Articles

Advent and Course of Pastoralism in the Kalahari

JAMES R. DENBOW AND EDWIN N. WILMSEN

It has long been thought that farming and herding were comparatively recent introductions into the Kalahari and that it has been a preserve of foraging "Bushmen" for thousands of years. Agropastoral Bantu-speakers were thought to have entered this region only within the last two centuries. However, fully developed pastoralism and metallurgy are now shown to have been established in the Kalahari from A.D. 500, with extensive grain agriculture and intracontinental trade added by A.D. 800. Archeological, linguistic, and historical evidence delineates the continuation of mixed economies in the region into the present. Consequences of this revised view for anthropological theory and for policy planning concerning contemporary Kalahari peoples are indicated.

WHEN THE PRINCIPAL ETHNOGRAPHIC STUDIES OF southern African peoples, then called "Bushmen" (*1*), were undertaken in the 1950's and 1960's, very little was known of their prehistory or of the history of their association with herding and farming peoples; a similar lack of historic depth characterized earlier southern Bantu studies (*2*). At the time, it was universally assumed that Bantu-speaking farming-herding peoples had intruded into the Kalahari no more than two or three centuries ago. The region was presumed to have been peopled previously only by San-speaking foragers who had, until then, remained isolated from external influences.

Before the mid-1970's, only two systematic archeological investigations had been carried out in Botswana, an area approximately the size of Texas (575,000 square kilometers); only one attempt had been made to integrate the history of relations among hunting and herding Kalahari peoples (*3*). In addition, the climatic history of the Kalahari and its potential influence on local economies was entirely unknown. Likewise, linguistic studies, with their implications for revealing the history of social interaction and diversification in the region, were in their infancy. The assumption that pastoralism and social heterogeneity in the Kalahari were very recently introduced appeared to be correct.

Current work in archeology, geology, linguistics, and anthropology renders that assumption untenable. Since 1975, excavations have been carried out at 34 archeological sites in Botswana as well as at other sites in Zimbabwe and Namibia (Fig. 1). Seventy-nine radiocarbon dates now delineate the chronology of domesticated food production in Botswana during the past 2000 years (Table 1). These investigations indicate that cattle (*Bos taurus*) and ovicaprids (*4*) were introduced along with ceramics into the northern Kalahari in the final centuries B.C. and first centuries A.D. Slightly later, grain cultivation and metallurgy were part of the economic repertoire of Early Iron Age (EIA) pastoralists in the region. By the ninth century, these peoples were engaged in trade networks that brought exotic goods such as glass beads and marine shells from the Indian Ocean into the Kalahari.

Geologic evidence suggests that significantly higher rainfall may have created an environment that encouraged the initial establishment of pastoral economies in the region. Linguistic evidence points to the diversification of Khoisan and southern Bantu languages coincident with this agropastoral expansion. Archival sources from the 18th and 19th centuries as well as oral histories document varying conjunctions of pastoralism and foraging in the economies of both Khoisan and Bantu-speakers that existed in precolonial time and characterize the region to this day. These sources also confirm the continued involvement of these peoples in ancient intracontinental trade networks that were not dominated by European colonial merchants until the second half of the 19th century. As a result of these studies, relations among hunters and herders in the Kalahari are shown to be both of longer duration and more integrated than has been thought.

The Context of Initial Pastoralism

Excavations of Late Stone Age (LSA) sites in the Kalahari reveal forager subsistence patterns differing from those recorded ethnographically among San in the region. Brooks and Helgren (*5*) report that, in at least some LSA sites in the Makgadikgadi Pans area, fish and other aquatic resources complemented land animals in the subsistence of foragers between 4000 and 2000 years ago. At Lotshitshi, on the southeastern edge of the Okavango Delta, a LSA stratum dating within this period was found to contain fish, bullfrogs, and turtles along with large land mammals. Reconnaissance in the Makgadikgadi complex located over 50 additional LSA sites; two of these include small quantities of Bambata ceramics in their assemblages; eight others contain somewhat later EIA Gokomere or Kumadzulo pottery types. At Bambata Cave, in Zimbabwe, ceramics with remains of domesticated sheep are dated tentatively as early as the second century B.C. (*6, 7*). Maunatlala, in eastern Botswana, has ceramics and pole-and-clay hut remains at the end of the fourth century A.D. (*8*).

The middle LSA level of Lotshitshi dates in the third century A.D. Faunal remains from this component indicate a broadly based economy including cattle (*B. taurus*) along with zebra, wildebeest, duiker, warthog, smaller game, and fish. Ceramics from this site are too fragmented for accurate identification, but their thin, charcoal-tempered fabric and finely incised decoration are compatible with Bambata types. Farther westward, in Namibia, ceramics (not Bam-

J. R. Denbow is associate professor of anthropology, University of Texas, Austin, TX 78712; E. N. Wilmsen is professor of anthropology in the African Studies Center, Boston University, Boston, MA 02215.

bata ware) were present before A.D. 400 at Mirabib (with domestic sheep) and Falls Rock (*9*). Of the sites mentioned thus far, only Maunatlala has yielded evidence of metal use.

Radiocarbon dates placing sheep, and possibly cattle, but not metal, as far south as the Cape of Good Hope in the first century A.D. have been available for some years (*10*); consequently, a gap in data existed between these very early pastoralist manifestations in the far south and older centers north of the Okavango and Zambezi Rivers. The early pastoralist sites in the Kalahari and its margins begin to fill that gap. Consistent association of ceramics and domestic animals with LSA assemblages and their early dates indicate that pastoralist elements were introduced from the north into indigenous foraging economies here before the currently documented beginning of the Iron Age in southern Africa.

Recently acquired geomorphological evidence (Table 2) for fluctuating climates in the region has implications for these changes in LSA economies. At the Cwihaba caverns in western Ngamiland, periodically more humid climatic conditions are indicated by episodes of rapid sinter formation (*11*). In order to account for these episodes, Cooke (*12*) suggests that rainfall in western Ngamiland reached 300 percent of the present annual mean between 2500 and 2000 years ago and again around 750 years ago. In general, these dates parallel those obtained for the sequence of beach levels found around the Makgadikgadi, Ngami, and Mababe basins where a number of higher lake levels with intervening regressions are indicated between 3000 and 1500 years ago (*13*).

Although it cannot be assumed that these high lake levels were caused solely by increased rainfall, Shaw argues for generally wetter conditions over the delta at dates congruent with those of Cwihaba. He estimates that rainfall over the Okavango increased between 160 and 225 percent. Under such a regime, many currently ephemeral pans (*14*) and springs would also have contained more constant supplies of available water. Brain and Brain (*15*) found evidence, in the form of microfaunal proportions, for episodes of climatic amelioration between about 4000 and 500 years ago at Mirabib in Namibia. Thus, several independent studies indicate higher rainfall during the millennium embracing the initial spread of agropastoral economies through the region 2500 to 1500 years ago.

In recent years, studies of Khoe (Central Khoisan) languages have proliferated in the Kalahari; all lead to an estimate that Khoe diversification in this region began about 2000 years ago. Vossen (*16*) finds words for cattle and milking with apparent Proto-Khoe

Table 1. Chronology of food production in three areas of the Kalahari. Location refers to site number on Fig. 1. Association numbers represent 1, ceramics; 2, domestic animals; 3, grain cultivation; 4, metallurgy; and 5, external trade items present in a site; a dash indicates that the category is not present.

Location	Site	Association	^{14}C years ago	Date	Reference
		Western sandveld			
1	Xgi	- - - - -	110 ± 50	A.D. 1840	(*38*)
2	Otjiserandu	1- -4 5	140 ± 50*	A.D. 1810	
3	Kgwebe Hills	1234 5	<185	A.D. 1765	(*8*)
			195 ± 75	A.D. 1755	(*8*)
2	Depression	1- -4 -	305 ± 75	A.D. 1645	(*6*)
2			370 ± 75	A.D. 1580	(*6*)
2	Qomqoisi	1- - - -	420 ± 50*	A.D. 1530	
2	Depression	1- -4 -	470 ± 80	A.D. 1480	
1	Xgi	- - - - -	495 ± 45†	A.D. 1455	(*38*)
2	Nqoma	1234 -	860 ± 60*	A.D. 1090	
1	Xgi	- - - - -	810 ± 60†	A.D. 1140	(*38*)
2	Nqoma	1234 5	970 ± 50*	A.D. 980	(*8*)
			970 ± 50*	A.D. 980	
			970 ± 70*	A.D. 980	
			980 ± 60*	A.D. 970	
2	Nqoma	1234 -	1000 ± 60*‡	A.D. 950	
2		1234 5	1100 ± 80*	A.D. 850	(*8*)
4	NxaiNxai	12 -4 -	1150 ± 60*	A.D. 800	(*24*)
2	Divuyu	12 -4 5	1190 ± 70*	A.D. 760	
4	NxaiNxai	1- -4 -	1230 ± 50*	A.D. 720	(*24*)
2	Nqoma	1234 5	1220 ± 70*	A.D. 730	
2	Divuyu	12 -4 5	1220 ± 70*	A.D. 730	
2	Nqoma	1234 5	1290 ± 60*	A.D. 660	
2	Divuyu	12 -4 5	1330 ± 60*	A.D. 620	
			1330 ± 60*	A.D. 620	
			1370 ± 60*	A.D. 580	
			1400 ± 70*	A.D. 550	
		Eastern river system			
5	Toteng	- - - - -	<185	A.D. 1765	
			<185	A.D. 1765	
8	Gwi	- - - - -	235 ± 370§	A.D. 1715	(*37*)
2	Xaro	1- - - 5	360 ± 80	A.D. 1590	
5	Toteng	- - - - -	400 ± 100	A.D. 1550	(*37*)
7	Serondela	12 -4 5	800 ± 80	A.D. 1150	(*25*)
6	Matlhapaneng	1234 5	970 ± 50*	A.D. 980	
			1040 ± 50*	A.D. 910	
			1120 ± 110*	A.D. 830	
9	Hippo Tooth	12 - - -	1120 ± 190§	A.D. 830	(*24*)
10	Qugana	1- - - -	1190 ± 80	A.D. 760	(*8*)
7	Chobe	12 - - -	1190 ± 80	A.D. 760	(*24*)
		Eastern river system			
7	Serondela	12 - - -	1220 ± 80	A.D. 730	(*24*)
6	Matlhapaneng	1234 5	1260 ± 60*	A.D. 690	
			1270 ± 80*	A.D. 680	
6	Lotshitshi	12 - - -	1660 ± 100*§	A.D. 290	
8	Toramoja	- - - - -	2960 ± 50	1010 B.C.	(*5*)
6	Lotshitshi	- - - - -	3620 ± 270*§	1670 B.C.	
8	Gwi	- - - - -	4445 ± 60	2495 B.C.	(*37*)
		Eastern hardveld			
12	Toutswe	1234 -	450 ± 95	A.D. 1500	(*3*)
13	Domboshaba	12 -4 5	450 ± 80	A.D. 1500	
14	Broadhurst	12 -4 -	590 ± 50	A.D. 1360	(*39*)
13	Domboshaba	12 -4 5	490 ± 50	A.D. 1460	
12	Toutswe	12 -4 5	645 ± 95	A.D. 1305	(*3*)
15	Moeng	12 - - -	720 ± 125	A.D. 1230	(*40*)
12	Toutswe	12 -4 5	750 ± 95	A.D. 1200	(*3*)
15	Moeng	12 - - -	795 ± 75	A.D. 1155	(*40*)
12	Toutswe	12 -4 5	755 ± 75	A.D. 1195	(*24*)
16	Thatswane	1234 5	840 ± 75	A.D. 1110	(*24*)
17	Commando Kop	12 -4 -	835 ± 55	A.D. 1115	
18	Moritsane	12 -4 5	855 ± 75	A.D. 1095	(*6*)
22	Kgaswe	1234 5	860 ± 80	A.D. 1090	(*24*)
12	Toutswe	12 -4 5	860 ± 105	A.D. 1090	(*3*)
15	Moeng	12 - - -	880 ± 80	A.D. 1070	(*40*)
22	Kgaswe	1234 5	940 ± 80	A.D. 1010	(*24*)
			960 ± 80	A.D. 990	(*24*)
19	Maiphetwane	12 -4 5	960 ± 50	A.D. 990	(*24*)
17	Commando Kop	12 -4 -	970 ± 40	A.D. 980	
12	Toutswe	12 -4 5	990 ± 75	A.D. 960	(*24*)
20	Taukome	12 -4 5	995 ± 75	A.D. 955	(*24*)
15	Moeng	12 - - -	1007 ± 120	A.D. 943	(*40*)
16	Thatswane	1234 5	1025 ± 80	A.D. 925	(*24*)
14	Rraserura	1234 5	1130 ± 80	A.D. 820	
15	Moeng	12 - - -	1185 ± 120	A.D. 765	(*40*)
21	Thamaga	12 - - -	1190 ± 90	A.D. 760	(*37*)
20	Taukome	12 -4 5	1240 ± 80	A.D. 710	(*24*)
22	Bisoli	12 -4 5	1240 ± 80	A.D. 710	(*6*)
20	Taukome	12 -4 -	1265 ± 80	A.D. 685	(*24*)
22	Bisoli	12 - - -	1340 ± 50	A.D. 610	(*6*)
15	Maunatlala	1- - - -	1570 ± 140	A.D. 380	(*8*)
21	Thamaga	- - - - -	4510 ± 130	2560 B.C.	(*37*)

*^{13}C/^{14}C ratio calibrated to correct date for fluctuations in atmospheric carbon. †Material dated was carbonaceous soil. ‡Material dated was carbonized seeds. §Material dated was bone.

roots in the Khoe languages of north central Botswana. Köhler (*17*) finds such words, along with a Khoe crop vocabulary, among the Kxoe (Khoe-speakers of northeastern Namibia). Both conclude that pastoralism must have been familiar to these peoples for a long time.

Ehret (*18*) also argues that the basic separation of Khoi and Central Khoisan languages took place in the Botswana-Angola border region shortly after 500 B.C. He proposed further, from lexical evidence, that the basic pastoralist vocabulary of southern Bantu is derived through a Khoisan intermediary in this area, implying that these Bantu-speakers, but not others farther north, acquired cattle and sheep from Khoisan-speaking peoples. Pfouts suggests diversification of the Bantu languages of Namibia and southern Angola beginning about 1500 to 2000 years ago, whereas Ehret and Kinsman specifically place diversification of Proto-southeast Bantu in the EIA of this time frame (*19*). These authors suggest that economic factors contributed to this process of linguistic differentiation; their conclusions are compatible with the archeological evidence regarding initiation of pastoralism and socioeconomic heterogeneity in southern Africa. Elphick (*20*) reconstructs historical data to reach a similar conclusion.

The Early Iron Age

The western sandveld. The presence of Iron Age agropastoral communities in the Kalahari by the middle of the first millennium is now attested for Ngamiland as well as for eastern Botswana. At Tsodilo Hills, in the sandveld, 70 kilometers west of the Okavango, extensive excavations have uncovered settlements that span the period from the 6th to the 11th centuries A.D. Ceramics (Fig. 2) from the earliest (A.D. 550–730) of these sites, Divuyu, indicate that it belongs to an EIA variant, the distribution of which appears to extend northward into Angola (*21*). There are no close parallels in known EIA assemblages to the south, either in Zimbabwe or South Africa. Common decoration motifs consist of multiple parallel bands of combstamping (*22*) separated by spaces that are either blank or filled-in with incised motifs. Divuyu ceramics are charcoal tempered but have substantial inclusions of calcrete.

A wide variety of iron and copper implements and ornaments were recovered from Divuyu but only a single stone tool. The presence of slag and bloomery waste indicates that metal working took place on the site. An amorphous scatter of friable burned clay fragments with stick impressions marks the probable location of a pole-and-clay hut. Fragments of perforated ceramic strainers indicate that salt was extracted from local sources. Unidentified marine shells provide firm evidence for coastal links, possibly through Angolan sites. Local trade with peoples of the Okavango system is indicated by the presence of fish bones and river mollusk shells (*Unio* sp. or *Aspartharia* sp.). Domesticated ovicaprids made up a large portion of the diet at Divuyu; domesticated *Bos* was rare. Large quantities of carbonized mongongo nut shells (*Ricinodendron rautanenii*) attest to the importance of foraging in the economy.

In the second Iron Age site at Tsodilo, Nqoma, a lower stratum contains Divuyu ceramics contemporary with the final dates at Divuyu itself. The major components at Nqoma stratigraphically overlie this material and are dated in the ninth and tenth centuries. Ceramics from these later components (Fig. 3) are uniformly charcoal tempered with few inclusions of other materials; decoration is most often applied as bands of interlocking triangles or in pendent triangles filled with hatching, combstamping, or linear punctuating. False-relief chevron designs occur frequently. Only a few dated sites are presently available for comparison. We see affinities with Sioma, in southwestern Zambia, and Dundo, in northeastern Angola, dated to the sixth through eighth centuries in the range of Divuyu and the beginning of Nqoma occupations at Tsodilo (*23*), but systematic ceramic comparisons of these sites have yet to be undertaken. Nqoma ceramics are similar to those from the ninth century site at Kapako on the Okavango River in Namibia; charcoal-tempered ceramics have been dated to the same period far out in the sandveld at NxaiNxai and are found in adjacent parts of Botswana and Namibia (*24*).

Table 2. Chronology of sinter formation and raised beach levels in late prehistoric northern Botswana. (Beach levels are in meters.) SIV is sinter formation IV.

Location	Formation	^{14}C years ago	Date	Material	Reference
Cwihaba	SIV	750 ± 100	A.D. 1200	Carbonate	(*12*)
Lake Ngami	934 m	1460 ± 80	A.D. 490	Calcrete	(*13*)
Makgadikgadi	912 m	1590 ± 70	A.D. 360	Bone	(*13*)
		1710 ± 35	A.D. 240	Shell	(*13*)
Lake Ngami	933.5 m	1970 ± 70	20 B.C.	Calcrete	(*13*)
Savuti	928.5 m	2020 ± 60	70 B.C.	Calcrete	(*13*)
Cwihaba	SIV	2200 ± 100	250 B.C.	Carbonate	(*12*)
		2550 ± 100	600 B.C.	Carbonate	(*12*)
Makgadikgadi	912 m	3130 ± 50	1180 B.C.	Calcrete	(*13*)

Evidence for metal working is attested at Nqoma by the presence of tuyeres as well as slag and bloom. Iron and copper ornaments are common and include finely made chains and necklaces with alternating links of copper and iron as well as bracelets with designs sometimes preserved by rust and oxidation. Moderate numbers of stone tools of LSA types are present. Dense areas of burned clay with pole and stick impressions mark the locations of substantial house structures.

Cattle (*Bos taurus*) were paramount in the pastoral economy of Nqoma; preliminary analysis suggests they outnumber ovicaprids by a factor of 2 (*25*). Bifid thoracic vertebrae indicate that at least some of these cattle were of a hump-backed variety. Carbonized seeds of sorghum (*Sorghum bicolor* caffra), pearl millet (*Pennisetum americanum* thyphoides), and perhaps melons (*Cucurbita* sp.) provide direct evidence for cultivation. Remains of wild game along with carbonized mongongo nuts and *Grewia* seeds indicate that foraging

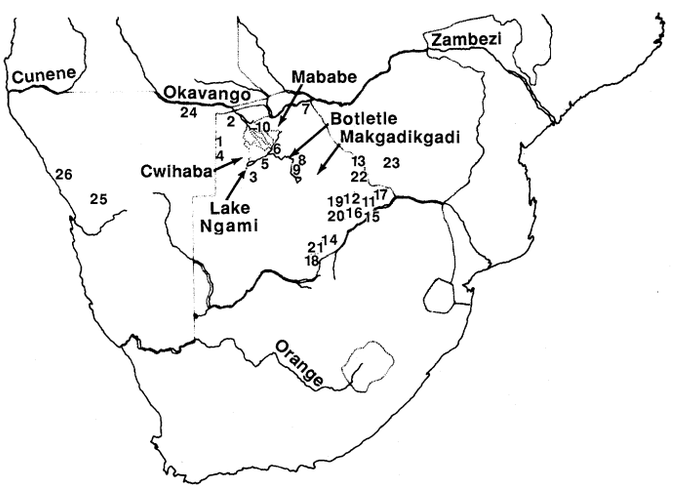

Fig. 1. Locations of sites mentioned in text. In Botswana, 1, Xgi; 2, Divuyu, Nqoma, Depression, Qomqoisi, and Otjiserandu at Tsodilo, and Xaro on the Okavango; 3, Kgwebe Hills; 4, NxaiNxai; 5, Toteng; 6, Matlhapaneng and Lotshitshi; 7, Serondela and Chobe; 8, Toramoja and Gwi; 9, Hippo Tooth; 10, Qugana; 11, Thakadu; 12, Toutswe; 13, Domboshaba; 14, Broadhurst and Rraserura; 15, Moeng and Maunatlala; 16, Thatswane; 17, Commando Kop; 18, Moritsane; 19, Maiphetwane; 20, Taukome; 21, Thamaga; and 22, Bisoli and Kgaswe. In Zimbabwe, 23, Bambata. In Namibia, 24, Kapako; 25, Mirabib; and 26, Falls Rock.

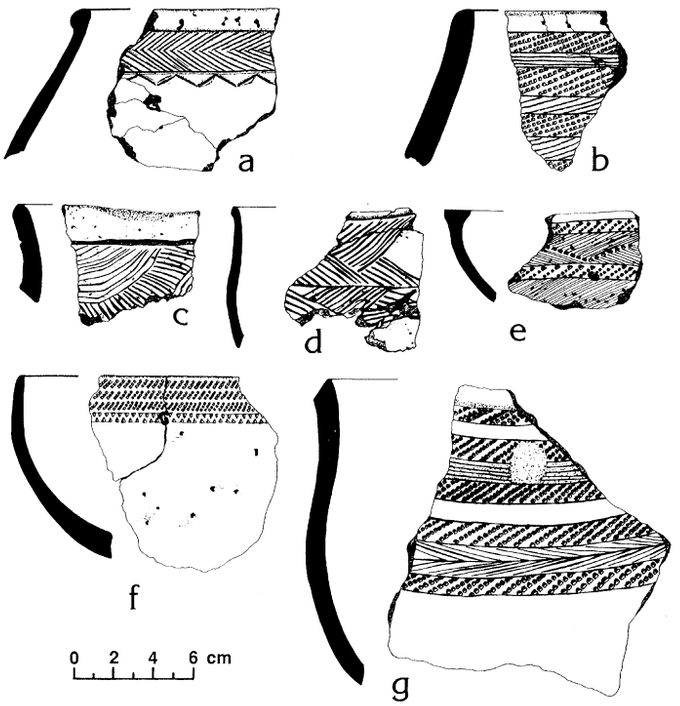

Fig. 2. Divuyu ceramics; design motifs are (a) incised herringbone band with triangle border; (b) alternating bands of oblique combstamping and hatched and parallel incision; (c) alternating curvilinear incision; (d) incised, interrupted, interlocking triangles; (e) lipped bowl with interlocking triangles bounded by combstamping; (f) unbounded combstamping with false-relief chevron border; and (g) alternating blank, combstamped, and parallel and herringbone incised bands.

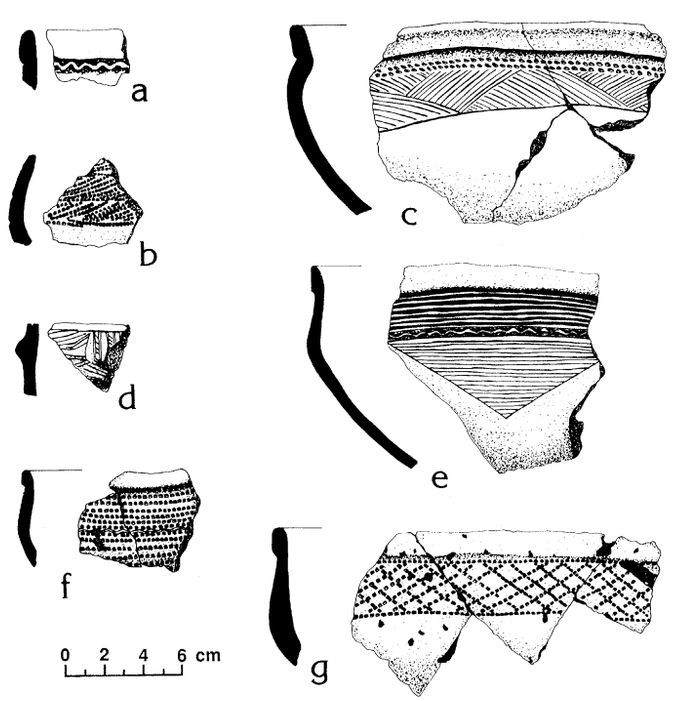

Fig. 3. Nqoma ceramics; design motifs are (a) thickened rim with false-relief chevron; (b) appliquéd stud with incised design; (c) incised, interlocking triangles with variant false-relief chevron; (d) multiple bands of oblique combstamping; (e) pendant triangles filled with parallel incising set off by false-relief chevron; (f) horizontal combstamping with false-relief chevron; and (g) thickened rim with band of cross-hatched combstamping.

continued to form an important part of the diet of this Iron Age population. Fish bones and river mollusk shells document continuing trade connections with the Okavango to the north and east.

Many glass beads and marine shells, primarily cowrie, along with worked ivory, one piece in the shape of a conus shell, provide evidence that Nqoma was an important local center in an intracontinental trade network extending to the Indian Ocean in the ninth century (*26*).

The river systems. Although the origins of the EIA communities at Tsodilo point consistently northward to Angola, contemporary agropastoralist sites on the eastern margins of the Okavango Delta as well as on the Chobe River belong firmly within the Kumadzulo-Dambwa complex documented by Vogel (*27*) for the Victoria Falls area. This complex forms a regional facies of the widespread Gokomere tradition of western Zimbabwe and northeastern Botswana. Kumadzulo-Dambwa complex ceramics and small clay figurines of hump-backed cattle were found at the eighth century site of Serondela, on the Chobe River, and cattle bones along with LSA lithics and similar ceramics were recovered at Hippo Tooth on the Botletle River dating to the early ninth century. At the island site of Qugana, in the eastern delta, the same ceramic complex with burned, reed-impressed clay hut remains dates to the eighth century; as yet, no domestic fauna have been recovered from this site.

Matlhapaneng, on the southeastern Okavango, is an extensive site dated between the late seventh and tenth centuries, contemporary with the Nqoma sequence at Tsodilo. Ceramics are charcoal tempered with Kumadzulo-Dambwa decoration motifs (Fig. 4). Pole-and-clay structures, iron, copper, and ivory ornaments, slag, and bloomery waste mark this as a fully formed EIA community. LSA stone tools are also present. Although this site is not as rich as Nqoma, long-distance trade connections are attested by the presence of cowrie shells and glass beads. Carbonized remains of sorghum (*S. bicolor* caffra), millet (*P. americanum* typhoides), and cow peas (*Vigna unguiculata*) provide evidence for agriculture; cattle and ovicaprids dominate faunal remains. Foraging was important here as it was at Tsodilo; carbonized marula (*Sclerocarya caffra*) and *Grewia* seeds are present and wild animal remains are common.

The eastern hardveld. Similar developments took place simultaneously in the eastern hardveld where thick kraal dung deposits vitrified by burning have been found at more than 200 sites, indicating that large herds were kept in the region. The same EIA suite of materials already described is present, although ceramics are of Gokomere-Zhizo types with affinities eastward to Zimbabwe and northern Transvaal. East coast trade, documented by glass beads and marine shells, is dated in the late first millennium at a number of these sites as well as at contemporary sites in Zimbabwe and the Transvaal.

Major chiefdoms developed along this eastern margin of the Kalahari at the end of the first millennium, marking a transition to later centralized state development. A tripartite hierarchy of settlement size and complexity is discernible at this time. Large towns of approximately 100,000 square meters, Toutswe, K2, and Mapungubwe, dominated extensive hinterlands containing smaller villages and many small hamlets. Rulers of these chiefdoms succeeded in controlling the Indian Ocean trade into the Kalahari; it is possible that a system supplying valued goods in tribute to these chiefdoms from the western sandveld was instituted at this time, displacing previous exchange relations in which foreign imports as well as local exports had circulated widely.

Supporting evidence for changes in social relations of economic production is found in a comparison of age distributions of cattle and ovicaprid remains at the middle-order sites, Nqoma, Matlhapaneng and Taukome, with those at the capital towns, Mapun-

gubwe and K2 (*28*). At the first set of sites, a bimodal culling pattern is found similar to that of present-day cattle posts in Botswana, where slaughter is highest in nonreproductive age classes. Such a strategy conserves breeding stock and emphasizes rates of herd growth rather than meat production. Producers and consumers of herd products at these sites probably belonged to the same local social units.

In contrast, at Mapungubwe and K2, both primary centers, the majority of cattle slaughtered were in prime age classes; offtake appears not to have followed the conservative strategy found at the secondary sites. In other studies (*29*), this form of distribution has been associated with differential social stratification among occupants of a site. This appears to be the most plausible explanation for the contrasting culling patterns observed in our study. Elites at primary centers appear to have been selective consumers of prime rather than very old animals, many of which would have been produced elsewhere.

The Kalahari in the Second Millennium

These eastern Kalahari chiefdoms collapsed around the beginning of the 13th century. Great Zimbabwe emerged at this time, supplanting the political role played earlier at Toutswe, K2, and Mapungubwe. The extent of this new hegemony is indicated by stone-walled Zimbabwe-Khami outposts found far out in the Kalahari on the margins of the Makgadikgadi Pans. Control of trade became the prerogative of this kingdom. The final component at Toutswe (A.D. 1500) is devoid of exotic goods and no long-distance trade items have been recovered from two rock shelters, Qomqoisi and Depression, excavated at Tsodilo and dated to the 16th and 17th centuries, nor in an upper stratum at Lotshitshi, which, though undated, probably falls in this period.

Glass beads reappear at Xaro in Ngamiland at the beginning of the 17th century. These and cowrie shells are abundant at the 18th century site, Kgwebe, as well as in a probably contemporary (though not yet dated) upper stratum at Nqoma. Portuguese, through their Atlantic trade into the Kongo and Angola, were the probable source of these beads, which reached the interior along trade routes that had functioned since the Early Iron Age (*30*). Many of the first Europeans to enter the region from the Cape record that this trade in Portuguese goods was active south of the Orange River and to the east at least as far as the Zambezi by the 18th century. Native peoples including San-speakers, not Portuguese themselves, are specified in these records as the interior agents of this trade (*31*).

Archival records as well as oral histories (*32*) testify to the importance of pastoralism throughout the Kalahari long before Europeans arrived. Every European who first observed the region from the 18th century on reports the presence of peoples of different languages, appearance, and group designation—Bantu and Khoisan—everywhere they went. Virtually every one of these Europeans remarks on the importance of pastoralism in all parts of the region and on the involvement of San-speakers in herding; several specifically mention San owners of livestock. Indeed, the herds of subsequently subjugated peoples were one inducement for Tswana expansion into Ngamiland in 1795 (*33*). So rich in cattle was the northwestern Kalahari that 12,000 head were exported annually from it alone to the Cape during the 1860's through the 1880's, while unknown but apparently large numbers of interior cattle had been supplied to the Atlantic trade since the late 18th century (*34*).

In addition to cattle, 100,000 pounds of ivory along with many bales of ostrich feathers and hides are recorded to have been exported annually from the region as a whole during those decades in exchange for guns, tobacco, sugar, coffee, tea, cloth, beads, and other European goods. These were newly developed markets, but the trade networks they followed were continuations of Iron Age systems. Both Khoisan- and Bantu-speakers are reliably recorded by many observers to have been thoroughly involved in production for precolonial regional exchange networks. When first seen by Europeans in the 19th century, the copper mines and salt pans of northern Namibia were exclusively under San control; 50 to 60 tons of ore were estimated to be taken annually from those mines and traded to Bantu smiths. Trade routes were linked to wider subcontinental networks. Salt, manufactured into loaves, was traded far into the interior and is reported to have been at least as important an exchange commodity as copper (*35*).

In extension of this economic activity, San are credited with producing the bulk of ivory and ostrich feathers exported through Bantu and Nama middlemen during the 19th century. Relations of production and exchange were thus not strictly bounded by ethnic or linguistic divisions but cut across them. More than anything else, it is this negotiable lattice of relations among peoples and production that characterizes the last two millennia in the Kalahari.

Discussion

We have summarized a large body of data pertaining to prehistoric and historic economies of Kalahari peoples, and those surrounding them, which has been accumulated by a number of investigators during the past decade. We have concentrated on the early introduction and subsequent local transformations of agropastoralism in the

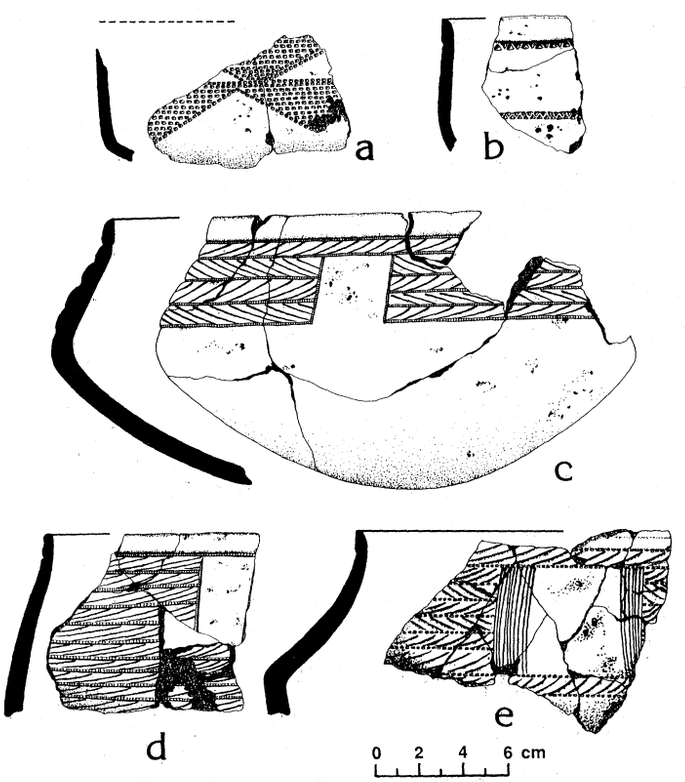

Fig. 4. Matlhapaneng ceramics; design motifs are (a) multiple bands of pendant triangles filled with horizontal combstamping; (b) two lines of false-relief chevrons; (c) carinated bowl with interrupted bands of alternating oblique incision set off with combstamping; (d) multiple interrupted bands of oblique incision bounded by combstamping; and (e) interrupted bands of alternating oblique incision bounded by combstamping and vertical line incisions.

region because these have been the least known aspects of those economies. Pastoralism has been treated in the ethnographies cited at the beginning of this article as if its history in and adjacent to the Kalahari has been recent and separate from that of indigenous foraging. A guiding assumption of these anthropological studies was that 20th-century foraging there is a way of life that has remained unchanged for millennia. Practitioners of these segregated economies have been rather strictly supposed to have had distinct ethnic and racial origins, in contact only for the last two centuries or less. This position can no longer be supported.

Many problems remain to be investigated. Much of the central Kalahari is unexplored archeologically, and the extent to which Iron Age pastoralism penetrated this area is unknown. A hiatus exists in our knowledge of the entire region between the 12th and 16th centuries. While large centralized states with many satellite communities flourished in the east, few if any sites are presently known for this period in the entire western half of southern Africa, with some possible exceptions at the Cape. Drier conditions may have led to shifts in settlement size and location, making detection of sites in the Kalahari difficult under present conditions. A reasonable hypothesis posits a concentration of population along the river systems and permanent springs leaving less densely peopled the drier hinterland, where foraging may have waxed and waned in accordance with changing environmental and regional economic conditions, particularly after European influence penetrated the region. It is unlikely that herders withdrew entirely from the sandveld; more likely, they at least continued to exploit seasonal surface water and grazing. At present, there is no evidence either to support or refute these propositions.

All of the peoples of the Kalahari during the past two millennia have been linked by extensive social and economic networks; thus, during this period of time, the Kalahari was never the isolated refuge of foragers it has been thought to be. It was the vastly intensified extraction of commoditized animal products in the colonial period, abetted by a drying climatic trend and stock diseases, especially rinderpest, which killed 75 percent of all cattle and antelope in southern Africa at the end of the 19th century, that combined to pauperize the region. These forces became factors leading to increased labor migration to the newly opened South African mines. In the process, the dues and privileges of earlier native states became increasingly translated into private family fortunes of a colonially favored aristocracy, while previously flexible relations among Khoisan and Bantu-speakers were transformed into ethnic categories defined by criteria of race, language, and economic class (*36*). The resultant divisions gave, to anthropological observers in the 20th century, the false impression of a Kalahari eternally empty, its peoples long segregated and isolated from each other.

An unresolved problem concerns the presence of Bantu-speakers in the western half of the subcontinent, a presence that now appears to have been more pervasive and much earlier than previously assumed. There is no doubt that the introduction of EIA economies from central Africa brought with it a complex interdigitation of peoples south of the Zambezi-Okavango-Cunene Rivers. In the eastern half of the subcontinent, it is well established that Iron Age Bantu agropastoralists gained a dominant position over indigenous foragers and pastoralists, ultimately subjugating, absorbing, or eliminating them. This did not happen in the west where, in fact, Khoi-speaking (Nama) herders dominated a large part of the area when first encountered by Europeans. It has been thought that a major reason for this difference lay in the short history of association of these peoples in the west. The perceived isolating severity of the Kalahari environment has been seen as a primary factor protecting San foragers from Bantu pastoralist domination. Neither supposition finds support in the research reported here.

This research has profound implications for understanding relations among contemporary southern African peoples. In particular, those relegated to the ethnographic categories "Bushman" and "hunter-gatherers" are seen to have a history radically different from that hitherto assumed. It is clear that, rather than being static, uniform relics of an ancient way of life, San societies and cultures have undergone transformations in the past 2000 years that have varied in place and time in association with local economic and political alterations involving a variety of peoples.

Two important consequences flow from this new understanding. The first forces reevaluation of models of social evolution based on assumptions brought to the anthropological study of these peoples. At the very least, ethnographic analogies formulated on modern San "foragers" and applied to studies of evolving social forms must be modified to take into account the millennia-long association of these peoples with both pastoralism and Bantu-speakers. Following on this, and more immediately important, is the need to bring the results of this research into the arena of policy planning. In this arena, San are routinely dismissed as rootless "nomads," without legitimate claim to full participation in modern national politics because they are conceived to be unprepared by history to cope with complex decisions involving economic and political alternatives. That this is no more true of them than of any other peoples should be clear in even this brief account of their recent past.

REFERENCES AND NOTES

1. Etymologies of the terms "Bushmen" and "San" are debated; a long-standing derogatory connotation is acknowledged for the first of these, but San, as also "Bantu," has acquired segregating racial and ethnic overtones. To avoid such implications, we use Khoisan and Bantu as adjectives to designate speakers of two different language families, retaining San only where necessary to specify peoples so labeled in ethnographies. We use Setswana spelling, in which *c* and *x* represent the front clicks and *q* the back clicks of Khoisan words.
2. L. Marshall, *The !Kung of NyaeNyae* (Harvard Univ. Press, Cambridge, MA, 1976); R. Lee, *The !Kung San* (Harvard Univ. Press, Cambridge, MA, 1979); J. Tanaka, *The San* (Univ. of Tokyo Press, Tokyo, 1980); G. Silberbauer, *Hunter and Habitat in the Central Kalahari Desert* (Cambridge Univ. Press, Cambridge, 1981); I. Schapera, *The Bantu-Speaking Tribes of Southern Africa* (Routledge, London, 1937); W. Hammond-Tooke, Ed., *The Bantu-Speaking Peoples of Southern Africa* (Routledge, London, 1974).
3. G. Okihiro, thesis, University of California, Los Angeles (1976); J. Yellen, *Archaeological Approaches to the Present* (Academic Press, New York, 1977); L. Lepionka, *Botswana Notes Rec.* **9**, 1 (1978).
4. In the absence of horn cores, it is usually not possible to distinguish sheep from goats osteologically; we use ovicaprid to designate the presense of sheep (*Ovis*) or goats (*Capra*) or both in our sites. When citing the work of others, we use published designations.
5. D. Helgren, *Ann. Assoc. Am. Geogr.* **74**, 298 (1984).
6. J. Denbow and A. Campbell, *Nyame Akuma* **17**, 3 (1980); N. Walker, *S. Afr. Arch. Bull.* **38**, 88 (1983).
7. T. Huffman [*Arnoldia* **8**, 23 (1978)] distinguished Bambata ware from Gokomere and Kumadzulo types by its more friable paste, thinner vessel walls, and generally simpler decoration.
8. J. Denbow and A. Campbell, *Sprache Gesch. Afr.* **7**, 83 (1986).
9. B. Sandelowsky, *Madoqua* **10**, 221 (1977); ———, J. van Rooyan, J. Vogel, *S. Afr. Arch. Bull.* **34**, 15 (1979); J. Kinahan, *S. Afr. J. Sci.* **80**, 273 (1984).
10. F. Schweitzer, *S. Afr. Arch. Bull.* **29**, 75 (1970); R. Klein, in *From Hunters to Farmers,* J. D. Clark and S. Brandt, Eds. (Univ. of California Press, Berkeley, 1984), p. 281.
11. Sinter is carbonate precipitate accumulated during moist conditions in underground caverns.
12. H. Cooke, *Geogr. J.* **143**, 431 (1975); D. Grey and H. J. Cooke, *Catena* **4**, 123 (1977).
13. H. Cooke, in *Late Cainozoic Paleoclimates of the Southern Hemisphere*, J. Vogel, Ed. (Balkema, Rotterdam, 1983), p. 265; K. Butzer, in *ibid.*, p. 235; H. Cooke and H. Verstappen, *Z. Geomorphol.* **28**, 1 (1984); P. Shaw, *Trans. Inst. Br. Geogr.* **10**, 333 (1985).
14. Pans are shallow depressions that fill with water when rain falls in their catchment basins.
15. C. Brain and V. Brain, *Madoqua* **10**, 285 (1977).
16. R. Vossen, *Botswana Notes Rec.* **16**, 19 (1984).
17. O. Köhler, *Sprache Gesch. Afr.* **7**, 205 (1986).
18. C. Ehret, *J. Afr. Hist.* **8**, 1 (1967).
19. ——— and M. Kinsman, *Int. J. Afr. Hist. Stud.* **14**, 401 (1981); A. Pfouts, "Economy and society in precolonial Namibia: A linguistic approach," paper presented at African Studies Association meeting, Boston, 6–10 December 1983.
20. R. Elphick, *Khoikhoi* (Yale Univ. Press, New Haven, 1975).
21. J. Dos Santos, Jr., and C. Ervedosa, *Estudos de Biologica* (Universidade de Luanda, Luanda, 1970).

22. Combstamping is a technique for impressing decoration into partially dry pottery before it is fired; a tool with an edge prepared to resemble a comb with stubby teeth is used.
23. J. Clark, *Publ. Cult. Mus. Dundo 62* (1963); *ibid. 78*; J. Vogel, *Zambia Mus. J.* **4**, 153 (1973); R. de S. Martins, *Contrib. Estud. Antropol. Port.* **9**, 243 (1976); C. Ervedosa, *Arqueologia Angolana* (Edicos 70 Limitada, Lisboa, 1980).
24. E. Wilmsen, *Botswana Notes Rec.* **10**, 5 (1978); in *Settlement in Botswana*, R. Hitchcock and M. Smith, Eds. (Heinemann, Marshalltown, 1982), p. 98; J. Denbow and E. Wilmsen, *S. Afr. J. Sci.* **79**, 405 (1983); J. Denbow, *S. Afr. J. Sci.* **76**, 474 (1980); in *Past and Present in Hunter Gatherer Studies*, C. Schrire, Ed. (Academic Press, Orlando, FL, 1984), p. 175; *J. Afr. Hist.* **27**, 3 (1986); B. Sandelowsky, *S. Afr. Arch. Soc. Goodwin Ser.* **3**, 52 (1979); J. Kinahan and J. Kinahan, "An archaeological reconnaissance of Bushmanland and southern Kavango," report to South West Africa Department of Agriculture and Nature Conservation (1984).
25. E. Voigt, "Tsodilo Hills, Botswana: report on identifiable faunal remains" (Transvaal Museum, Pretoria, 1982).
26. J. Sutton [*Hist. Assoc. Tanzania Pap.* **11** (1973)] argues that glass beads and sea shells found in the interior do not indicate important trade, although he concedes that Arab and Swahili on the coast grafted their trade onto much older interior networks dealing in iron, salt, and other goods; J. Vansina [*Hist. Afr.* 7, 293 (1980)] sees such networks as having an influence on Bantu expansion.
27. J. Vogel, *Kumadzulo: An Early Iron Age Village Site in Southern Zambia* (Oxford Univ. Press, London, 1971).
28. E. Voigt, *Mapungubwe* (Transvaal Museum, Pretoria, 1983); J. Denbow, thesis, Indiana University, Bloomington (1983).
29. M. Zeder, *Br. Arch. Res. Monogr.* **202**, 279 (1984).
30. D. Birmingham, in *History of Central Africa*, D. Birmingham and P. Martin, Eds. (Longman, London, 1983), p. 1; J. Miller, in *ibid.*, p. 118.
31. J. Alexander, *An Expedition of Discovery into the Interior of Africa* (Struik, Cape Town, 1967), facsimile edition of 1838 original; F. Galton, *The Narrative of an Explorer in Tropical South Africa* (Murray, London, 1853); D. Livingstone, *Missionary Travels and Researches in South Africa* (Murray, London, 1912; first published in 1857); C. Andersson, *The Okavango River* (Harper, New York, 1861); W. Oswell, *William Cotton Oswell* (Heinemann, London, 1900); E. Mossop, Ed., *The Journal of Hendrik Jacob Wikar (1779)* (The van Riebeck Society, Cape Town, 1935); *The Journals of Brink and Rhenius* (The van Riebeck Society, Cape Town, 1947); B. Tindall, Ed., *The Journal of Joseph Tindall, Missionary in South West Africa* (The van Riebeck Society, Cape Town, 1959).
32. A. Campbell, in *Settlement in Botswana*, R. Hitchcock and M. Smith, Eds. (Heinemann, Marshalltown, 1982), p. 13; E. Wilmsen, *Botswana Notes Rec.* **18**, 17 (1986).
33. T. Tlou, thesis, University of Wisconsin, Madison (1972); Q. Parsons, in *The Roots of Rural Poverty in Central and Southern Africa,* R. Palmer and Q. Parsons, Eds. (Univ. of California Press, Berkeley, 1977), p. 113.
34. J. Chapman, in *Travels in the Interior of Africa*, E. Tabler, Ed. (Balkema, Cape Town, 1971); J. Esterhuyse, *South West Africa, 1880–1894* (Struik, Cape Town, 1968); A. Kienetz, *Int. J. Afr. Hist. Stud.* **10**, 553 (1977).
35. C. H. Hahn, in *Tagebücher 1843–1860*, B. Lau, Ed. (Archeia, Windhoek, 1984).
36. T. Tlou, in *Slavery in Africa*, S. Miers and I. Kopytoff, Eds. (Univ. of Wisconsin Press, Madison, 1978), p. 367; E. Wilmsen, *Rev. Anthropol.* **10**, 9 (1983).
37. L. Robbins, *Botswana Notes Rec.* **16**, 1 (1984); *ibid.* **17**, 1 (1985).
38. A. Brooks, A. Crowell, J. Yellen, "‡Gi: A Stone Age archaeological site in the northern Kalahari Desert: Botswana," paper presented at the Eighth Pan-African Congress on Prehistory and Quarternary Studies, Nairobi, 9 September 1977.
39. J. Denbow, *S. Afr. Arch. Bull.* **36**, 66 (1981).
40. T. Molyneux and T. Reinecke, *ibid.* **38**, 99 (1983); D. Kiyaga-Mulindwa, "Moeng I: A Tswana Early Iron Age site in central Botswana," paper presented at Ninth Pan-African Congress on Prehistory and Related Studies, Jos, Nigeria, 12 December 1983.
41. Our work has been supported by the National Science Foundation, the Social Science Research Council, the Wenner-Gren Foundation for Anthropological Research, the Max Planck Institut, Seewiesen (West Germany), and the Government of Botswana. G. Turner, Transvaal Museum, Pretoria, identified faunal remains; J. de Wet, University of Illinois, Urbana, identified plant remains; and B. Boudreau and F. Touhey prepared the drawings.

New Production Techniques for Alberta Oil Sands

MAURICE A. CARRIGY

Low world oil prices represent a serious threat to expanded commercial development of the Canadian oil sands in the near term, as they do to all of the higher cost alternatives to crude oil such as oil shales and coal liquefaction. Nonetheless, research and field testing of new technology for production of oil from oil sands are being pursued by industry and government in Alberta. New production technology is being developed in Canada to produce synthetic oil from the vast resources of bitumen trapped in the oil sands and bituminous carbonates of northern Alberta. This technology includes improved methods of mining, extraction, and upgrading of bitumen from near-surface deposits as well as new drilling and production techniques for thermal production of bitumen from the more deeply buried reservoirs. Of particular interest are the cluster drilling methods designed to reduce surface disturbance and the techniques for horizontal drilling of wells from underground tunnels to increase the contact of injection fluids with the reservoir.

ALTHOUGH THE WESTERN WORLD APPEARS TO HAVE ABUNdant supplies of low-cost light oil at the present time, evidence suggests that these resources will be depleted in the not too distant future and the Western world will have to use a lower grade of hydrocarbon to satisfy its need for liquid fuel. Whenever this occurs, vast resources of heavy oil, extra heavy oil, and tar sand are available. In North America the largest concentrations of extra heavy oil and bitumen are located in the Province of Alberta, Canada, where more than 1×10^{12} barrels of bitumen are present at shallow depths in four major oil sand (tar sand) deposits (Fig. 1).

Most of this bitumen is in sands of Lower Cretaceous age buried too deeply for mining, but 10% is close enough to the surface to be mined by open-pit methods (*1*). In 1967, the first open-pit mining extraction and upgrading plant (designed to produce 45,000 barrels of synthetic oil per day) began production 390 km north of Edmonton, and in 1978 a second plant twice as large was built 10 km northwest of the first one. Subsequently, these plants have expanded, and together they now produce more than 170,000 barrels per day of synthetic oil, or 15% of Canada's total oil

The author is acting chairman of the Alberta Oil Sands Technology and Research Authority, Edmonton, Alberta T5J 3L8, Canada.