School of Animal Studies, The Univ. of Queensland, Australia	r.aljassim@uq.edu.au
Al Shami, Salah A.	College of Veterinary Medicine and Animal Resources, King Faisal University, Saudi Arabia	salshami@kfu.edu.sa
Al-Sobayil, Khalid	Gassim University, Saudi Arabia	kasobayil27@hotmail.com
Ahmed, Amira Mohamed Mokhtar	Private sector, Khartoum, Sudan	superfatma2@hotmail.com
Alfattah, Mohammed Abdulaziz M.	Camel Research Centre, King Faisal University, Saudi Arabia	malfattah@yahoo.com
Alkhalifa, Majed Ali H.	Camel Research Centre King Faisal University, Saudi Arabia	mm20mm@hotmail.com
Alsharief, Salaheldin Hussien Mohammed	Africa City of Technology, Khartoum, Sudan	alaubee2006@yahoo.com
Alzuraiq, Fuad Hamed	Ministry of Agriculture, Riyadh, Saudi Arabia	alzuraiq@gmail.com
Arias, Nino	University of Veterinary Medicine Vienna, Austria	nino.arias@vetmeduni.ac.at
Awad, Faisal Nureldin	Food Research Centre, Khartoum, Sudan	faisalnor@yahoo.com
Awwadi, Isam Zaki T.	Department of Animal Wealth Laporatories, Ministry of Agriculture, Amman, Jordan	awadivet@yahoo.com
Aymen, Balla Mustafa Yasin	Faculty of Human Development, University of Juba, Sudan	aymanssw@hotmail.com
Basmaeil, Saeid	Dept. Animal Production, King Saud University, Saudia Arabia	basmaeil@ksu.edu.sa
Becker, Cornelia	Institute for Prehistoric Archaeology, Freie Univ. Berlin, Germany	cobecker@zedat.fu-berlin.de
Bo Rsais, Khalid Abdulaziz	Camel Research Centre, King Faisal University, Saudi Arabia	kab2018@hotmail.com
Bornstein, Set	The National Veterinary Institute, Uppsala, Sweden	set.bornstein@telia.com
Burger, Pamela	Institute of Population Genetics, University of Veterinary Medicine Vienna, Austria	pamela.burger@vetmeduni.ac.at

Charruau, Pauline	Institute of Population Genetics, University of Veterinary Medicine Vienna, Austria	pauline.charruau@vetmeduni.ac.at
Chuluunbaatar, Otgonbayar	Institute for Folk Music Research and Ethnomusicology, University of Music and Performing Arts Vienna, Austria	mongolischdolmetscher@yahoo.de
De Cupere, Bea	Royal Belgian Institute of Natural Sciences	bdecupere@naturalsciences.be
Curci, Antonio	University of Bologna, Ravenna, Italy	antonio.curci@unibo.it
De Verdier, Kerstin	National Veterinary Institute, Sweden	kerstin.de-verdier@sva.se
Dostal, Walter	Institute for Social Anthropology, Austrian Academy of Sciences	via: eva-maria.knoll@oeaw.ac.at
Dulamtseren, Enkhbileg	Wild Camel Protection Foundation, Mongolia	camelproject@gmail.com
El Zubeir, Ibitisam El Yas Mohammed	Department of Dairy Production, University of Khartoum, Sudan	ibtisam_elzubeir@yahoo.com
Eisa, Mohamed Osman M.	Dept. of Animal Production, Omdurman Islamic University, Sudan	moeisa3@gmail.com
Elamin, F.M.	Department of Genetics and Animal Breeding, University of Khartoum, Sudan	felamin2@hotmail.com
Elfaroug, Omer Sid Ahmed	Institute of Chemistry and Biochemistry, University of Veterinary Medicine Vienna, Austria	0945262@students.vetmeduni.ac.at
Elkhair, Nawal M.	Department of Physiology, University of Khartoum, Sudan	nawalelkhair@yahoo.com
Elmaz Orhan	Institute for Oriental Studies, University of Vienna, Austria	orhan.elmaz@univie.ac.at
Elnowrani, Mohammed Khalid Elimam	Faculty of Animal Production, University of Khartoum, Sudan	elnowrani@hotmail.com
Eltigani, Elmahdi Mohamed Farah	Agricultural Sciences; Private Sector, Khartoum, Sudan	tigani2000@hotmail.com
Erlingsson, Signe	Ölands Oasen, Köpingsvik, Sweden	olandsoasen@yahoo.se
Erlingsson, Bengt	Ormöga Kamelranch, Köpingsvik, Sweden	bengt02@hotmail.com
Fadelelseed, Abdelnasir Mohammed A.	Department of Animal Nutrition, University of Khartoum, Sudan	nasir.fadel@gmail.com
Faye, Bernard	CIRAD, France	faye@cirad.fr
Felt, Ulrike	Department of Social Studies of Science, Univ. of Vienna, Austria	ulrike.felt@univie.ac.at
Fischer, Anja	Institute of Cultural and Social Anthropology, Univ. Vienna, Austria	afischer@imuhar.eu
Fragner, Bert	Institute of Iranian Studies, Austrian Academy of Sciences	bert.fragner@oeaw.ac.at
Gassner, Gerda	First Austrian Camel Riding School	gassner@kamelreiten.com
Geigl, Eva-Maria	Institute Jacques Monod CNRS, Univ. Paris Diderot, France	geigl.eva-maria@ijm.univ-paris-diderot.fr
Ghada, Ahmed Ibrahim	Faculty of Animal Production, Upper Nile University, Sudan	igadah@yahoo.com
Gingrich, Andre	Institute for Social Anthropology, Austrian Academy of Sciences	andre.gingrich@oeaw.ac.at
Hager, Eltigani Elmahdi Mohamed	Faculty of Veterinary Medicine / Government of Sudan	hagervet@yahoo.com
Han, Jianlin	CAAS-ILRI Joint Laboratory on Livestock & Forage Genetic Resources, Insti. of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, China	h.jianlin@cgiar.org

Hanotte, Olivier	University of Nottingham, UK	olivier.hanotte@nottingham.ac.uk
Hare, John	Wild Camel Protection Foundation, UK	harecamel@aol.com
Hassan, Nabia Mustafa	The Government of Khartoum, Sudan	azizban1@yahoo.com
Heiss, Johann	Institute for Social Anthropology, Austrian Academy of Sciences	johann.heiss@oeaw.ac.at
Iqbal, Arshad	Department of Livestock Management, University of Agriculture, Faisalabad, Pakistan	aiqbal_uaf@yahoo.com
Juma, Kisa Ngeiywa	Kenya Camel Association; ASAL Based Livestock and Rural Livelihoods Support, Nairobi, Kenya	kisajuma@yahoo.com
Kaczensky, Petra	Research Institute of Wildlife Ecology, University of Veterinary Medicine Vienna, Austria	petra.kaczensky@fiwi.at
Kakar, Raziq	Society of Animal, Veterinary and Environmental Scientists, Quetta, Pakistan	raziq2007@gmail.com
Khalafalla, Abdelmalik	The Arab Center for Studies on Arid Zones & Dry Lands, Syria	abdokhlf@yahoo.com
Knoll, Eva-Maria	Institute for Social Anthropology, Austrian Academy of Sciences	eva-maria.knoll@oeaw.ac.at
Knospe, Clemens	Institute for Veterinary Anatomy, LMU, Munich, Germany	c.knospe@anat.vetmed.uni-muenchen.de
Kohl, Ines	Independent Researcher, Austria	kohlspross@hotmail.com
Konuspayeva, Gaukhar	Al Farabi Kazakh National University, Almaty, Kazakhstan	konuspayevags@hotmail.fr
Lang, Maria-Katharina	Institute for Social Anthropology, Austrian Academy of Sciences	maria-katharina.lang@oeaw.ac.at
Loidl, Verena	Institute for Social Anthropology, Austrian Academy of Sciences	verena.loidl@oeaw.ac.at
Makkawy, Abdelaziz Abdelrahman	Sudan University of Science and Technology, Khartoum, Sudan	azizmakkawy@yahoo.com
Mubarak, Amel Mustafa	Faculty of Agriculture, University of Khartoum, Sudan	amelmu@yahoo.com
Munkh-Erdene, Lkhamsuren	Institute for Social Anthropology, Austrian Academy of Sciences	lkhamsuren.munkh-erdene@oeaw.ac.at
Mutafi, Mahmoud Ibrahim Ahmed	Nomads Development Council, Khartoum, Sudan	mutafi_75@yahoo.com
Mwangi, David Miano	Kenya Agricultural Research Institute	dmmwangi@kari.org
Nafisa, Mohamed Abbkar Yagoub	Dept. of Animal Nutrition, Upper Nile University, Sudan	nafisamohamed72@yahoo.com
Pejov, Katharina	Private Sector, Malmö, Sweden	kpejov@hotmail.com
Procházka, Stephan	Institute of Near Eastern Studies, University of Vienna, Austria	stephan.prochazka@univie.ac.at
Ptak, Roderich	Institute for Sinology, Ludwig-Maximilians Univ. Munich, Germany	ptak@lrz.uni-muenchen.de
Reading, Richard	Denver Zoological Foundation, USA	rreading@denverzoo.org
Ritt-Benmimoun, Veronika	Department of Near Eastern Studies, University of Vienna, Austria	veronica.ritt@univie.ac.at
Saeed, Alia Ahmed Amin	Department of Physiology & Biochemistry, University of Nyala-South Dafur, Sudan	aliasaeed77@hotmail.com
Saif Aldaen, Mohamed	Ministry of Agriculture, Riyadh, Saudi Arabia	drsaiif1000@gmail.com

Saleh, Faisal	Biology School, Nottingham University, UK	faisalvet@hotmail.com
Saleh, Razi	Project of Developing the Steppe, Ministry of Agriculture, Syria	razisaleh@hotmail.com
Schobesberger, Gerhard	Labor Schobesberger, Steyr, Austria	labor-schobesberger@aon.at
Shunnaq, Mohammed	Department of Anthropology, Yarmouk University, Jordan; guest professor Institute of Cultural & Social Anthropology, Univ. Vienna	mshunnaq@hotmail.com
Silbermayr, Katja	Institute of Animal Breeding and Genetics, University of Veterinary Medicine Vienna, Austria	katjasown@gmail.com
Tabbaa, Darem	Faculty of Veterinary Medicine, Al Baath University, Hama, Syria	spana@net.sy
Tosi, Maurizio	Department of Archaeology, University of Bologna, Italy	maurizio.tosi@tiscali.it
Trinks, Alexandra	Institute of Anthropology, Palaeogenetics Group Mainz, Germany	a.trinks@gmx.net
Uerpmann, Hans-Peter	Institute of Pre- and Protohistory and Mediaeval Archaeology, University of Tübingen, Germany	hans-peter.uerpmann@uni-tuebingen.de
Uerpmann, Margarethe	Institute of Pre- and Protohistory and Mediaeval Archaeology, University of Tübingen, Germany	margarethe.uerpmann@uni-tuebingen.de
Ullah Khan, Rifat	Department of Physiology and Pharmacology, University of Agriculture, Faisalabad, Pakistan	rifatullahkhan@gmail.com
Varisco, Daniel Martin	Department of Anthropology, Hofstra University, New York, USA	daniel.m.varisco@hofstra.edu
Walzer, Chris	Research Institute of Wildlife Ecology, University of Veterinary Medicine Vienna, Austria	chris.walzer@fiwi.at
Wang, Jianlin	Institute of Zoology, Lanzhou University, China	jlwang@lzu.edu.cn
Weitensfelder, Daniela	Department of English, University of Vienna, Austria	d.weitensfelder@bhakwien11.at
Wilson, Kelly	Department of the President's Affairs, the Management of Scientific Centres and Presidential Camels, UAE	kjw@live.com.au
Yadamsuren, Adiya	Institute of Biology, Mongolian Academy of Sciences, Ulaanbaatar	ya.adiya@gmail.com
Yahya, Muhammad	Livestock and Dairy Development Department Balochistan, Quetta, Pakistan	yahya_chang@hotmail.com
Yaqoob, Muhammad	Department of Livestock Management, University of Agriculture, Faisalabad, Pakistan	uafilm@yahoo.com
Younan, Mario	Kenya Agricultural Research Institute, Nairobi, Kenya	marioyounan@gmail.com
Younas, Muhammad	Faculty of Animal Husbandry, University of Agriculture, Faisalabad, Pakistan	myounas07@gmail.com
Yuan, Lei	Xinjiang Lop Nur Wild Camel National Nature Reserve, P.R. China	iceyuanlei@126.com
Zayed, Rania Hassan	College of Animal Science and Technology, Sudan University of Science and Technology, Khartoum	raniazaied01@gmail.com
Zein, Mouse Esa Mohamed	Tambool Camel Research Center, Ministry of Animal Resources and Fisheries, Sudan	m_zain1975@yahoo.com