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.RY GENETICS

GEOGRAPHY

PHILOSOPHER:
IFE AND WRITINGS OF
SSEL WALLACE

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ANIMALS AND MAPS

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ardly placed round the world; that a detailed study of these 'symbols' through the centuries might reveal an entirely new facet of the map-maker's art.

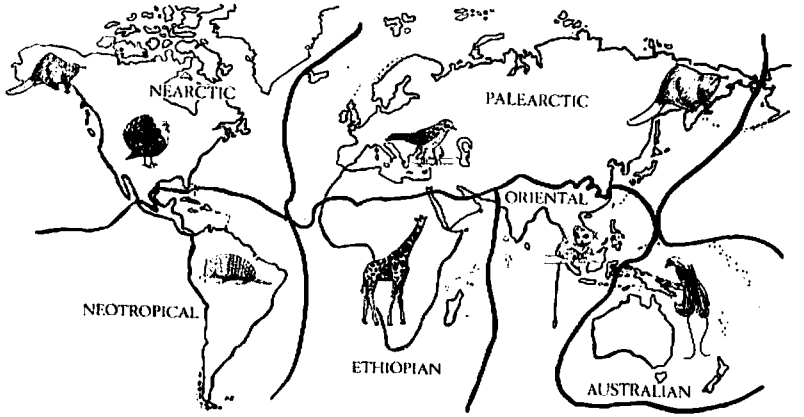
ANIMALS

It is not fortuitous that some animals that occur in the Old World are missing from the New, that some animals are confined to one continent while others have a world wide distribution. Animals have come to occupy their present habitations as a result of their slow evolution and spread in the past. As the animals evolved, so did the outlines of the great land masses of the world. The reciprocal effects of animal evolution and land evolution have led to the characteristic distribution of animals round the world.

On the basis of its animals the world can be divided into six zoogeographical regions which correspond roughly with the main continents (fig 1.1). In the New World, the neotropical region corresponds roughly with South America and the nearctic region with North America. In the Old World, there are two tropical regions, the ethiopian occupying most of Africa and the oriental region stretching from south of the Himalayas to the Malay Archipelago. The Old World temperate zone of Eurasia is known as the palearctic region. Finally, there is the australian region corresponding to the continent of Australia with a few nearby islands.

Each region has animals peculiar to itself and each region has a

Fig 1.1 The zoogeographical regions of the world



characteristic assemblage of the animals not so confined. Thus, there are no elephants in the New World, no opossums in the Old World, no bears in Africa and very few placental mammals in Australia. Instead, there are tapirs, armadillos and humming birds in the neotropical region; turkeys and beavers in the nearctic; beavers and hedgesparrows in the palearctic; ostriches, giraffes and rhinoceroses in the ethiopian; tapirs, rhinos and tarsiers in the oriental; and many families of marsupial mammals as well as egg-laying mammals (monotremes), cassowaries and birds of paradise in the australian region.

The early explorers setting out from Europe, from the Mediterranean basin in the early days, overland to China or across the seas to the New World in later centuries, would come across a fauna and flora whose composition would strike them as different from their own. Not only would they be unable to find some of the commoner mammals and birds with which they were familiar at home but also they would be struck by creatures and by plants they had never seen before nor ever heard of. From early accounts of travels and voyages, it is clear that men were aware of the strangeness of many of the animals they met. Further, they were interested enough to record them, often to describe them in detail and, in some cases, to bring home specimens or parts of specimens, such as the tail feathers of a macaw or a piece of prickly pear.

It is not, therefore, surprising that some of the cartographers, following the journals of expeditions or making their own observations on the spot, should have included as part of the land's features some of its peculiar animals, some of its plants. They were decorative but they were in all probability used diagnostically of the countries they inhabited, just as banners identified knights. If there were no towns to put on the maps, it is arguable that the animals or plants were as reputable an indication of the terrain as a range of hills or a river.

MAPS

Until 1477, when maps based on Ptolemy's *Geographia* were printed, there were only manuscript maps available. Some of these were made for generally instructive or decorative purposes: to hang behind an altar like the world map in Hereford Cathedral (fig 2.3); or to add to a nobleman's room like the Borgia map (fig 2.12). Others were

Fig. 2.4 Two humped camel in the land of Bactria on the Hereford map of the world about 1290 in Hereford Cathedral

Ebstorf map. In the palearctic there are again aurochs, bison, horse, two humped camel, tiger, other large cats, bear and golden eagles. The antdog, saiga and chameleon are absent. Monkey, genet and maneater are depicted for the first time in this region. There are pelicans, cranes and an ostrich in the Hereford palearctic.

The Hereford ethiopian region is characterised by fewer snakes and lizards than were found in the Ebstorf ethiopian region. There is no ostrich (which has migrated into the palearctic), no hyena, camelopardalis, elephant or mirmicaleon, although there are two gold-digging, insect-like formice. Instead, there is a rhinoceros and a monoceros.

Lizards are more prominent than snakes in the Hereford oriental. There are birds of which one may be an Indian hornbill, the so-called two headed bird. The elephant occurs here instead of in the ethiopian region, which is its home on the Ebstorf map. There is a crocodile and a wolf (marginally palearctic). The maneater, manticora, already noticed in the palearctic, is described in the inscription as living in India in spite of its actual siting on the map. And in writing it is referred to India on the Ebstorf map.

The maneater, manticor or martikora, had been described by Ktesias in about 400 BC: 'Its face is like a man's—it is about as big as a lion, and in colour red like cinnabar. It has three rows of teeth—ears like the human—eyes of a pale-blue like the human and a tail

like that of the land scorpion, armed with a sting and more than a cubit long' (McCrindle 1882). This might be any of the large cats which vary considerably in colour and size from place to place or, more probably from the picture of it on the Hereford map, it might be a cheetah *Acinonyx jubatus*. Cheetahs used to be common throughout Asia. They have a rounded head, short ears, the pupil of the eye is round and the tail long. The claw, or sting, on the tip of the tail which has often been described for the large cats, seems to derive either from the distinct curl at the end of the normal tail or from the fact that the terminal vertebrae of the tail are often injured and displaced.

This interpretation is not dissimilar to that given during the second century by Pausanias: 'I am persuaded that it is no other than the tiger.' The preference for identifying it as a cheetah is strengthened by the fact that a tiger is represented next to the manticora on the Hereford map, although tiger was a name given generally to the large cats. The manticora of the map is described in much the same words as Ktesias used, with the additional information that it had a hissing voice. The tiger is described as being a very fast animal.

It would be hard to take exception to the placing of any of these animals all of which are representative of the parts of the world in which they occur with the exception of the deer in the ethiopian region, a monkey which unaccountably sits in Norway and the northerly placing of the ostrich on the Hereford map. It might also be argued that elephants should have equally occurred in the ethiopian region and rhinoceroses in the oriental if they were to be depicted at all but this seems to be too demanding. What is remarkable is that at this time the positioning of the animals chosen for record should be so adequate and based presumably only on the accounts of the classical writers from Herodotus to Pliny, Aelian and Isidore of Seville, but with special attention, often explicit, to the writings of Solinus.

Another thirteenth century map of the same type but now only existing in fragmentary form is the Vercelli map which again has a number of animals depicted on it (Bagrow 1964). There are fewer animals, particularly in the palearctic, which is represented by what might be an aurochs and some sort of large carnivore pursued by a dog. The ethiopian has lions, a camel, a large indeterminate spotted animal, possibly a leopard, a parrot, a falcon and various dragon-lizard animals. In the oriental region there is a domestic elephant, a

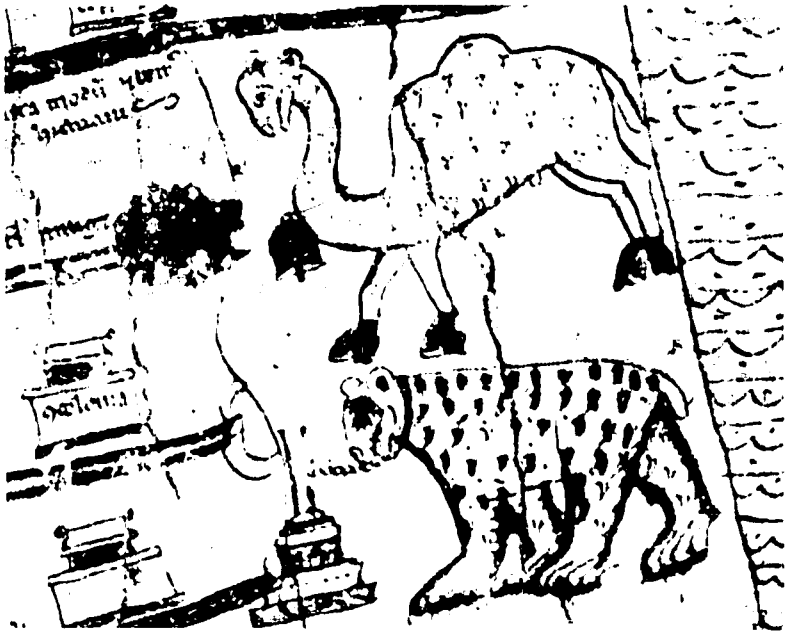


Fig 2.6 One humped camel in Ethiopia on the thirteenth century Vercelli map of the world in the Duomo Vercelli

distinctly cloven hoofs (fig 2.6).

On these early maps, then, lions have been found roaming widespread over the Old World. The palearctic region has already become typified by some cloven hoofed ungulate, a wild ox, a bison or an elk. The ethiopian and oriental regions are correctly depicted with elephants, many birds and reptiles and they are distinguished from one another by the occurrence of the yale only in the oriental region.

Birds and reptiles are, sensibly, particularly abundant in the oriental region. Many, like the basilisks and the dracones in their pictorial representation are difficult to identify with any living animal but are probably to be taken as imaginative pictures based on real but incorrectly observed lizards and snakes. Quick moving reptiles leave only an impression of their shape and colour. According to Pliny, the basilisk 'is a native of the province of Cyrenaica, not more than twelve inches long, and adorned with a bright white marking on the head like a sort of diadem. It routs all snakes with its hiss, and does not move its body forward in manifold coils like the other snakes

but advancing with its middle raised high. It kills bushes not only by its touch but also by its breath . . .' (Rackham 1940). This description has usually been taken to refer to the spitting cobra *Naja* but one of the sidewinding vipers, *Cerastes* perhaps, would be described as moving differently from other snakes even though it neither spits nor kills bushes by its breath. Perhaps this basilisk is a mixture of cobra and viper.

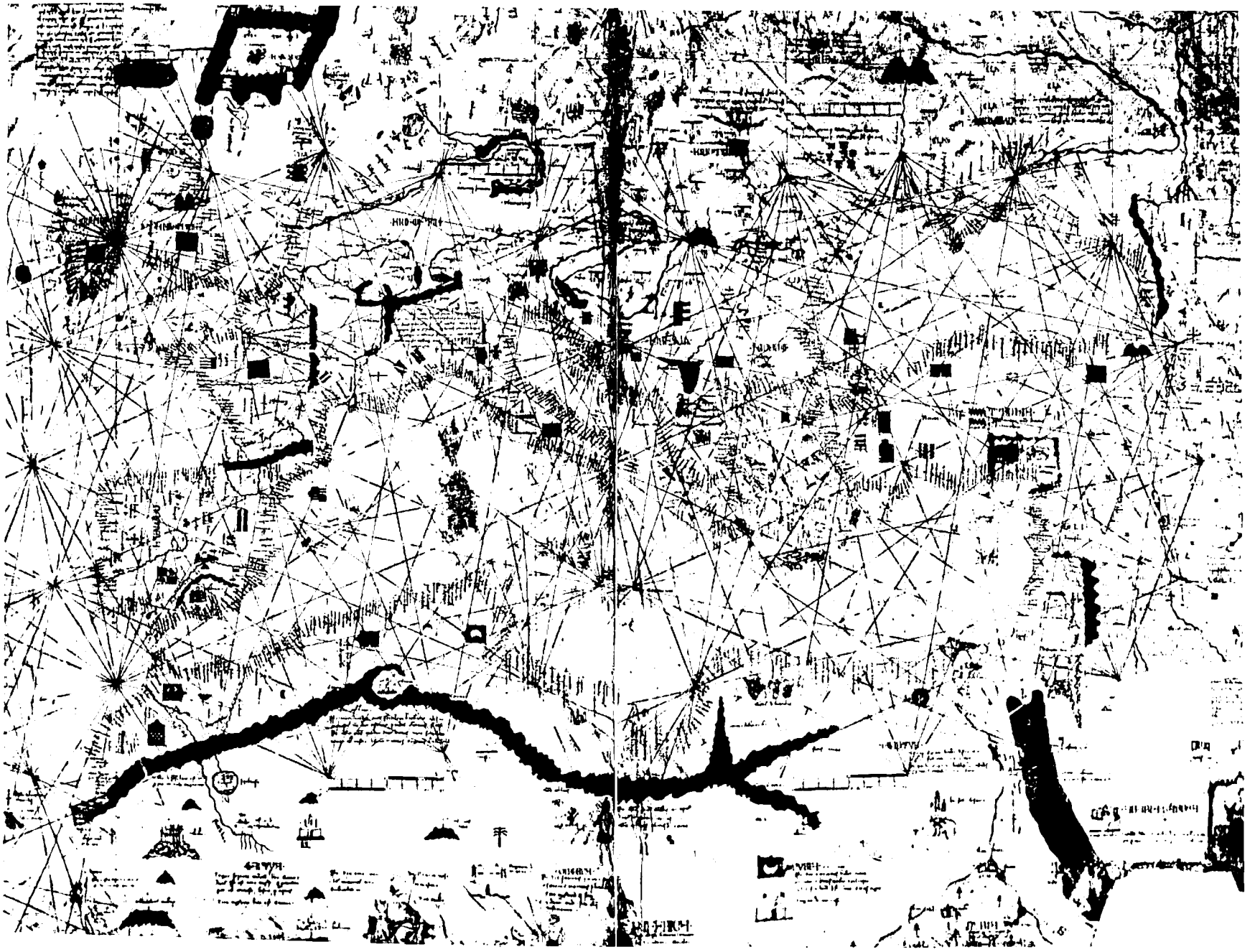
Other basilisks have feathered bodies and snakes' tails and may well represent a bird of prey, the drawing compounded from a bird with a snake in its talons. In fact, a Bodleian twelfth century bestiary (MS 764) announces that basilisks eat snakes and figures the crowned bird which, with variations on the tail, resembles the Ebstorf basilisk and recurs on maps for many centuries. Almost certainly basilisks had come to represent the blackish crowned eagles *Circaëtus* of Eurasia and Africa which live almost exclusively on snakes.

More obvious crocodiles, lizards and snakes also abound in the oriental region on these early maps as well as the flying lizard *Draco*, see p. 38.

FOURTEENTH CENTURY MAPS

By the fourteenth century, practical sailing charts had come into use, in conjunction with the magnetic compass, to replace the written periplus of earlier centuries. Catalan and Italian cartographers were foremost in this field and many of these portolans, particularly the Catalan, were in widespread use. The Catalans, based on Majorca and influenced both by the Arabs and by the usual early literature and by their adventurous contemporaries, produced portolans of wider scope than their Italian counterparts. Italian portolans tend to be restricted to the coastlines of the Mediterranean in contrast to the Catalan portolans which are on the scale of world maps, reaching from Scandinavia to China and including a considerable part of north Africa. These Catalan maps are the main source of zoogeographical information in the fourteenth century and, compared with the Ebstorf and Hereford maps, the information is sparse and they add very little to the cumulative knowledge of animal distribution. Yet, at least some of these mapmakers would have had the benefit of the reports brought home by Marco Polo. He described many animals that he encountered on his travels, even giving an accurate account of a rhinoceros but calling it a unicorn. His rhinoceros is depicted, a bit

Fig 2.7 Three toed ostrich, domestic camel, domestic elephant and a bird of prey in north Africa; falcon in Norway on Dulcert's portolan of 1339 in the Bibliothèque Nationale, Paris



far north but marginally in the oriental region, on the map painted on the wall of the Doge's Palace in Venice.

When animals appear on the fourteenth century portolans, Africa is linked with the camel and the elephant. An ostrich occurs in Africa on the Catalan portolan of Angelo Dulcert in 1339 (Nordenskiöld 1897) and a parrot on the Venetian chart of the Pizigano brothers in 1367 (Jomard 1854). This is not the first occurrence of ostriches for they were represented on the Ebstorf and Hereford maps also though, in spite of its incorrectly drawn three toes, the Dulcert ostrich is a superior representation to either of the two earlier ones (fig 2.7). The Hereford ostrich, however, was correctly two toed, though somewhat northerly in distribution. Falcons make their appearance as representative animals of the palearctic and, on all these maps, only the elephant has wandered too far north, on the Paris Catalan map of Abraham Cresques (Bagrow 1964) and the Venice map of Marco Polo's travels but, since these elephants were domesticated, saddled and driven, their position is understandable.

The Gough map of Great Britain in the Bodleian Library (about 1360) merits notice for the occurrence on it of a wolf in the county of Sutherland with the remark 'hic ha bundant lupi' and, near Loch Ness, a deer 'hic maxima venaccio'.

Although the fourteenth century maps cannot be considered remarkable for increasing knowledge of the fauna of the known world, they are interesting in two other ways. Firstly, while the boundaries of the world were not increasing in any spectacular way on the maps, knowledge of peculiar animals was coming in from many sources, in particular from the accounts of the travels of Marco Polo, so that it was by now far too ambitious a project to attempt to put all the animals of a continent into the space on a map. There may have been vast empty spaces but it is unlikely they would hold all the animals known to exist in them. After the exuberance of the animals on some thirteenth century maps there was already, then, a tendency to restrict the numbers of animals on the maps to a few that were considered typical of the continent: the camel, the elephant and the ostrich, for instance, were becoming symbols of Africa and the falcon a symbol of the European parts of the palearctic.

Secondly, there had been a noticeable improvement in the accuracy of representation of some of the animals, an accuracy greater than many contemporary bestiary illustrations. The Catalan one humped

camel of Abraham Cresques and those of Dulcert are cloven hoofed with an indication of the pad-like quality of the feet and given an excellent impressionist rendering of a camel (fig 2.7). All these camels are domestic animals, either shown in company of men or shown saddled and bridled. The elephants, too, are more carefully drawn than those of the previous century, though they still show considerable variation in the number of toes and the position of their ears. Dulcert's African elephant has large feet with four toes, large ears and long tusks. The tusks of the elephants curl upwards, extravagantly, but the general impression is that they are curling in this unlikely manner correctly from the upper jaw (fig 2.7). There was a good deal of disagreement over the provenance of these valuable teeth possibly because of the somewhat ambiguous guidance given by Oppian about AD 212. 'For such growths from the upper jaws of wild beasts as are horny, spring upward: if they incline downward they are certainly teeth . . . Of these two horns of the Elephant the roots first of all spring from the head, mighty as the head is mighty, even as the roots of the oak; then below, concealed by the skin where they meet the temples, they project into the jaw; and when left bare by the jaws they give to the vulgar the false impression of teeth' (Mair 1958).

As late as 1491, an elephant is drawn in a book of natural history *Ortus Sanitatis* by J. von Cube with the tusks representing lower jaw teeth and Cadomosto reported that 'these elephants have two large teeth at each side of their mouths that is, one on each side like the wild boar, but set in the lower jaw. There is no difference save that the points of the teeth of the boar are turned upwards, while those of the elephant are turned downwards towards the ground' (Crone 1937). However, other explorers described the opposite: 'the two great teeth or tuskes, are placed in the highest jawe' (Lewes Vertomanus 1503, Eden 1555). But this interesting fact had to be rediscovered by John Lok in 1555 (Hakluyt 1598) and was forgotten again twenty years later in Münster and Belle Forest's *La cosmographie universelle de tout le monde*. One way and another, there was considerable doubt and controversy over this simple anatomical fact. Interesting, in so far as the elephant had been a well known domestic and show animal, particularly during the Roman Empire. It is represented accurately on many Roman decorative objects, such as medals and in statuary. But it lost its domestic use in Europe during the Middle

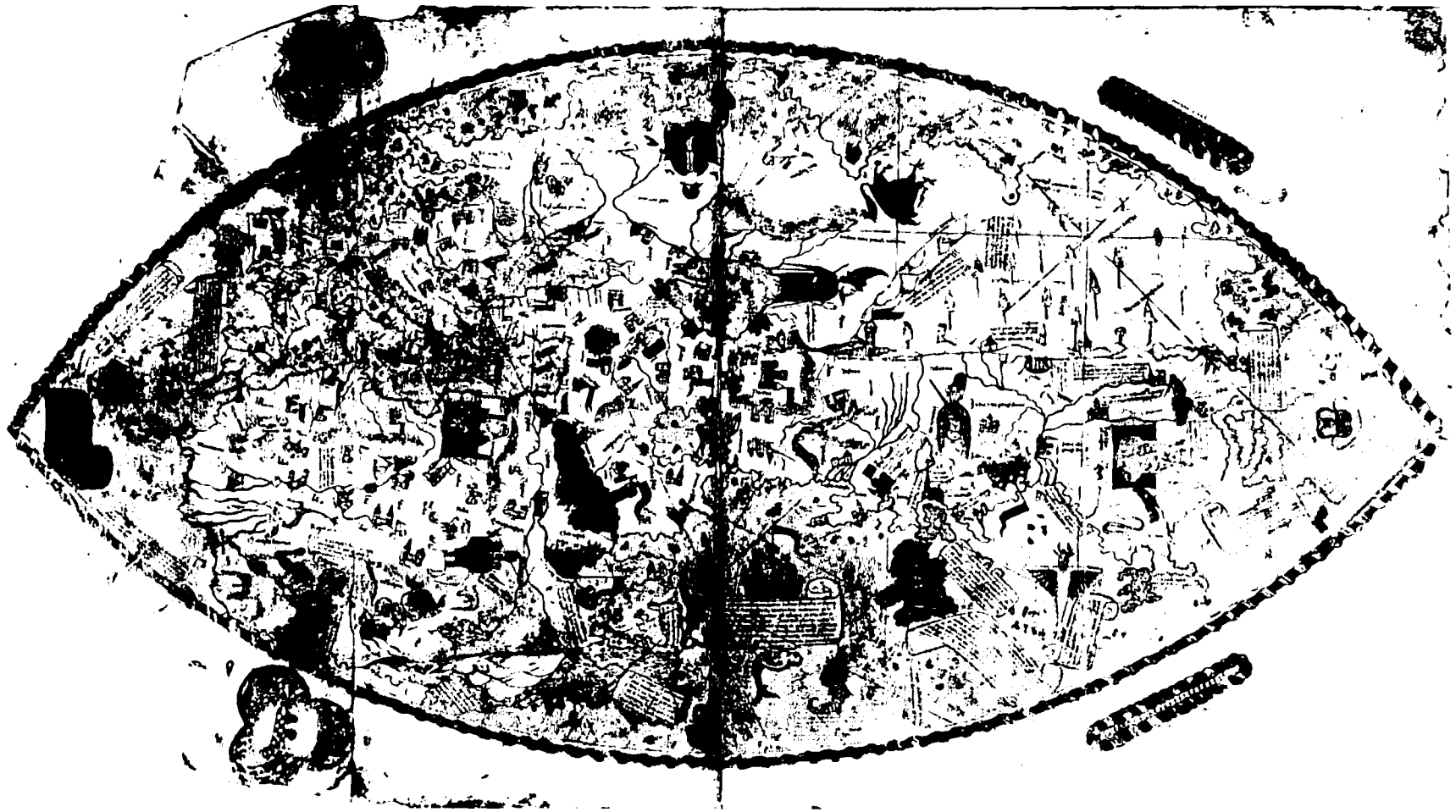
Ages, and there were few specimens to be seen from then until the sixteenth century. Its anatomy had to be continually rediscovered and yet it lived on through the maps and bestiaries of the Middle Ages as an animal representative of either Africa or India or both.

FIFTEENTH CENTURY MAPS

The main advances in the knowledge of the world during the fifteenth century as depicted in the maps of the period was an increase in accuracy of the lands bordering the Mediterranean and an extension

of the coasts of Africa and the East Indies. Voyages southwards along the coasts of Africa were gradually increasing in length and, by the middle of the century, the more southerly part of Africa was known not to turn eastwards but to continue south, although the Cape was not rounded until 1487 and a fairly modern representation

Fig 2.8 The Genoese world map of 1457 in the Biblioteca Nazionale, Florence: elephant, camel, lion, monkeys, giraffe, dragon and crocodile in the ethiopian region; griffon or black vulture, leopard, ox and polar bear in the palearctic region; snake and storks in the oriental region



of Africa does not appear on maps until towards the end of the century (Henricus Martellus about 1490 in Bagrow 1964, for example). Advances towards the spice islands of the East Indies and southern China had also been made by the middle of the century. The Venetian, Nicolo de Conti, in 1444, had reported the existence of Ceylon and Sumatra again (Penzer 1937) and these islands were drawn into the mid-century map of Fra Mauro (Bagrow 1964). The accuracy of the coastline of India itself was improving and, to the east, there had been an extension to islands which may represent the Moluccas.

The introduction of Ptolemy's *Geographia* to western Europe in manuscript form in 1406, the technological improvement in navigation instruments and improvements in the ships themselves all contributed to the profound advances in geographical knowledge during the fifteenth century. By the end of the century, the development of printing presses extended the availability of maps. The *Geographia* was printed, with maps, in 1477. From the end of the century dates the earliest known globe to have survived, that of Martin Behaim made in 1492 (Ravenstein 1908).

The extension of knowledge of the coastline of Africa was not paralleled by any marked increase in zoological knowledge. On world maps of the century the ethiopian region is still mainly symbolised by the camels and elephants of the previous century although they were by now becoming less exclusively domesticated representatives of their species and being more accurately drawn. The most striking advance, however, was the depiction of a recognisable giraffe (fig 2.8) on the Genoese world map of 1457 (Bagrow 1964).

This was the first time an accurate giraffe had represented Africa although camelopardalis had appeared much earlier in the ethiopian region of the Ebstorf map (fig 2.2). Camelopardalis, however, was only a giraffe by name, being a four clawed spotted animal with a normally short neck.

But although a map had to wait for a well proportioned giraffe until 1457, giraffes had been known accurately and depicted accurately as representatives of the land of the Nile at least as far back as the third century BC. Beautiful illustrations of these and many other African animals, lions, onagra, monkeys, a rhinoceros and a hippo are depicted on the Barberini mosaic *L'Inondazione del Nilo* preserved in Italy at Palestrina (fig 2.9). These animals were more accurate than any that occurred on maps before the sixteenth and seventeenth

centuries. Strabo had described the camelopards: '. . . though they are in no respect like leopards, for the dappled marking of their skin is more like that of a fawnskin, which latter is flecked with spots, and their hinder parts are so much lower than their front parts that they appear to be seated on their tail-parts, which have the height of an ox, although their forelegs are no shorter than those of camels . . .' To which Pliny could add 'feet and legs like an ox, and a head like a camel'. And many years later, in about 1362, Mandeville commented: 'and he may well enough stand on the earth and look over a high house' (Letts 1953).

The ethiopian region continues to be represented by large carnivores: lions range through the Africa of several of the later world maps and, on the Behaim globe of 1492, a mongoose is shown in west Africa attacking a snake. Crocodiles and monkeys inhabit Ethiopia and, on a fifteenth century portolan fragment in the Biblioteca Estense in Modena occurs, in company with a crocodile and a lion, a cumbersome animal in shape like the later portrayal of rhinoceroses but with nothing more than two lumps on the head (fig 2.10). This rhinoceros is very different from the slender animal of the Hereford map and the bestiaries but bears some resemblance

Fig. 2.9 Part of the mosaic *L'Inondazione del Nilo*, third century BC, Palestrina

to the much earlier rhinos of the Italian mosaics. Like its predecessors it has claws on its heavy feet.

Of the birds, the ostrich seems to have been growing in importance as an African type, becoming two toed once more and becoming more splendidly aggressive and ostrich-like in, for instance, he 1497 *Carta Nautica* of Jehuda ben Zara (fig 2.11). Snakes and dragons are frequent at this time.

In the palearctic the animal assemblage is different. It continues the tradition of the earlier maps and adds to it. Boar, wolf and lion inhabit the far north of Mecia de Viladestes' Catalan chart of about 1413 (Marcel 1896). Foxes and bears occur in the 1492 Behaim globe palearctic and, in 1457 on the Genoese world map, there is a white carnivore in the northern regions which could represent, though not with noticeable accuracy, either an arctic fox or a polar bear. At about the same time, the decorative Borgia map of the world, engraved on

Fig 2.10 Lion, crocodile and probably a rhinoceros in Africa on an anonymous fifteenth century portolan fragment in the Biblioteca Estense, Modena

metal some time between 1410 and 1458, portrays a definite polar bear emerging from an igloo in Norway.

Falcons continue to represent the palearctic and, in particular, the northern ungulates continue often in association with falconry. A deer occurs in Norway and a domesticated reindeer or stag takes part in falconry further east in 1413. A reindeer again helps to represent the palearctic region on the Florence Catalan map of 1439 (Cortesão 1954). An elk and similarly domesticated reindeer occur on the Borgia map, oxen draw a cart on the Genoese map, horses and a reindeer are domesticated on the Modena Catalan world map of 1450 (Bagrow 1964).

Africa and the palearctic are given the most animals. The expanding areas of the east are left mainly empty, in contrast to the earlier efforts to colonise it with birds, serpents, unicorns, dragons, elephants and cloven hoofed ungulates. Only two maps of the fifteenth century contribute animals to the oriental region, the Genoese world map which permits a snake to inhabit the area and the Borgia map which, in its formalised exuberance resembling the twelfth century maps, populates the oriental region with camels, jackals or hyenas, an elephant, a panther, lion, dragon and, marginally in the region, some reptile.

Again the most striking feature of these maps is the rarity with which errors in placing of the animals occurs. But it should also be recognised that, apart from remarkably improved accuracy of drawing by the end of the century (particularly the Jehuda ben Zara and Ancona portolans, de Santarem 1849), the Hereford and Ebstorf maps are much fuller as essays in zoogeographical mapmaking. Camelopardalis of the Ebstorf map may have looked less like a giraffe than that of the Genoese world map but it did record one of the most typical animals of the ethiopian region by name and an animal which, like the ostrich, is confined to the region. Already, by the sixth century, Cosmos was aware that giraffes were typically ethiopian animals and could report that 'the cameleopard is found only in Ethiopia. These also are wild beasts and have not been domesticated. But in the palace (at Axum in Abyssinia) they have one or two which they have tamed by the king's command by catching them when young, in order to keep them for show' (Yule and Cordier 1915).

Other typical ethiopian animals such as hippos had been described from the Nile by Herodotus: 'the animal has four legs, cloven hoofs

wards, some forty million years, accounts for the horses, hyraxes, jerboas and dormice which the two regions share.

Because the climate is temperate, many typical Old World forms which were once widespread no longer occur in the palearctic, thus differentiating it from the tropical ethiopian and oriental regions. Elephants, rhinoceroses and monkeys, which once ranged over the area, became extinct in the north during the ice ages of the last million years.

Only one family of mammals found in the palearctic has an anomalous distribution, the camel family. The camel family occurs here and in the neotropical but not in the nearctic which lies between. The explanation for this discontinuity lies in the past. The camel family originated in the nearctic in eocene days, sixty million years ago (fig 5.9), spread to the palearctic and neotropical in the pliocene, fifty million years later, when there were continental highways available and then, for some reason, died out in its country of origin, leaving camels in the palearctic and guanacos and their relatives in the neotropical.

THE ACHIEVEMENT OF THE MAPS

On the maps, of the twenty eight land mammal families inhabiting the palearctic, twelve of them are represented, forty three per cent, a smaller total than for the New World regions.

Neither of the two unique families is represented but one of the four shared with the nearctic (the beaver family), one of the four shared ethiopian families (the horses) and the only shared neotropical family (the camels), all occur on the maps. Of the remaining nine families, the most obvious and abundant occur most frequently on the maps: the deer, the bears, the goats and foxes.

Less startling than the New World because, perhaps, taken for granted, the palearctic maps, nevertheless, show nearly half the typical mammalian fauna of the region.

VI

Oriental Region

The oriental region is a comparatively small land area occupying southern Asia. Its southern and western boundaries are clearly defined by the Indian Ocean, its most easterly by the Pacific. It is bounded by the Himalayas in the north from where the foothills run to the Arabian Sea in the west and to the East China Sea in the far east. It includes the Malay peninsula, the Philippines and the large islands of Borneo, Sumatra and Java. Its south-eastern boundary lies among the islands of the Malay Archipelago, where it meets the north-westerly edge of the australian region.

THE FAUNA

Characteristically, the oriental region has an Old World tropical fauna, resembling the ethiopian region in its tropical elements and the palearctic region in its more temperate elements. Thus, its fauna is characterised by the elephants, rhinoceroses, Old World monkeys, lorises, pangolins, chameleons and hornbills which it shares with Africa and by the pheasants which it shares mainly with the palearctic. With its wide variety of reptiles, greater than in any other region, it has an abundance of deer, absent from Africa, parrots and bovids.

Only four mammal families are confined to the area and, of these, two are primates, the tupaiid tree shrews and the tarsiers. The colugo, or so-called flying lemur, forms a third family and the spiny dormice the fourth.

Among the reptiles the gavials, slender nosed fish eating crocodiles, are found nowhere else.

In addition to the unique families and a mixture of Old World tropical and temperate families there are many representatives of widespread families such as bears, cats, squirrels, rats, pigs, snakes, lizards and tree frogs. And the oriental region shares one mammalian family, the tapirs, with the far away neotropical region.

Discontinuously distributed, the tapirs are represented by three species: two in the neotropical region and one in Malaya. The oriental tapir, although resembling the neotropical forms so closely that it is united with them under the same generic name, is strikingly different in its vivid black and white body colour. Once, tapirs occupied the northern lands, presumably covering a wide area from Malaya to Europe and to the New World (Radinsky 1965) but, with the advent of the cold northern conditions of the pleistocene ice ages, they died out from the north, maintaining colonies only in the neotropical and oriental regions.

EARLY RECORDS OF THE FAUNA

A considerable amount of the fauna of the oriental region had been known since the earliest times, when traders visited India from the west.

Marco Polo described the fauna of south-west India at the end of the thirteenth century. 'There are in this country many and divers beasts quite different from those of other parts of the world. Thus there are lions black all over [black leopards or panthers], with no mixture of any other colour; and there are parrots of many sorts, for some are white as snow with red beak and feet, and some are red and some blue, forming the most charming sight in the world; there are green ones too. There are also some parrots of exceeding small size [parakeets], beautiful creatures. They have also very beautiful peacocks, larger than ours and different; and they have cocks and hens quite different from ours and what more shall I say? In short, everything they have is different from ours, and finer and better. Neither is their fruit like ours, nor their beasts, nor their birds, and this difference all comes of the excessive heat. . . . There are also gatpauls [monkeys] in wonderful diversity, with bears, lions, leopards in abundance' (Yule & Cordier 1903). In addition, Marco Polo described elephants and rhinoceroses from the Malayan islands.

Marco Polo stressed the differences between the oriental and the palearctic regions. Others had noticed similarities between the oriental and ethiopian regions. Herodotus had reported that elephants and crocodiles were shared by these two regions and, to these, Strabo had added monkeys, tigers and antdogs. Pliny described chameleons coming from the two regions.

The cartographers have not lavished animals on their oriental regions to the same extent as the other regions: on the T-O maps, the oriental region of the Hereford (fig 2.3), Ebstorf (fig. 9.1) and Vercelli maps contains birds, elephants, a crocodile, unicorn, rhinoceros, yale, a large bovid, lizards, snakes and a parrot; animal inhabitants based on a meagre interpretation of the older naturalists. The maps based on Marco Polo's discoveries show even less interest in the oriental fauna. There are no animals on Fra Mauro's map of the world in 1459 (Bagrow 1964) and the Catalan atlases of the late fourteenth and early fifteenth centuries are mainly concerned with camel, horse or elephant caravans to China or Africa.

In spite of the increasing knowledge of the fauna of the oriental region, it did not seem to attract the cartographers in the same way that other regions had done. By far the most popular representative animals of the oriental region continued to be elephants. This is, perhaps, hardly surprising, since they were well known both as wild animals and, more particularly, as beasts of burden. One of the most spectacular of modern mammals, occurring in only the ethiopian and oriental regions, the elephant represents both these regions abundantly, through the centuries. All early travellers reported large numbers of elephants wherever they touched on the shores of India and Ceylon.

ELEPHANTS

For the most part, very little effort was made to differentiate between the smaller tusked and smaller eared Indian elephant *Elephas* and the altogether larger African elephant *Loxodonta*. Maggiolo drew different elephants in the ethiopian and oriental regions of a 1516 world map which is in the Huntington Library of San Marino, California. Although, on the map, the Indian elephant is larger than the African, their general outlines give a good impression of the difference in shape of the two genera. Furthermore, the ears of the African elephant are fluted and relatively larger than those of the Indian which have a smoother outline. African elephants do, sometimes, frill out their ears when approached and the fluted ears are familiar on early wood

cuts of what are mainly African elephants, that of Crescenzi about 1360, for example. Desceliers made a distinction between the two, on both his 1546 and 1550 maps of the world: on both, the African elephants are shown with larger ears than most of those in the Indian region. And, during the century, a map of Ortelius, *Carta dell' Asia* (Almagià 1948), represents the African elephant as generally bigger and taller than the elephant that depicts the oriental region. For the rest, no distinction was made between the two genera and both were shown, frequently, as domesticated animals: though it seems that the Indian elephant was the more usually domesticated of the two, the African elephant having the unjustified reputation of bad temper and waywardness.

That the mapmakers rarely recognised the difference between *Loxodonta* and *Elephas* is hardly surprising when the writings of the naturalists are considered. Strabo maintained that the two were different but mistakenly chose the Indian elephant for the bigger, suggesting that, because the rivers and rains of India were more nourishing than those of Africa, all the animals of India were larger than those of Africa or European Mediterranean lands: 'Ethiopia produces elephants that rival those of India.' Pliny agreed that the Indian elephant was the bigger: 'Elephants are produced by Africa beyond the deserts of Sidra and by the country of the Moors; also by the land of Ethiopia and the cave-dwellers, as has been said, but the biggest ones by India.' Solinus added: 'There are two kinds of them: the nobler sort are known by their greatness, the lesser sort are called bastards.'

Cosmos, writing about AD 545, understood clearly the difference between the two genera: 'The Indian elephants are not furnished with great tusks. . . . The Ethiopians do not understand the art of taming elephants . . . and they are of the kind that have great tusks' (Yule & Cordier 1915). Yet, as late as 1658, in *The History of Four-footed Beasts, Serpents and Insects*, Topsell wrote that it had been said, that the African elephant was greater than the Indian but that he himself did not believe it. It was not until 1799, that Cuvier finally set the two genera apart.

Camels and lions were the next most popular animals of the cartographers: the camels, being mainly domestic, single humped, artificial representatives of the region; the lions, tending towards the heraldic, in many cases. Although not generally associated with India, lions

do occur there. But the seemingly more typical tiger is not depicted, although on at least two occasions a distinctive cheetah is found (Le Testu 1555 and van Keulen 1660).

RHINOCEROSES

Fourth in popularity, as faunally characteristic of the region, are the rhinoceroses. Like the elephants, the rhinos are, today restricted in their range to the ethiopian and oriental zoogeographical regions and, only rarely, do they stray on the maps. Unlike the two genera of elephants; the rhinoceroses can be divided into four, two to each region (Simpson 1945).

In Africa, both rhinoceroses, the black rhino *Diceros* and *Ceratotherium* the so-called white rhino (Dutch *weit*, wide: referring to the mouth), have two nasal horns. In the oriental region, the hairy eared Sumatran rhinoceros *Dicerorhinus* has two horns, the distal one being long and the proximal one a small knob; but the great Indian rhinoceros *Rhinoceros* is single horned.

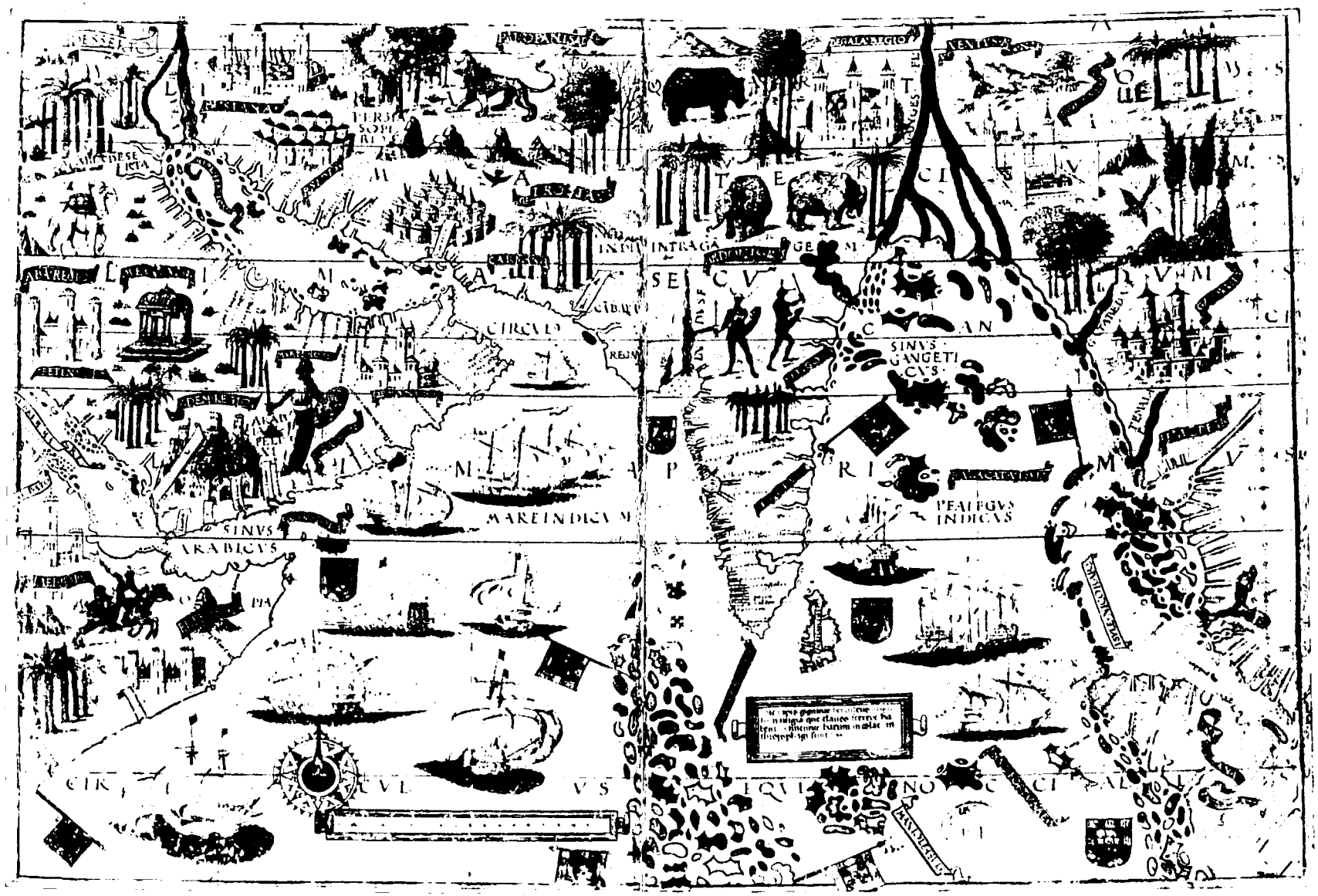
Rhinoceroses had been reported, from both India and Africa, since the early days of faunal records. Aristotle referred to a single horned animal from India and Strabo reported a rhinoceros from Africa.

If Pliny is to be believed, it was Indian rhinoceroses that were brought to Rome for the games. 'At the same games there was also a rhinoceros with one horn on the nose such as has often been seen.' The truth of Pliny's observation is supported by Solinus, who comments that the Romans had not seen an African rhinoceros.

The early mapmakers seem to have relied mainly on Aristotle, portraying the rhinoceros with a single long nasal or forehead horn and the light build of an 'Indian ass' (fig 2.3).

By the end of the thirteenth century, Marco Polo had reported: 'They have hair like that of a buffalo, feet like those of an elephant, and a horn in the middle of the forehead, which is black and very thick. They do no mischief, however, with the horn, but with the tongue alone, for this is covered all over with long and strong prickles. The head resembles that of a wild boar, and they carry it ever bent towards the ground. . . .' In 1516 (Kammerer 1935) and again in 1519, the Homem-Reinel maps figured a good one horned Indian rhinoceros in Bengal conforming to Marco Polo's description except that the horn was drawn more correctly near the tip of the

Fig 6.1 From the Homem-Reinel Miller Atlas 1519 in the Bibliothèque Nationale, Paris: lion, one horned rhinoceros, elephants and birds in the oriental region



snout (fig 6.1).

By the end of the century, what was to become the standard rhinoceros for years had crept on to the maps: a heavily armour plated Indian rhinoceros with, in addition to its nasal horn, a small forward pointing horn on its shoulders.

This copy of the famous Dürer woodcut of 1515, which had been incorporated as an illustration in Gesner's *Historiae Animalium* in 1551, became standard in the oriental region, in spite of the fact that many of the maps themselves had been constructed from the descriptions of Enciso, who had also described the fauna of the countries extensively in his *Suma de Geographia* 1518, giving an accurate account of an Indian rhinoceros: 'and ther be bestes called Rhynocerotes which be as elephants and almost of their colour, thei be as bygg as a bull and is of making like a hogge saving he hathe his nose croked like a horn and is very hard, wherewith he fighteth with other beastes' (Taylor 1931).

Almost a Dürer rhinoceros occupies southern China in Lin-

Fig 6.2 South China from Linschoten's *Itinerario* 1595: rhinoceros, elephant and possible giraffes

schoten's map of south-east Asia in *Itinerario* 1595 (fig 6.2). Three years later, the rhinoceros has lost the forwardly directed shoulder horn, a small backwardly directed spine of armour being all that remains of this anomaly but, meanwhile, it has become less carefully drawn (fig 6.3). Description, again, was better than draughtsmanship. Linschoten himself had described the animal in 1583. 'They are lesse and lower than the Elephant. It hath a short horne upon the nose, in the hinder part somewhat bigge, and toward the end sharper, of a browne blewe, and whitish colour; it hath a snout like a Hog, and the skin of the upper part of his body is all wrinkled, as if it were armed with shields or Targets' (Purchas 1625).

However, a moderately well drawn Dürer rhinoceros dominates again for the seventeenth century, occurring in the oriental region of several of Blaeu's and de Wit's maps: de Wit's world map of 1660, for example (Wieder 1925).

The representation of what appears to be the hairy eared rhinoceros of the far east in Aldrovandi's *De Quadrupedibus Solidipedibus* of 1616 never appears on maps of the oriental region.

ANTEATING MAMMALS

The 1546 map of Desceliers is particularly interesting in its oriental region, as it depicts what is almost certainly a pangolin, for the first and only time in this region (Jomard 1854). Pangolins are the scaly

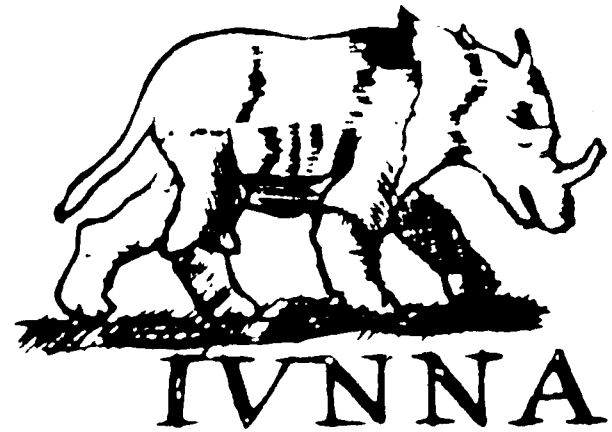


Fig 6.3 Rhinoceros from 1598 edition of Linschoten's *Itinerario*

their greatest diversity in Eurasia, being represented both by a large number of species as well as by large numbers of individuals, so that it seems possible that this bird is intended to represent a crane. It is partly red and, on the map, it is a red bird. Egrets are common birds in many other parts of the world and, therefore, seem unlikely to have been picked out specially for the oriental region. The alternative interpretation would be a peacock *Pavo cristatus*. Peacocks had been known from India and associated with the oriental region from earliest times. 'The king of Egypt was presented with a Peacock from India, the largest and most magnificent of its kind,' suggesting that Aelian considered it a particularly oriental bird, an assumption that persisted until 1937, when a peacock was discovered in the Congo (Gilliard 1953). The absence of the spectacular train of the male peacock, on the maps, could be because only the male possesses it and, then, only in the breeding season, while both sexes are crested all the year round. It is interesting that, in the thirteenth century *De Arte Venandi cum Avibus* of Frederick II (Wood & Fyfe 1943), of all the birds figured, only the peacock has a crest and its crest is like a crown like the crests on the maps. In the early bestiaries only the peacock, heron, hoopoe and sometimes the phoenix are crested.

Apart from these animals, the only noteworthy portrayals on the maps are jungle fowl, of which a fine example appears on Gutiérrez' 1551 world map (fig 6.4); a number of pheasants, typical oriental birds; a bird on the Ulpius globe 1542 (fig 6.6), which bears a close resemblance to the black ibis *Pseudibis papillosa* of Gesner 1551; and the hornbill that flies over the Old World of Le Testu's 1566 map of the world in company with pheasant and bird of paradise (fig 9.3).

OMISSIONS

The monkeys, langurs and apes are, surprisingly, not represented, although many would consider them outstanding members of the fauna.

Less surprising is the absence of the black and white Malay tapir whose New World counterpart eventually reached maps of South America. The oriental tapir is a rare animal and is confined to the deep forests of Burma, Malaya and Sumatra where its bold contrasting pattern, though striking in captivity, would tend to make it nearly invisible. It was not discovered and brought out of the forest alive until 1805 and the first written description appeared in 1816 (Raffles 1821).

None of the unique oriental families occur on maps: tree shrews, tarsiers, flying lemurs, spiny dormice or gavial crocodiles, for instance.

But omissions are, as usual, greater than errors.

UNICORNS

The most constant error of the oriental region is the unicorn (fig 6.5). Interestingly, in those drawings whose details can be observed, the unicorn is, distinctly, a cloven hoofed animal, not the single hoofed horse that it eventually became in English heraldry. It is unlikely that the unicorn is a confusion of early reporters' tales of rhinoceroses because, from early times, a distinction was made between the rhinoceros with a horn on its nose and the monoceros which, according to Pliny, had cloven hoofs and was an antelope. He added that, unlike many horned animals, the female unicorn was also horned. Solinus gave it the body of a horse. Isidore of Seville (Megenburg 1481) described the unicorn as a small animal, a description hardly applicable to most rhinoceroses; further, he made a distinction between the rhinoceros and the monoceros, as all previous writers had done.

It seems clear that the unicorn was one of the straight horned, cloven hoofed ungulates. Cloven hoofed ungulates lie down typically by first bending the forelegs to a kneeling position, thus conforming to the pictures of the unicorn kneeling to put its head in the lap of a virgin. Horse-like ungulates, including the rhinoceroses, first bend the hind legs, into a sitting position, before lying.

The most obviously straight horned of the Asian cloven hoofed ungulates are the horse-antelopes, the gazelles and the goat-gazelles. The horse-antelopes have very long horns and, as their name implies, a heavier more horse-like build and tail than most other antelopes, thus conforming to the descriptions of both Pliny and Solinus. The oryx and the addax are horse-antelopes.

According to Aldrovandi, in 1612, the unicorn is called oryx although, in a detailed and accurate description of the oryx in 212, Oppian had clearly written of two horns (Mair 1958).

Seen in profile, however, an oryx might easily be thought to have only one horn; or an oryx might lose a horn and become a unicorn (Cuvier 1817, Shepard 1930).

From earlier civilisations, many examples can be found of horned animals represented with only one horn. Sometimes, this was paralleled by the depiction of only one fore leg and one hind leg, as in the

Aurignacian drawings, of approximately thirty thousand years ago, at Pairnon-Pair in France and those of the Bovidians of the Sahara, of some six thousand years ago (Lhote 1959). At other times, there were four legs but only one horn, as on Greek vases and as may be seen in the reproduction on modern Greek match boxes. The weak point in this argument, from the point of view of the oriental region, is that the ideal unicorn, the oryx, is primarily an African animal (with one species occurring in Arabia and, perhaps until recently, more northerly deserts) although it is known that both the addax and oryx were domesticated by the Egyptians (Zeuner 1963) and might, therefore, have been taken from Africa to India or China. Unicorns are often described in captivity: by Lewes Vertomanus in 1503 (Eden 1555), for example.

Failing the oryx, there is a wide variety of gazelles and goat-gazelles *Procapra* that range over Eurasia and could provide unicorn prototypes. *Pantholops hodgsonii* the chiru of Tibet is a rare straight horned goat to which many legends have become attached. Timotheos mentions an oryx of the Hydaspes which has been identified as the chiru by Keller (1909). Blundeville 1594, not the most reliable

Fig 6.5 Unicorns in India from Linschoten's *Itinerario* 1596

of naturalists, maintained that there were at least two sorts of unicorn, one of which inhabited Africa and the other India. The African form had cloven feet, a mane and a long horn, the Indian form was called the Indian Asse. Thus, the Indian unicorn corresponded to the 'wild asses' of Ktesias: 'as large as horses, some being even larger. Their head is of a dark red colour, their eyes blue, and the rest of their body white. They have a horn in their forehead, a cubit in length' (McCrindle 1882).

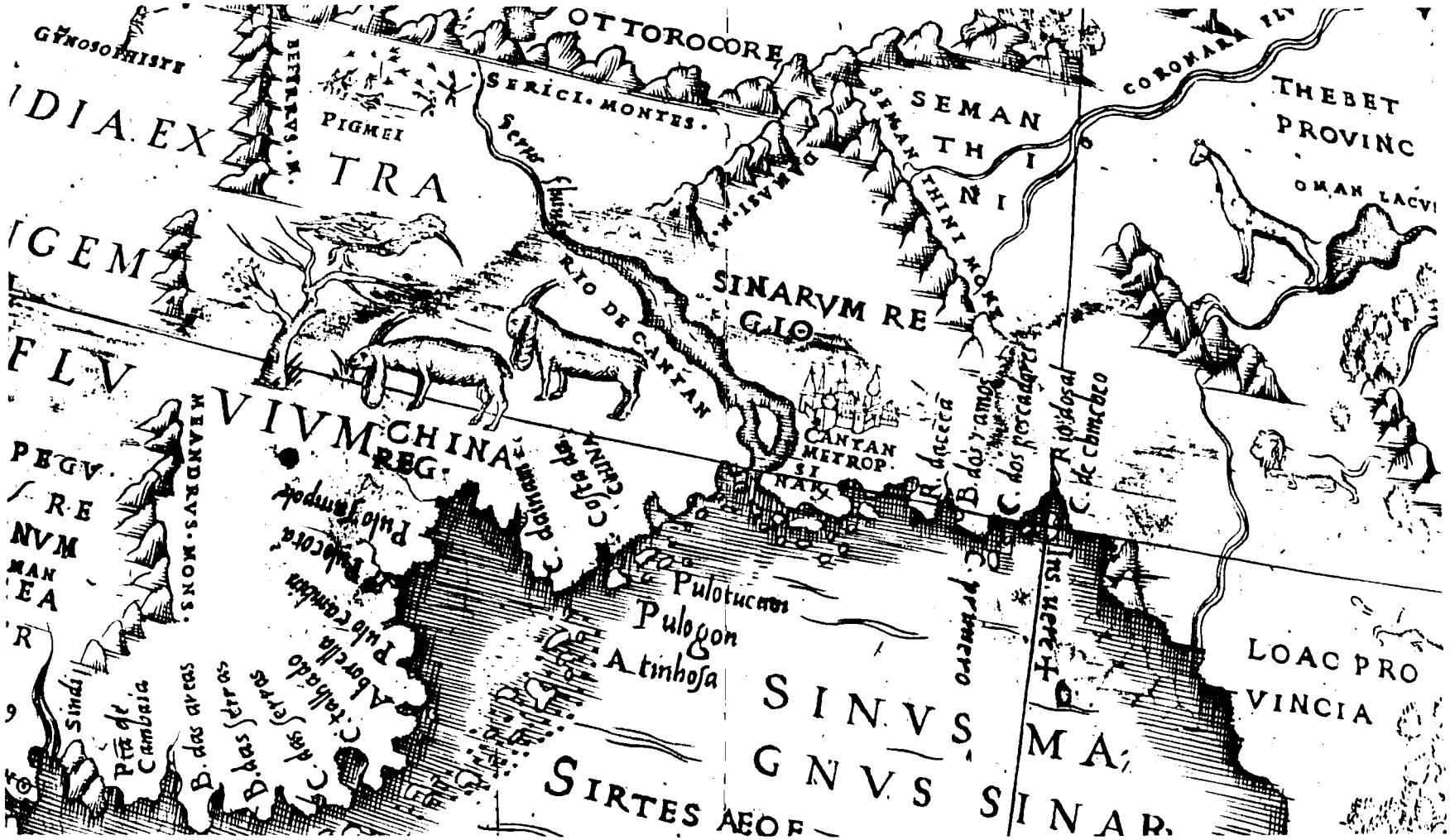
Perhaps the confusion, between the rhinoceros and the monoceros, or unicorn, stems from Aristotle's observation that cloven hoofed animals never have a single horn and, for this reason, his reference to the Indian rhinoceros as an Indian ass. Even so, the confusion was not universal because some, like Pliny, continued to distinguish between the unicorn and rhinoceros. Justel 1674 reports an anonymous Portuguese explorer writing: 'It is not to be confused with a rhinoceros because the rhinoceros has two horns a bit arched. The unicorn is as big as a splendid horse of dark bay colour, with maine and tail black and a long whiteish horn. They live in woods and are very timid and not often seen. Others from the plains report a unicorn rather smaller like a genet d'Espagne (barbary horse).'

There is such a wide variety of antelopes and gazelles from which to choose a unicorn that it is difficult to reach a final decision. More than likely there is not one unicorn but at least two, the Afro-Arabian horse-antelope, oryx, and the Asian goat-gazelle, chiru.

SEROWS AND GIRAFFES

On the Ulpius globe, of 1542, in the library of the New York Historical Society, are two interesting ungulates in northern Indo-China (fig 6.6). They have two long backwardly curved horns and long floppy ears. The indische Hausziegen had appeared with short horns, cloven feet and floppy ears, in a travel book by Breydenbach in 1488 and they turn up again, in 1551, in Gesner's *Historiae Animalium*, described as Capris indicus. On the Ulpius globe, their horns are much longer than in either of these other representations. In 1583, Martines figures the short horned variety in his atlas, in the Bibliothèque Nationale in Paris and, in 1655, on Blaeu's far-eastern sheet of his map of the world at the National Maritime Museum, Greenwich, they are figured without the floppy ears.

Fig 6.6 Indo-China from the Ulpius Globe 1542 in the library of the New York Historical Society: ibis, Indian goats, giraffe and lions



No animal fits the picture adequately. One of the problems is that the size of both the horns and the ears varies, according to the author. It is just possible that they represent nothing more exciting than a particular breed of goats from the oriental region.

They may, however, be one of the wild goats, in which the region abounds and it is tempting to suggest the serow *Capricornis*, a goat related to the chamois and having long mule-like ears and curved horns. Serows range over China, Japan, Burma and Malaya wherever there are mountains.

Another curious ungulate, that appears on Gutiérrez' 1551 map of the world, is a four horned sheep (fig 6.4). This may be only an abnormal sheep, of which many examples are known but, less likely,

World tropical animals obtained either from the north, where they have later become extinct in the face of the cold, or from Africa while there was a migration route. In addition, many more typically temperate animals from the north have flourished in the oriental, such as the deer which never invaded the ethiopian region. Owing to its short period of isolation, few unique families are found in the region.

The oriental region of the cartographers, too, is not a rich zoological region but, within its modest limits, it shows some of the animals that the oriental shares with other regions: the elephants, rhinoceroses, a monkey, a pangolin and crocodiles with the ethiopian, for instance; some, like the deer, cranes, pheasants, which are more typically shared with the temperate regions; and others, like the lions, which are of more widespread distribution. An outstanding exception to this is the goat subfamily, the Caprinae, of which almost all the genera inhabit Asia. Omitting the domesticated variety, this subfamily is well represented only in the oriental region of the maps. At least a third of the living Asian forms seem to be represented, in the oriental region and nowhere else, even if some of them do take the somewhat bizarre forms of unicorn, alce mulo and capris indicus. However, only just over a third of the oriental land mammal families are represented on the maps (eleven out of thirty) which is considerably fewer than in the other regions. But, its striking similarity to the ethiopian region is shown by the occurrence of half the shared families. It is curious that some of the most characteristic oriental families, the monkeys and the squirrels, either do not occur or occur only rarely on the maps.

VII

Ethiopian Region

The ethiopian region comprises, with the oriental region, the tropical area of the Old World. In the east, the south and the west, it is clearly defined by the Indian and Atlantic oceans. In the north, the boundary is formed by the Sahara desert and the deserts of Arabia. Thus, in zoogeography, the ethiopian region includes most of Arabia and Egypt and excludes the most northerly part of Africa.

But, continuing the convention adopted in the earlier part, because of the inaccuracy of the early maps, the whole African continent will be discussed as the ethiopian region. In fact, as more of Africa came to be represented on the maps, so the animals receded from the north coastal strip and became, zoogeographically, more accurate.

Some zoogeographers include Madagascar in the ethiopian region, others do not. But it is so rarely populated with animals, by cartographers, that neither its fauna nor its zoogeographical status will be considered.

COMMON MAP ANIMALS

For animals, the ethiopian region is unsurpassed. Its fauna was represented from the earliest days of mapmaking and, although even African maps were denuded of animals by the eighteenth century, elephants occur as late as 1782 on a map by de la Rochette (Tooley 1949) and several other maps, only a few years earlier, were richly populated. A Dutch map, by Brink, the surveyor on the Hop expedition to South Africa in 1761, for instance, has a wildebeeste, zebra, giraffe and horse (Hop 1778, Koeman 1952). Inhabited maps of the

ethiopian region run through six centuries.

But the fauna of the Nile had been given permanent pictorial representation in Europe, long before that, in the mosaics preserved in Palestrina, Pompeii and Sicily.

A considerable range of animals inhabits the ethiopian, from the earliest times, but the predominant animals, through the centuries, are the elephants, camels and lions. Ostriches lost their early popularity, to some extent, lying in fourth place after the fifteenth century. Then came monkeys, rhinoceroses, dragons and crocodiles. In fact, there had been little general expansion of the fauna since the early maps, by which time all these animals had occurred on the continent, some of them frequently.

There is little to be said for the advancement in accuracy of drawings either. On some maps, the animals tended to be formalised, Alonso de Santa Cruz 1542 (Nordenskiöld 1889), for example; on others, they settled down to comparatively standard forms.

The elephants, early, acquired their pillar legs and large ears, but there was considerable uncertainty still over the provenance of their tusks, see p. 43. In some of all periods (Homem-Reinel 1519, Desceliers 1550, Prunes' 1586 portolan in the Bibliothèque Nationale, Paris, for instance) the tusks came, erroneously, from the lower jaw while in many no decision was taken. But, by the seventeenth century, the Dutch cartographers were drawing the tusks, consistently, from the upper jaw.

An interesting elephant occurs, in Le Testu's 1555 *Cosmographie Universelle*, with the tusks hanging from the mouth (fig 7.13). It is difficult to decide whether they originate from the upper or lower jaw but, from the way they lie, it seems probable that Le Testu knew that they came from the upper jaw but was uncertain about the orientation. The tusks follow the more usual alignment of long incisors, hanging, from the upper jaw, downwards.

From the sixteenth century, most elephants were figured as wild animals, without the domestic trappings of the earlier ones.

Camels, too, from a domesticated beginning, had a tendency to be depicted as wild animals, later on. Most camels were of the Mediterranean domesticated one humped variety but, occasionally, a two humped form appears. In Maggiolo 1516, Agnese 1543 (Bibliothèque Nationale, Paris) and in Le Testu 1555, two humped camels made their appearance in north Africa.

MORE RHINOCEROSES

Rhinoceroses had been well known members of the African fauna from remotest times. In the Barberini mosaic *L'Inondazione del Nilo* the rhinoceros appears as a pig-like animal with three toes, small tufted ears, a short tail and two short nasal horns, the front one somewhat larger than the back one. This animal is firmly labelled 'rinokemus'. It is a very fair representation of the African black rhinoceros and a great deal better than the slim, maned rhinoceros of the Hereford map which, anyway, having only one long nasal horn, more nearly represents the oriental rhinoceros.

Many of the early writers were aware that the African rhinoceros had two nasal horns. Pausanias wrote: 'I have likewise seen the Aethiopian bull, which they call rhinoceros, because a horn projects from the extremity of its nostril, and another small one under: but it has no horns on its head' (Taylor 1824). Many others, including Cosmos the Monk, wrote of more than one horn on the ethiopian rhinoceros.

Some had even contrasted the ethiopian and oriental rhinoceroses. Timotheos wrote that rhinoceros was the name for the African rhinoceros and that rhinoceroses from India were called oxen. Centuries later, Nicolo de Conti could be more precise. Of the Indian rhinoceros, he wrote, in 1444: 'Also there is a certaine Beast, having a head like unto a Hogge, the tayle lyke unto an oxe, and a horne in his forehead, like unto a unicorne, but smaller by a cubite. He is in coulore and bignesse like unto the Elephante' and, later, of the African rhinoceros, 'also there is a kind of beastes of divers couloures like unto the Elephant, but they have not such a trunk and snoute, they do call him Belus. They have feete like unto a Camell, and two very sharp hornes, each of a cubit in length, the one standeth in his forehead and the other upon his nose' (Penzer 1937). The cartographers were less clear about the differences, though many of them were aware that rhinoceroses inhabited both the ethiopian and oriental regions.

In 1516, rhinoceroses occur, on different maps, in both the oriental and the ethiopian regions but, in each case, they are a one horned variety. The oriental rhino of Homem-Reinel resembled an elephant, except for its terminal horn and lack of a trunk. Waldseemüller's African rhino (fig 7.1), on the other hand, was a heavily armoured three toed single horned beast, with considerable likeness to the

great Indian rhinoceros. It was as good an Indian rhino as the Barberini mosaic was a good African one. L. Fries copied Waldseemüller's rhino on his maps of Africa in 1520 and 1524 (Bagrow 1959).

Thereafter, the rhinoceros deteriorated on the maps probably owing to the influence of Gesner and subsequent naturalists who had accepted Dürer's rhinoceros as the only rhinoceros. The lack of realisation that there were several genera of rhinoceroses and the false lead given by Gesner caused confusion among the naturalists for many years. Thus, Topsell 1607 declared: 'Euchemis saith, that the Rhinoceros hath two horns in his nose, but that is utterly false, as you may see from the picture [Dürer's]: although Martial seems

Fig 7.1 Waldseemüller's African rhinoceros from the *Carta Marina* 1516 in Schloss Wolfegg

to expresse so much in these verses.' But Justel 1674 reports a Portuguese author: that thè rhinoceros cannot be confused with the unicorn because the rhinoceros has two horns a bit arched.

Buffon finally dismissed the Dürer rhinoceros but described and figured accurately only the great Indian rhinoceros in 1754 but, in the supplement in 1776, the confusion takes shape once more. Buffon concludes that there are two horned rhinoceroses after all and that they form a variety of the one horned version. Furthermore, he declares that they are found equally in Asia and Africa. At this point it seems to be believed that both one and two horned forms occurred both in Africa and Asia. Certainly, in 1778, an engraving

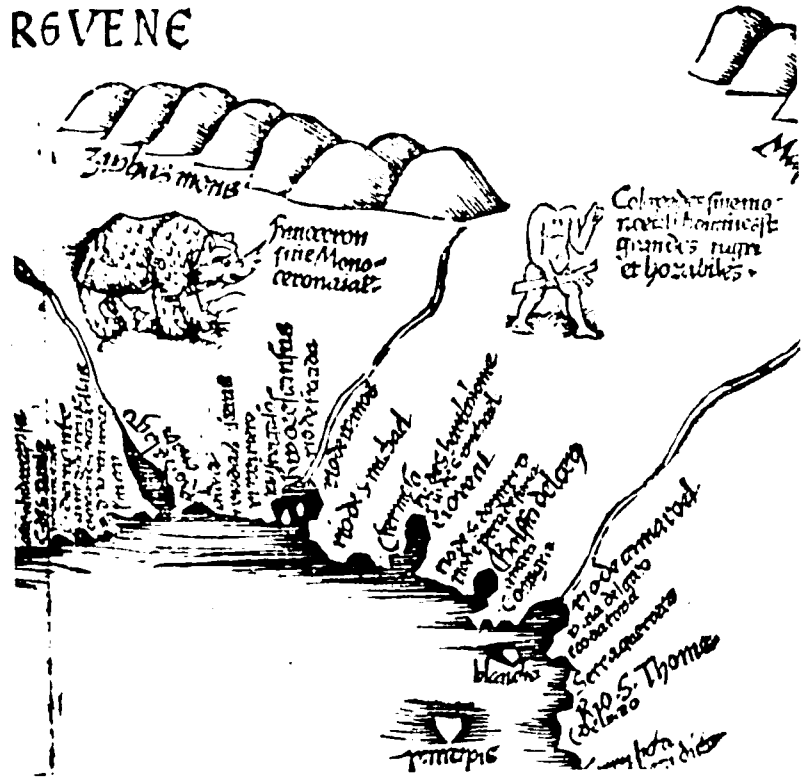


Fig 7.2 Rhinoceros in the Ptolemaeus Argentorata *Geographica* 1525

of what purports to be a south African rhino has only one horn, midway up his nose (Hop 1778).

On the maps confusion was even greater. In the early part of the sixteenth century, following on Waldseemüller and Fries, came the rhinoceros of the 1525 *Ptolemaeus Argentorata* (Nordenskiöld 1897), a debased version of the former, its single horn now large and with a saw edge (fig 7.2). A more pig-like version inhabits the Africa of Peter Apian's world map of 1530 in the British Museum (fig 7.3). By 1542, the Dürer shoulder horned rhinoceros had arrived, on the Ulpius globe. A single horned Indian rhinoceros with cloven feet occurs five years later in the Africa of the Vallard atlas (fig 7.4).

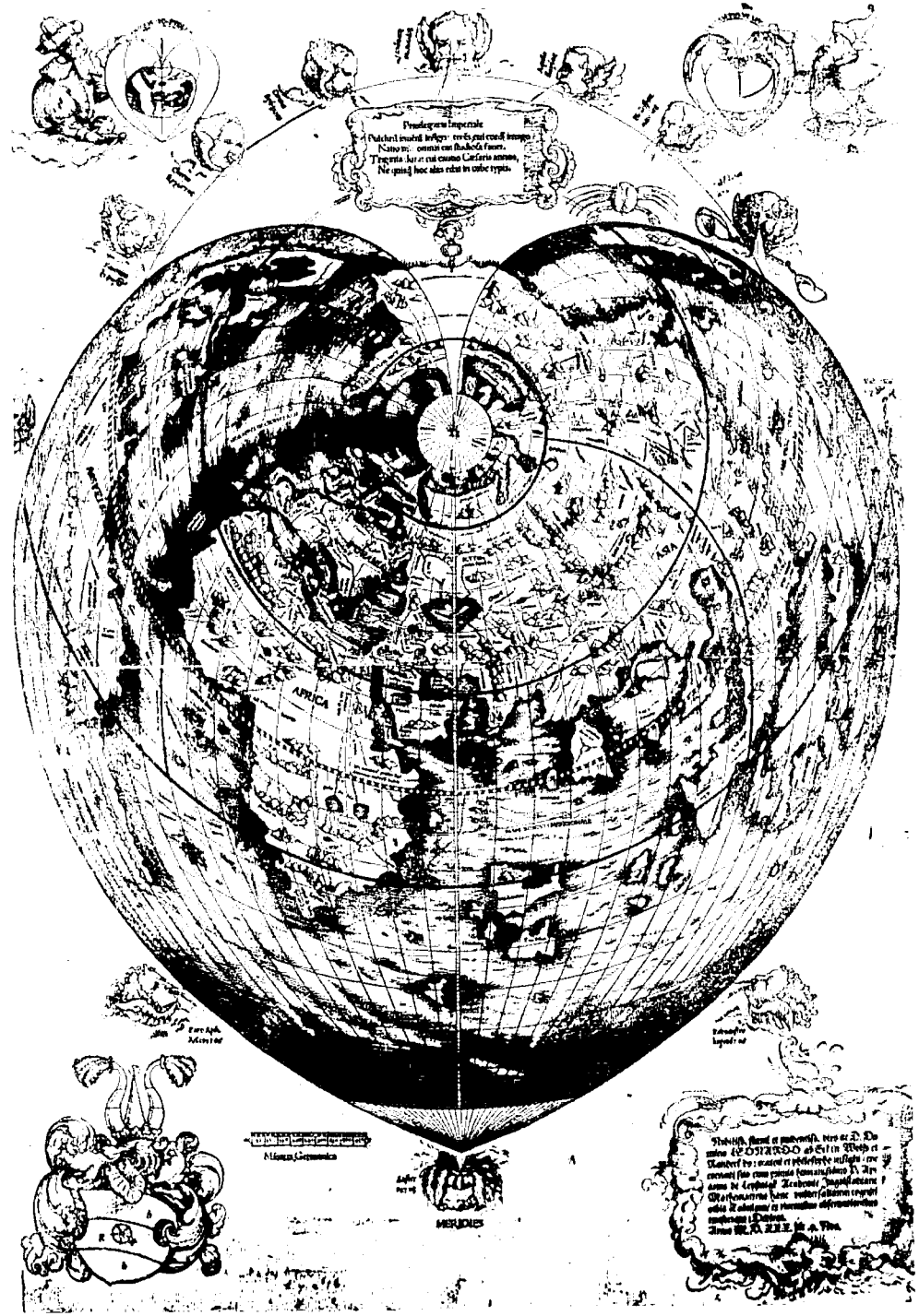
1550 saw two versions of African rhinoceroses: Desceliers' curious saw nosed animal on a map of the world, possibly a further deterioration from the original Waldseemüller, possibly a drawing hesitating between one and two horns (fig 7.5); and an anonymous chart of the Atlantic that decides for one horn and elephant pillar legs (fig 7.6).

Three years later, Desceliers, on another map of the world, destroyed in 1915 (Oberhummer 1924), made another attempt and redrew his rhino (fig 7.7). This time it was a more distinctly three toed animal with a short thin tail in contrast to the bushy tail that had been creeping in and its single nasal horn had the saw edge towards the animal instead of away from it as in earlier versions. In 1555 yet another rhinoceros had occurred, in Le Testu's *Cosmographie Universelle*. This was a tall, scaly animal with three functional toes and a huge curved horn from half way along the nose (fig 7.12). In 1558, in the Homem atlas (Cortesão & Teixeira da Mota 1960), the rhinoceros was well armoured with four clawed toes on each foot and one long curving nasal horn (fig 7.8). After 1558, the Dürer rhinoceros, which had appeared in Africa in 1542 and the oriental region in 1595 (Linschoten), persisted both on the maps and in the works on natural history until, according to Buffon, an Indian rhinoceros was correctly described in 1735.

SIMILARITIES BETWEEN ETHIOPIAN AND ORIENTAL REGIONS

Whatever their inaccuracies in detail, the most frequently recurring animals of the ethiopian region gave a reasonably good picture of

Fig 7.3 Apian's map of the world 1530 in the British Museum, London: rhinoceros in the ethiopian region; birds in the oriental region; macaw in the neotropical region



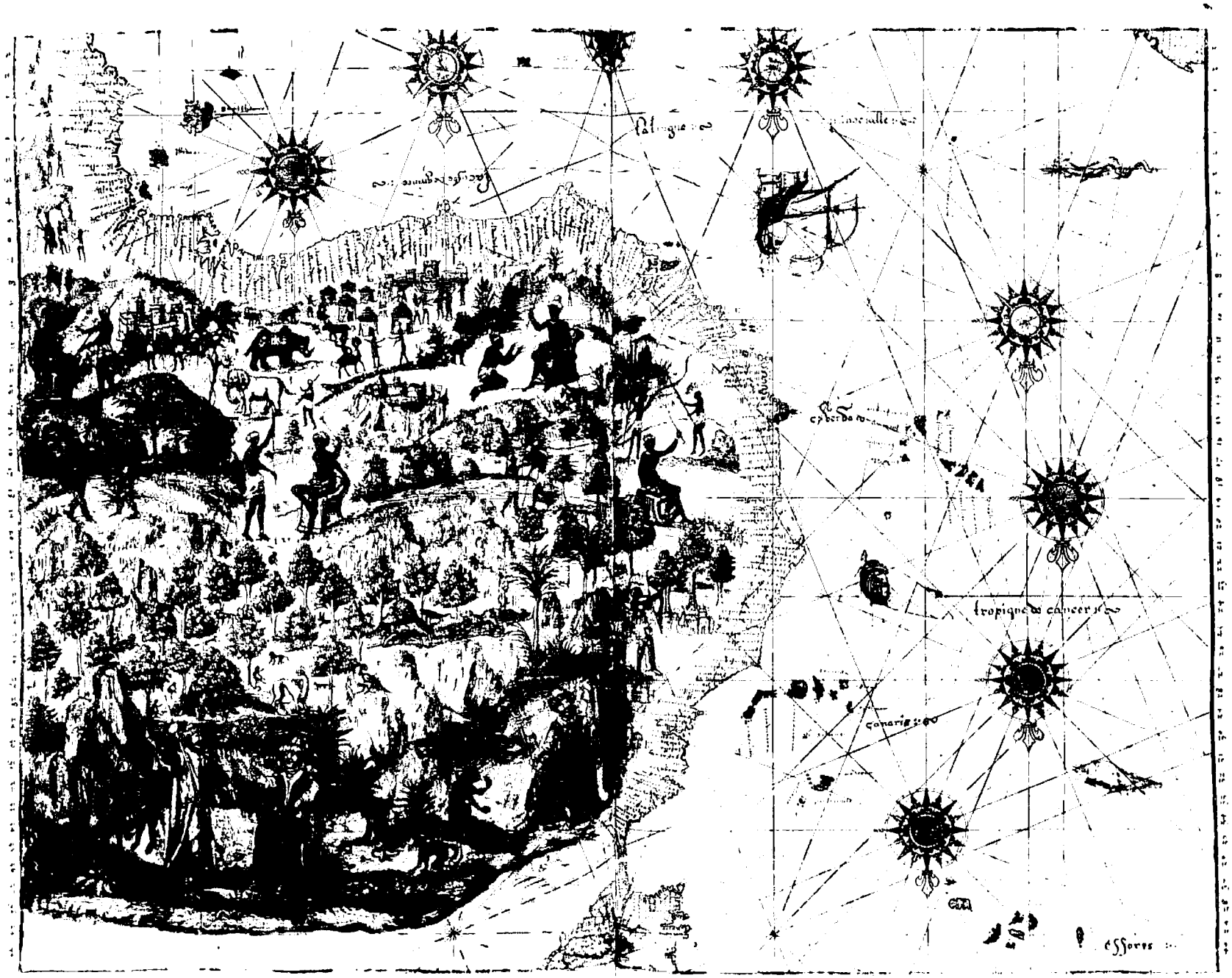


Fig 7.4 West Africa from the Vallard Atlas 1547 in the Huntington Library, California: cattle, rhinoceros, elephant, camels, monkeys, crocodiles, lions, antelopes (impala or gerenuk), small carnivores and parrot

the Old World tropics. Furthermore, the ethiopian shared on the maps its elephants, lions, camels, rhinoceroses and crocodiles with the oriental region. Thus, some of the outstanding similarities between the regions were given due representation by the cartographers. Monkeys were not often part of the oriental scene although they figured largely in the ethiopian. The camels were, of course, strays from the palearctic, except in their domesticated state.

The ethiopian region shares eight mammalian families with the oriental region alone: elephants, rhinoceroses, chevrotains, lorises, Old World monkeys, apes, bamboo rats and pangolins. The elephants and rhinoceroses are well represented on the maps. Monkeys occur mainly in the ethiopian region of the maps where they are abundant and range through the long tailed monkeys, macaques or guenons (Desceliers 1550) and a naked buttocked drill (Le Testu 1555), to a lion maned baboon on a late sixteenth century Italian portolan of the Mediterranean (Winter 1950). The loris and ape families would not be expected to be distinguishable from the monkeys of these early dates. Of the other shared families, chevrotains and bamboo rats do not appear and the pangolin is an occasional visitor to both regions in Wells' *New Sett of Maps* 1701, for example (fig 7.9 and see p.159).

Crocodiles and dragons occur in both regions but chameleons, which are shared by the two with their main centre of diversification in Africa, occur mainly on maps of the ethiopian region. According to Pliny: 'Africa also has the chameleon, although India produces it in greater numbers. . . . And it is more remarkable for the nature of its colouring, since it constantly changes the hue of its eyes and tail and whole body and always makes it the colour with which it is in closest contact, except red and white.'

DRAGONS

Dragons and flying snakes are frequent. These are animals that are normally labelled mythical and dismissed. Certainly, some of the drawings are highly speculative but some, nevertheless, are no worse impressionistic representations of real animals than some of the rhinoceroses and some of the South American mammals. Several genera of snakes are known as flying snakes, *Chlorophis* the African colubrid

Fig 7.5 From Desceliers' 1550 map of the world in the British Museum, London: camels, cattle, horses, rhinoceroses, dragons, carnivore and snakes

green tree snakes, for example. They do not have wings but they shoot from trees, holding themselves rigid by curving the scales and muscles of the ventral part of the body. By progressing through the air, they merit the name flying snakes. Although coiled, Desceliers' 1550 flying snake is propelled through the air and without wings (fig 7.5). Le Testu's 1555 flying snakes are both with and without wings (fig 7.13). In addition to the flying snakes, numerous more ordinary forms occur on the maps.

The frequently occurring dragons are even less fanciful, at least for the oriental region. Small lizards, belonging to the genus *Draco*, have membranes stretched over elongated ribs to provide brilliantly coloured parachute wings, with which they can glide from trees. Of the many species, some have monstrous formations of the head. Pomponius Mela described the flying serpents of Arabia about AD 43: 'Of serpents the worthiest to be had in remembrance, are those which

Fig 7.6 Rhinoceros and lion in the west Africa of an anonymous chart of the Atlantic in the Bodleian Library, Oxford

being very little (and whose stinging is present death) are reported to come forth of the frozen Fennes at certain times of the yeare, and from thence flying in flockes towards Aegipe' (Golding 1590). And Pausanias wrote: 'I have never indeed seen winged serpents, but I am persuaded there are such animals' and the picture of 'le serpent ailé' of Belon 1557 bears considerable resemblance to *Draco* except that it has only two legs, a mistake perpetuated for many centuries.

> Dangereuse est du serpent la nature,
> Qu'on voit voler pres de mont Sinai
> Qui me serait, de le voir, esbahy,
> Si on a peur, voyant sa portraiture.

The range of the genus is across the whole of southern Asia and Arabia so that, although they do technically just come to the ethiopian region, they are not strictly continental African animals. When they occur on African maps, they are sometimes scattered across the continent but, frequently, they are confined to the more north-easterly areas which, often, include Arabia. The cartographers had varied opinions on the structure of *Draco* for sometimes it has two legs and sometimes four, the two legged variety being just in the

Fig 7.7 Rhinoceros from Desceliers' map of the world 1553

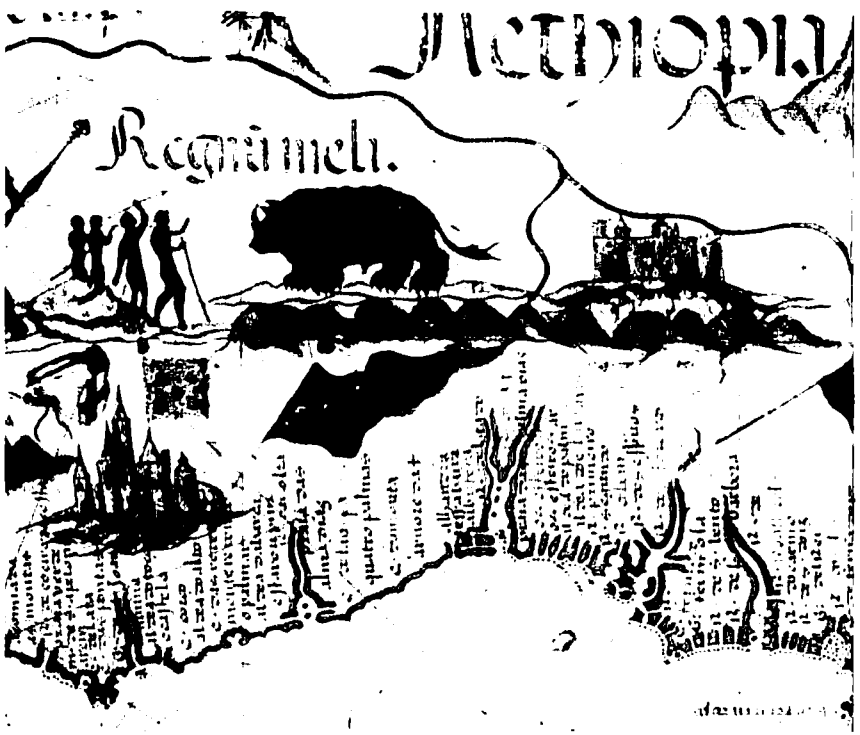


Fig 7.8 Rhinoceros from the Homem Atlas of 1558 in the British Museum, London

majority. Apart from the Ebstorf and Gutiérrez 1551 dragons, which show some resemblance to the one most commonly found in bestiaries, the cartographers seem not to have been influenced by the books of animal drawings, nor very markedly by one another. The best *Draco* occurs on a 1683 map of Abyssinia by Ludolfi in Allardt's *Atlas Major* (fig 7.10). This one has four legs, wing membranes supported from the thorax and a typical *Draco* head, resembling very closely *D. volans* of Malaya with orange and black wings (Gadow 1901), a picture much superior to the two legged variety of Gesner, Belon and Topsell as late as 1658.

AFFINITIES WITH THE NORTH

Mixed with this mainly tropical fauna are a few palearctic animals: dormice, jerboas, conies and wild horses, as well as the hyenas and Old World porcupines, which the ethiopian shares with both

Fig 7.9 Nubia from Wells *A New Sett of Maps* 1701

the palearctic and the oriental. Both the horses and hyenas are represented on the maps, horses as domestic horses, wild horses and, in a few cases, zebras: Speed's *Prospect* 1626 (fig 7.11) and several subsequent Mercator-Hondius *Atlas* maps. 'Here is also the zevera or zebra,' according to Andrew Battell writing between 1589 and 1607, 'which is like an horse, but that his mane, his taile, his strokes of divers colours downe his sides and legges, doe make a difference. These zeveras are all wilde, and live in great herds, and will suffer a man to come within shot of them, and let them shoote three or four times at them before they will run away' (Purchas 1625).

A porcupine is probably represented on the 1655 Blaeu world map at Greenwich, the 1659 Blaeu map of Africa in the *Klencke Atlas* about 1660 in the British Museum and the Coronelli atlas 1691–1696 in Paris. It had been reported from Africa by Solinus as being 'very ryfe in those Countries a beast like a Hedghog, wyth a hyde full of rough brystles, which he oftentimes looseneth of his owne accorde, and darteth them foorth so thicke as it were a showre of pricks' (Golding 1590). An African porcupine had been figured by Gesner in 1551 and many visitors reported either the porcupines themselves or quantities of porcupine quills.

In addition, the maps portray leopards, unicorns, cattle and antelopes, animals of a reasonably wide distribution. The unicorns, already discussed, may be the horse-antelope oryx or addax or a con-

fusion with the rhinoceros. 'We enquired above in the country if they had any knowledge of the Unicorne, and they have told me that higher within the Land is a beast which hath one horne only in his fore-head, but describe him as to be of the colour and bignesse of a fallow Deer, and the horne to be about the length of their arme, and no otherwise; not like that which we have described of which I doubt whether there be any such,' wrote Richard Jolson in 1620 (Purchas 1625). And, 150 years later, in 1773, Michael Collinson wrote to the American botanist John Bartram: 'With regard to the unicorn I am rather divided in my judgment, even in respect to their present existence, in the interior region of Africa, of which, at this period, we are extremely ignorant' (Darlington 1849).

Some of the cattle on the maps seem to represent the native eland with its humped back (Oliva's atlas 1625 in the Bibliothèque Nationale, Paris; Janssonius' *Novus Atlas* 1646; Blaeu's world map 1648), although it is difficult to decide whether the drawings are meant to represent wild bovids or domestic cattle. Other cloven hoofed animals occur frequently but not as frequently as might be expected, considering the spectacular radiation of the antelope subfamily in Africa. Small horned dorcas gazelle *Gazella* appear on the 1504 Maggiolo world map and on some of the Hondius and Blaeu maps of the mid-seventeenth century (fig 7.11). Some of the bigger antelopes, too, are figured such as impala *Aepyceros* on the Oliva portolan of the Mediterranean in the library of the Hispanic Society of America in New York and in the Vallard atlas 1547 (fig 7.4). The impala

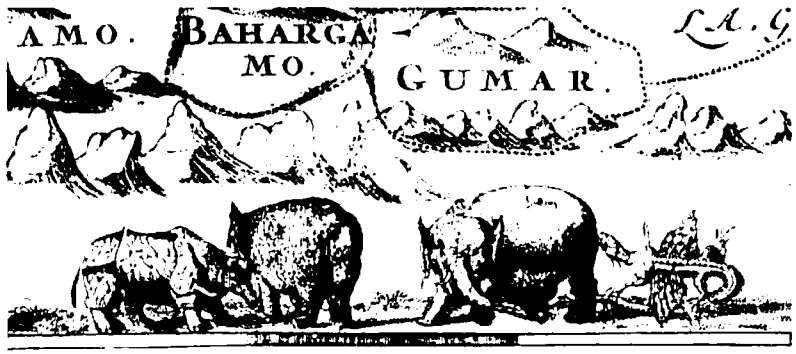


Fig 7.10 From a map of Abyssinia by Ludolfi 1683 in Allardt's *Atlas Major*: single horned rhinoceros but typically African elephants with large ears and a flying lizard *Draco volans*

had been referred to by name in an account of a journey in Angola by Eduardo Lopes in 1588 (Purchas 1625) and gazelles were frequently named by travellers. Erroneously, they also wrote of stags and deer and, from time to time, branched horned deer do appear on maps of Africa.

The ethiopian region is essentially Old World in its mammalian fauna. It has no families which it shares only with either the nearctic or the neotropical. Some of its reptiles, amphibia and fish are similar to those of the neotropical but this likeness extends only doubtfully to the birds and not at all to the mammals, unless some rodent families of Africa are confirmed to have affinities with neotropical forms. There are, of course, members of all classes in Africa that are of world wide occurrence.

ENDEMIC FAMILIES

Competing in number with the tropics of the New World, the ethiopian region has twelve unique families of mammals, several birds including ostriches and secretary birds, a lizard and turtle family as well as an amphibian and several fish families.

Three of the endemic mammal families are little known insectivores: golden moles, elephant-shrews and African water shrews. A further six unique families are rodents, difficult to distinguish from the better known northern rodents. The remaining three unique families are large distinctive animals: the giraffes, hippopotamuses and the aardvark.

Giraffes occur accurately drawn on early mosaics of the African fauna (fig 2.9), go through the nearly unrecognisable camelopardalis of the thirteenth century Ebstorf map (fig 2.2), through the formalised long necked animal of the Genoese world map of 1457 (fig 2.8), to the excellently drawn slender animal of Nicolo de Caveri in 1502, influenced possibly by one of the early woodcuts such as Breydenbach 1488. 'Also', wrote Nicolo de Conti in 1444, 'they reported that there is another kind of Beast, of nine cubits in length, and sixe foot in height, having cloven feete like unto an Oxe. Their body is a cubit in compasse, and much like in haire unto the Libard, headed like unto a Camell, and hathe a necke of four cubits in length. His tayle is very thicke, and much esteemed, for the women do worke with it, embroidering it with precious stones, hanging them at their armes' (Penzer 1937). The giraffe degenerates to a camelopardalis in 1504 on

CENOZOIC HISTORY

It seems likely that Africa became separated from all other continents during the cretaceous, having received only a few mammalian migrants, such as insectivores and condylarths. During the period of separation, probably until late eocene days, the insectivores could radiate into the several forms known today and the condylarths founded the elephant stock and probably the little changed aardvarks. Ancestors of modern monkeys and apes arrived during this time.

With the rejoining of the continent to the north early in the cenozoic, Africa was free to receive early carnivore stock and rodents and free to send out her elephant stock and primates (fig 7.14). Gradually the land connexion between Africa and the north dried, forming once more a barrier to faunal interchange, so that little migration took place after the pliocene. By that time, elephants had returned in more modern form, modern antelopes and horses were established and the rhinoceroses had come down from the north. The bears were a family that evolved too late to make the journey, an absence which made an impression on F. Alvares in 1520: 'except two which I never saw or heard tell that there are any of them here, bears and rabbits' (Beckingham & Huntingford 1961–1962). There are hares

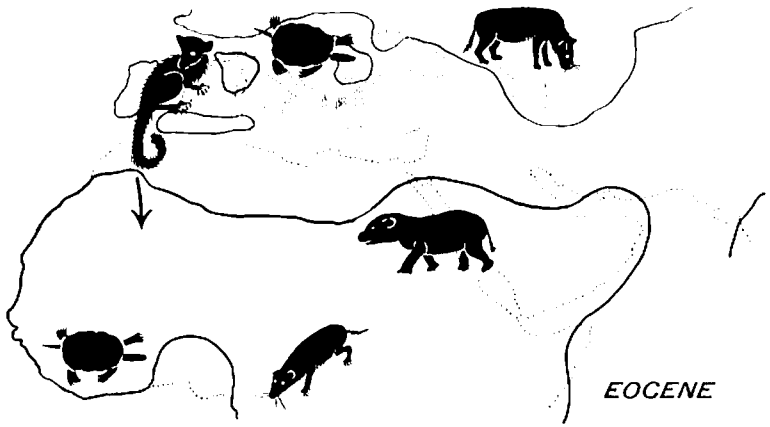


Fig 7.14 Hypothetical state of North Africa in the eocene about sixty million years ago: ancestors of elephants and African insectivores; primates migrate along the island chains from the palearctic

but, otherwise, only introduced European rabbits in Africa. But it is less clear why the deer were excluded, though it may be that the antelopes, arriving first, had already occupied all the niches suitable for fast moving cloven hoofed herbivores.

Thus, the fauna of the ethiopian region differs from the oriental region, because it was cut off from the rest of the Old World in the early stages of the cenozoic, but resembles the oriental because it had a channel of communication with it from oligocene to pliocene days (Arambourg 1964). It differs from the other tropical area of the world, the neotropical, both in the timing of its isolation and in its position in contact with the palearctic and oriental as distinct from the nearctic.

The resultant differences and similarities with other regions are reasonably well indicated on the maps. Its affinities with the oriental on the maps have already been indicated, by the appearance of five out of the eight shared families and, at the same time, its difference from this region is indicated by the occasional hippopotamus and ostriches which, correctly, do not appear in the cartographers' oriental region.

It is differentiated from the palearctic maps by lack of the commonly occurring bears and deer of that region and allied to it by horses from among the four families the regions share.

It is differentiated dramatically from the neotropical by, for instance, the large herbivores of the two regions, elephants and rhinos in the ethiopian compared with tapirs and llamas in the neotropical. But, tropical similarities are stressed in the appearance of snakes, dragons and monkeys in the two regions and, among birds, by the parrots and the large grazing flightless birds, ostriches and rheas.

In spite of their considerable success in typifying the ethiopian region, the cartographers portrayed only a maximum of thirteen of the thirty eight families of land mammals of the region, thirty four per cent, although the actual abundance of a variety of animals on any one map is as outstanding as some of the North American maps. This is particularly true of the Dutch maps like the Blaeu map in the *Klencke Atlas* about 1660 in the British Museum (fig 7.15).

Fig 7.15 (over) The ethiopian fauna on a map of Africa by Blaeu in the *Klencke Atlas* about 1660 in the British Museum, London

IX

World Maps

The foregoing survey of the zoogeography of the world as seen on maps was based not only on complete maps of the world but also on the individual maps of atlases and on maps made of more restricted localities. The conclusions reached are, therefore, those that could have been reached by anyone looking through these maps. No one map provided all the information nor were all the maps world maps.

MAPS OF THE WORLD

World maps, that portray animals, do not necessarily have all their regions filled with animals, so that some maps are not, strictly, representing the different faunas of the world but indicating the fauna of one or two regions. This is mainly true of the earlier maps, several of which have an occasional animal in Africa and none in the rest of the world although, generally, animals appear, if they appear at all, in both the ethiopian and the palearctic regions with only the oriental region consistently deprived of its fauna. Even so, at least five of the early maps are strictly zoogeographical maps, in the sense that they have a fauna for all three regions: the Ebstorf (fig 9.1), Hereford (fig 2.1) and Vercelli maps of the thirteenth century and the Borgia (fig 2.12) and Genoese (fig 2.8) world maps of the fifteenth century. The fourteenth century neglected the oriental region.

From these early 'distribution' maps, it could be learnt that, while snakes, dragons, birds, some carnivores and domestic camels were common to all regions; elephants, unicorns and crocodiles were shared by the ethiopian and oriental regions; leopards, pelicans and ostriches by the palearctic and ethiopian and that, while elk and bears were particularly representative of the palearctic, giraffes were peculiar to the ethiopian, along with rhinoceros and antelope which, however, occur only once.

As an attempt at mapping animals, these maps were only a partial success. They give a general, if sparse, idea of the fauna of the three regions, but they are not outstanding for the accuracy with which the animals are distributed. But the errors are, usually, those of omission: the animals tend not to have a wide enough range to satisfy accuracy. Only rarely do animals occur in the wrong region. Camels are the main offenders but, in the domesticated form, they have been used all over the Old World for centuries and their presence in all three regions is not, therefore, particularly misleading. It is interesting that, already, elephants had come, correctly, to represent the ethiopian and oriental regions and elk to represent the palearctic.

During the first half of the sixteenth century, interest turned to the New World but, in spite of the new discoveries, the fauna of the ethiopian region still held first place on world maps and in world atlases. Indeed, some maps populated only the ethiopian region, leaving the rest of the world blank, while others populated only the neotropical region. At least eight featured the fauna of both ethiopian and neotropical regions, disregarding the rest of the world. These eight maps seem to have been particularly concerned to emphasise the differences between the two great southern continents: elephants were primarily the typical animals of Africa; parrots and then, towards the middle of the century, opossums represented South America.

There were, however, several maps and atlases which gave a fauna to all five regions of the then known world and some also included the sixth, unknown, region. Several others covered at least four regions. These were mainly the work of the Dieppe school, the earliest of which to fall in this category is the 1536 Harleian or Dauphin map to be followed by, among others, the Desceliers, Vallard and Le Testu maps.

From early sixteenth century maps of the world, new facts could be added to the early distribution maps. The cat family of carnivores had taken on a world wide distribution whereas, earlier, they had been confined to the palearctic and ethiopian regions. The range of deer had been correctly extended to cover all regions, except the ethiopian. Bears retained their northerly distribution, but had been

extended to the recently discovered nearctic region. Although the bear family does reach its greatest diversity in the north, which is probably its centre of origin, there are species of bears in both the neotropical and the oriental region. Elephants were still, accurately, confined to the ethiopian and oriental regions.

With the extension of knowledge of the land surface, new concepts of animal distribution were made clear. It became apparent, from the maps of the early sixteenth century, that some animals were discontinuously distributed. Such were the flightless birds, ostrich and rhea, occurring in the two large southern continents but absent from the intervening nearctic and palearctic regions. Monkeys are similarly shown on the maps, discontinuously distributed. They are shown mainly in the neotropical and ethiopian regions, with a few in the oriental. Again, other animals occur with a southerly but different distribution such as the rhinoceroses, which are always portrayed correctly in the ethiopian or oriental regions. Yet others have a wider but still discontinuous distribution such as the snakes and parrots, which turn up correctly in all the southern regions and are absent from the north.

Some of the regions could be further characterised on these maps by unique animals: animals occurring in only one region. The opossum, for instance, is shown as typical of the neotropical region (it has migrated into the United States only recently); the reindeer is made to symbolise the palearctic (although there are North American reindeer, caribou); a jungle fowl is correctly confined to the oriental and a giraffe continues to be confined to the ethiopian.

As the century advanced and knowledge increased, the main additions to the maps of the world were newly discovered animals such as armadillos and anteaters. The distribution of the well known groups hardly changes from the earlier years but is reinforced by reiteration.

Several world maps stand out for being of particular interest. The 1551 map of the world by the Spanish Royal cosmographer Sancho Gutiérrez is lavish with its animals (fig 9.2). In the New World, the southern continent has two sorts of llamas, alligators, monkey, macaws and other birds while the north has deer, bison, a coyote, jack rabbit and birds. In contrast, in the Old World, the southern continents have camel, elephant, ostrich, lion, tiger, unicorn, jackal, snake, dragons and cattle in the ethiopian and pheasant, boar, goats, jungle fowl, elephant, four horned goat or antelope and what is, probably, a bear in the oriental. The northern region of the Old World is typified by a reindeer and a stork. Thus, Gutiérrez indicated some similarity between the two northern temperate regions but contrasted the southern regions both with one another and with the north.

In 1566, Le Testu's map of the world is interesting in its emphasis on the overall difference between the Old World and the New World with less regard for precise localisation (fig 9.3). Thus, a bear stands in the nearctic, an armadillo and an anteater in the neotropical. Over the New World, in general, grouse and quail fly. In contrast, giraffe, lynx, deer, elephant and dragon stand indiscriminately over the northerly part of the Old World with a chameleon in the ethiopian region. Over the Old World fly pheasants, a hornbill and a bird of paradise.

José de Costa e Miranda's world map of 1706 is interesting more for its late date than for anything it adds to the knowledge of the fauna (fig 9.4). It follows the convention of deer in the north, armadillo in the neotropical, elephant in the oriental and monkey in the ethiopian region but, except for the Coronelli globe from the end of the seventeenth century, it stands alone, so late in time, as an essay in zoogeography.

It is interesting to compare these maps with modern attempts at portraying, in a small space, the distinctive features of the zoogeographical regions.

Termier and Termier 1960, for instance, show palearctic and nearctic sharing bears and deer, with bison in the nearctic and a Bactrian camel in the palearctic. Elephants represent both oriental and ethiopian, with the addition of giraffe and single humped camel in Africa. An armadillo and a llama are considered distinctive of the neotropical and a kangaroo of the australian.

A second example, a récent Italian map, in *Knowledge* 1965, well filled with animals, unites palearctic and nearctic with assorted deer, bears, marmots, squirrels, otters and wolves and, curiously, distinguishes between them by a beaver, an eagle and a Bactrian camel in the palearctic in contrast to polar bear, bison, musk ox, puma and lynx in the nearctic. The tropical regions on this map show mainly unique animals, except for the camel and cat family that link South America with temperate regions and the camel, horse and cat families

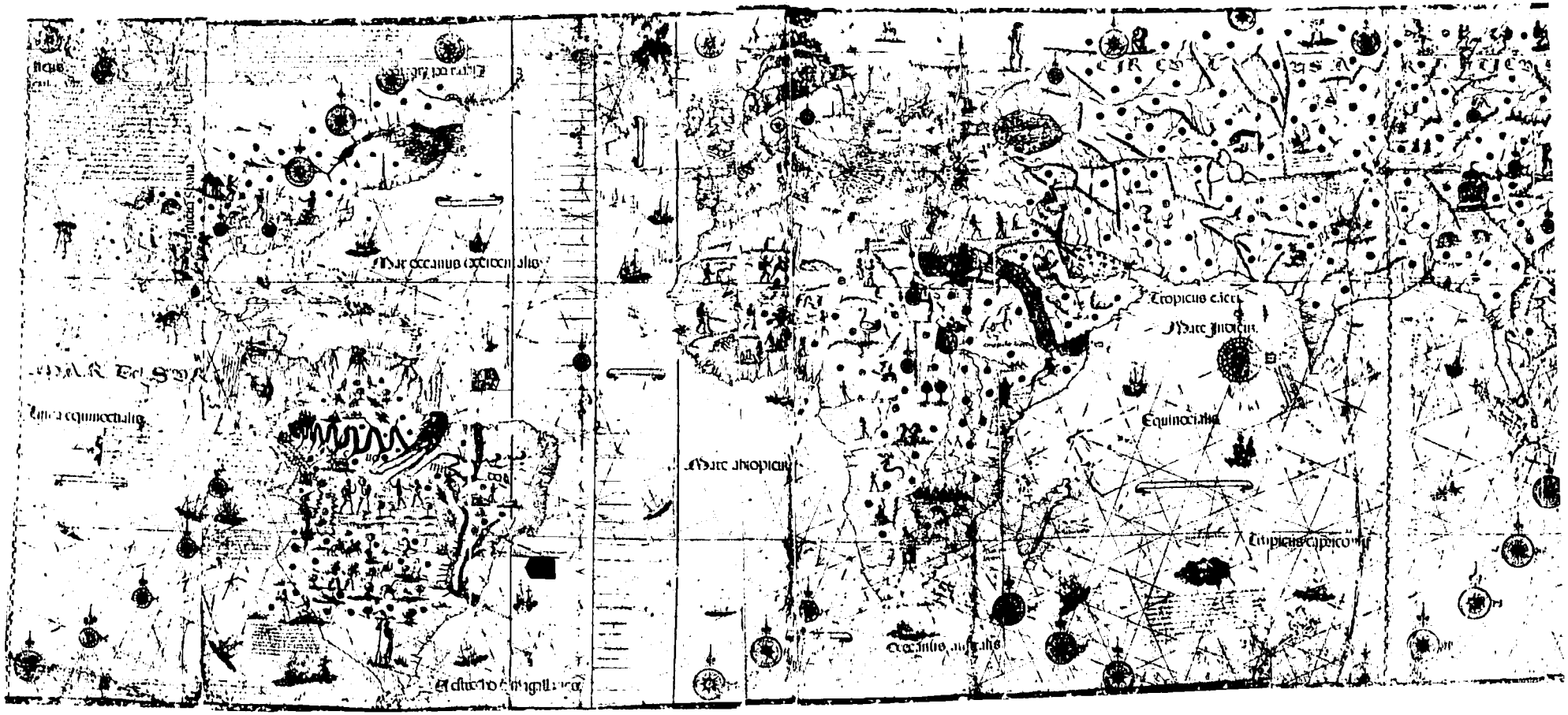


Fig 9.2 Gutiérrez map of the world 1551 in the Österreichische National-bibliothek, Vienna: animals in the neotropical, nearctic, palearctic, ethiopian and oriental regions

that link Africa with the north. South America and Africa show resemblances in having representatives of the cat family and large flightless birds. The ethiopian and oriental are united by elephants, rhinoceroses, cats and apes and distinguished by giraffe, hippopotamus, antelope, crocodile and chameleon. Only eagles join oriental and palearctic. The australian region has only crocodile, lizard, kangaroo and sea lion.

It must be conceded that even though these modern maps were drawn specially to show zoogeographical distribution, a subject that hardly came into being until well on into the nineteenth century (Johnston 1848, Wallace 1876), they do little better than some of the ancient maps drawn for more general purposes.

ATLASES

After 1547, the animals of the world were drawn mainly on the separate maps of atlases rather than on world maps. Of particular interest are the atlases of Vallard 1547, Le Testu 1555, de Jode 1593, Linschoten's *Itinerario* 1596, the Mercator-Hondius atlas of 1606 and the Blaeu atlases and their copies from 1635 onwards. In all these collections of maps, either all or many of the maps have animals on them. They continue the trend of the world maps in their animal dis-

tribution and frequently add to the fauna. Turkeys and beavers become common in the nearctic, the neotropical fauna flourishes, the ethiopian acquires an extensive fauna particularly in the Blaeu maps in the *Klencke Atlas* (fig 7.15), for instance, rhinoceroses and elephants become common in the oriental region.

Modern distribution maps can be seen in *Animal Geography* (George 1962) where each geographical region is drawn as a separate map. Like the late sixteenth century and early seventeenth century atlases, a turkey distinguishes the nearctic from the palearctic, a camel the palearctic from the nearctic. Beavers, however, unite the two regions whereas, in the early atlases, the beavers were mainly confined to the nearctic. Rhinoceroses and pangolins unite oriental and ethiopian regions, aardvark and okapi, tapir and tarsier distinguish them. The neotropical region resembles the oriental in its tapir, the palearctic in its llamas, the ethiopian in its large flightless bird and is distinctive for sloths and armadillos. The australian region has, among several marsupial mammals, cassowary, cockatoo and tortoise. The variety of animals has increased, but the same basic types of the old maps have continued to be used in modern zoogeographical illustrations.

Animal distribution maps similar to the atlases can be found today among many tourist maps.

THE REGIONS CONTRASTED

On the world maps that have an abundance of animals and in the atlases, where several regions have animals on them, the emphasis is mainly on contrast between regions with the exception of the oriental and ethiopian regions, which are continually being shown with similar elephants, camels, rhinos and unicorns. To some extent, the palearctic and nearctic are shown to have similarity by sharing deer and bears. In general, however, it is rare to feature animals in common between regions. From the earliest times contrasts had been emphasised. The reindeer, elks and polar bears represented a northern temperate region in the Old World, the palearctic; in marked contrast to animals of the tropical regions further south, the elephants, rhinoceroses, snakes and lizards of the oriental and ethiopian.

This representation would seem to come directly from the interests in the south of the traders who had operated from these earliest times. In India and in Africa, they searched for or bartered for rhinoceroses, elephants, lions: elephants for war, lions for the Roman games; elephants to provide the valuable ivory of commerce, rhinoceros horns, snakes and lizards for the apothecary (Schoff 1912).

EXPLANATIONS OF THE DIFFERENCES

Naturalists had commented on the products of the ethiopian and oriental regions, observing both their similarities and their differences from one another and from the palearctic. Some had tried to offer an explanation of the phenomenon. Aristotle, in *Historia Animalium*, ascribed the faunal differences to climate, which was a not unreasonable interpretation of Old World differences. Pliny, in *Naturalis Historia*, expressed surprise at the facts but offered no explanation. Saint Augustine of Hippo, in *De Civitate Dei*, realising that it was difficult to reconcile animal distribution with the story of the Ark, suggested that most animals had been regenerated on the spot from the mud, but those that required two of a kind to copulate had been preserved in the Ark and then distributed to their present homes, either by man or carried through the air by angels.

The distribution question became more acute with the discovery of a totally unexpected fauna in the New World, during the sixteenth century. Both the naturalists and the cartographers could not but stress the differences between the Old World and the New World, between northern regions and southern regions. The differences between Africa and South America were stressed by the absence of elephants, rhinoceroses and camels from the neotropical region, by the absence from the ethiopian of opossums, anteaters, peccaries, armadillos and llamas, for instance. Beavers and turkeys occupied North America, reindeer and elks Eurasia. But the increasing trade in fur skins from Russia and from North America also helped to stress similarities between the two northern temperate regions. This made the differences between South America and Africa even more striking and more puzzling.

Acosta, in *Historia Natural y Moral de las Indias* 1596, a book popular throughout western Europe, raised the problem of differential animal distribution when describing, with considerable accuracy, the fauna and flora of South America. Initially, he thought, the animals

Fig 9.3 (over) Le Testu's map of the world 1566 in the Bibliothèque Nationale, Paris

of the various regions had been created but, for him, the question still remained as to how they had got to America and Africa after being collected together in the Ark. Some might be new creations but the others must have travelled. He dismissed swimming as impossible and decided they must have travelled by land and he observed that the extent of the land towards the north pole and the south pole was not known, so that it was reasonable to suppose that the land was continuous and, therefore, provided a migration route. Small changes, from time to time, in the form of the north and south lands, however, altered the usefulness of the routes. Some animals could migrate across them, others could not. This was a view held by some cartographers of the time. For instance, Le Testu 1566 had an inhabited land to the south (fig 9.3), virtually continuous with South America and Australia and Camocio, in 1569, showed that North America and Asia connected across the Bering Straits. Others were less committed to north and south connexions: Ribeiro 1529, Mercator 1587, 1595, for example (Bagrow 1964).

Acosta's solution was not generally acceptable though his question retained its validity; many others continued to query why there were no elephants in South America (Thomas Browne 1643, Robert Burton 1628) but gave no answer. By this time, even greater problems were foreshadowed. The far eastern traders were bringing back, with their main cargo of spices, new varieties of parrots and the birds of paradise, unknown from anywhere else in the world. Gradually, too, reports came in of peculiar hopping mammals with prominent testicles and pouches for their young.

Buffon 1749–1766 returned to the challenge, setting out in detail the general mammalian characteristics of the New World and the Old World. In 1761, he contrasted the tapirs, peccaries, anteaters, llamas, opossums, agoutis and armadillos of the southern New World with the elephants, rhinoceroses, hippopotamuses, giraffes, camels, hyenas and chevrotains of the Old World, for instance, remarking that the monkeys of the two continents were different. Secondly, he noted that the two continents had some animals in common, though rarely of the same species. He resolved the problem in much the same way as Acosta but went further. Animals had been able to migrate between the continents, across the north between Asia and North America and, at some times in the past, between Africa and South America across what is now the

south Atlantic Ocean. But the sea had separated the continents before they had exchanged all their animals. Separated, the animals became different because of the different conditions on the different continents. 'Nature, I avow, is in a state of continual flux: but it is enough for man to seize the moment of his own century and to throw a few looks backwards and a few forward, to try to see what it was once like, and what it might eventually become.'

By Buffon's time, the cartography of the world was nearly complete. It seemed unlikely that there was continuous land either in the north or the south so it was necessary for him to suppose that this was something that had been in the past and was no longer true. This introduced an idea of change so, if change in the land, why not change in the animals themselves. In the main, however, creation held the day and few such disturbing questions were considered.

It was not until the nineteenth century that revolutionary thought on the distribution of animals became generally accepted.

Lyell 1830–1833 first established that while continents had always had some sort of identity related to the ones known today they had also undergone gradual change in detail, they had evolved. There could, therefore, have been connexions between continents which no longer exist today.

Darwin 1859 argued for the gradual evolution of animals by natural selection and used, as one of the arguments in its favour, the seemingly anomalous distribution of animals round the world. Natural processes, it seemed, had brought about the irregularity.

Wallace, 1876 and earlier, combined the theories of evolution of continents and evolution of animals by natural selection into the modern theory of zoogeography. Briefly, he argued that both continents and animals had changed during time. Thus, when two continents were connected they could exchange animals, when they were separated they could not. They could exchange only those animals that existed at the particular time in question. Modern faunas, then, were the result of interchanges between different continents at different geological periods at different evolutionary stages.

This theory could suggest, for instance, that bears had not evolved in time to migrate into Africa while a habitable stretch of land joined that continent with the palearctic or the oriental. It could suggest that some animals like tapirs and camels had once been widespread but, owing to extinction in the middle of their range, were left with the

Fig 9.4 Map of the world 1706 by José de Costa e Miranda in the Mitchell Library, Sydney

discontinuous populations of today. The theories of evolution gave a dynamic aspect to animal distribution: animals, plants, continents and climate changed during time.

Simple migration at various epochs from the north southwards and from east to west was the basis of Wallace's thesis. It appeared to account well for the spectacular differences between the southern continents and for the similarities between the palearctic and nearctic.

Opponents, unable to refute this explanation of differences, concentrated on the similarities between widely distanced lands, demanding not why are there tapirs in South America and rhinoceroses in Africa, but why are there monkeys in the two continents? Why are the porcupines, ostriches, turtles, frogs and lungfish of the southern continents more closely related to one another than they are to the intervening northern forms? The stress had shifted from the differences, which had found expression in the earlier naturalists' books and on the maps, to the similarities (George 1964*a*).

While many maps depict monkeys in either the one southern continent or the other or ostrich-like birds and parrots in either one or the other, only a few show them in both at the same time. The Cantino map of 1502 had parrots on both continents though contrasted by the long tails and bright colours of the South American forms. Desceliers 1546 had monkeys and ostrich-like birds in both southern continents. A few others showed either the ostriches or the monkeys in common.

To the cartographers of the sixteenth and seventeenth centuries, the neotropical and ethiopian regions were essentially different from one another and were to be contrasted.

This is probably a fair estimate of the situation. The differences