

Indigenous knowledge on 'siella' and its role in the farming systems of northern Ghana

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SUMMARY

An informal survey covering 32 villages in the Northern, Upper East, and Upper West Regions and involving over 250 men, women, and children was conducted to ascertain the indigenous knowledge on 'siella', a soil type licked by domestic animals and wild life. Samples of the soil were collected in several locations and analyzed for available macro- and micro-mineral content. The soil was found to be alkaline. Sodium and potassium content was 10-15 times higher than that in ordinary soils of the zone. Variation in mineral content was high across locations ranging from 0.0 to 6.83 mg/kg for phosphorus, and 64.97 to 7,485.5 mg/kg for calcium. The soils were found to be totally devoid of phosphorus in locations within the Upper West, and micro-mineral concentration was low in all locations. The soil is well known in the northern part of Ghana and is believed to play a vital role in the health and productivity of animals. Cows on 'siella' give birth to heavier calves and milk better. The soil has curative properties and stops diarrhoea. It is also believed to give good health and strength to aged humans.

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Introduction

About 70 - 75 per cent of Ghana's ruminant population is found in the northern part of Ghana, comprising the Northern Region (NR), Upper East Region (UER), and Upper West Region (UWR). In a predominantly mixed crop/livestock system with a relative abundance of fodder in the rainy

RÉSUMÉ

KARBO, N., BRUCE, J., LANGYINTUO, A., DITTOH, S. & YIDANA, J.: *La connaissance indigène de "siella" et son rôle dans les systèmes d'agriculture au nord du Ghana. Une enquête informelle embrassant 32 villages dans les régions du Nord, du Nord-Est et du Nord-Ouest et comprenant plus de 250 hommes, femmes et enfants, était faite pour vérifier la connaissance indigène de "siella", une espèce de sol léché par les animaux domestiques et la faune. Des échantillons du sol étaient prélevés de plusieurs emplacements et analysés pour le contenu disponible de macro-minéral et de micro-minéral. Le sol se prouvait alcalin. Le contenu de sodium et potassium était 10-15 fois plus élevé que celui des sols ordinaires de la zone. La variation du contenu minéral était élevée à travers les emplacements variant de 0.0 à 6.83 mg/kg pour le phosphore et de 64.97 à 7,485.5 mg/kg pour le calcium. Les sols se prouvaient entièrement dépourvu de phosphore aux emplacements du Nord-Ouest et la concentration micro-minérale était faible à tous les emplacements. Le sol est bien connu dans le secteur nord du Ghana et on croit que ça joue un rôle essentiel dans la santé et la productivité des animaux. Les vaches femelles mettent bas aux veaux plus lourds et traitent les meilleures. Le sol a des propriétés curatives et traite la diarrhée. On croit aussi que le sol donne la bonne santé et l'énergie aux êtres humains plus âgés.*

season and scarcity in the dry season, extensive management practices are used in animal rearing. Owing to declining soil fertility in most parts of the zone, essential minerals like sodium (Na), potassium (K), calcium (Ca), phosphorus (P), copper (Cu), and zinc (Zn) are at low levels in both soil and plant, and subsequently in animal

tissue. Animals using pastures on such soils may also record subnormal levels of essential minerals in tissues with varying degrees of deficiency (Underwood, 1981).

The use of conventional mineral supplements in the form of salt licks, bone meal, and dicalcium phosphate, for example, is often recommended to provide mineral supplementation to animals. However, in most parts of the hinterland, these products are unavailable and even in the urban centres where they may be found, the price is often prohibitive. Most of the livestock in the zone is reared by smallholders who cannot afford the supplements. However, with increasing human population and consequent increasing cropping pressure on available lands in certain areas of northern Ghana, the extensive system of management is slowly giving way to semi-intensive and intensive systems. Under these conditions, the provision of mineral supplements to the animals becomes important.

Wild and domestic animals, principally cattle on natural pastures, are observed licking clayey soil in certain locations on the range. This clayey soil, known as 'siella' in the Dagaari language of the UWR, is found along the banks of streams and in some valley areas. An initial analysis of one sample showed appreciable levels of some macro- and micro-minerals. Though the soil is seemingly well known by the rural communities, no studies have been conducted on it. Further, indigenous knowledge about the use of 'siella' as a natural resource for humans and animals has never been documented.

This paper reports on the spatial occurrence of 'siella', its chemistry, and the indigenous knowledge of its use by human beings and animals as a prelude to any detailed biological studies aimed at properly managing this natural resource.

Materials and methods

Coverage

Informal surveys were conducted by a multidisciplinary team of scientists in 13 districts

covering the three northern regions (Fig. 1).

A total of 32 villages was covered in the survey and over 250 men, women, and children (cow herders) drawn from 11 ethnic groups were interviewed. No advance notice of visits was given. Group discussions and individual interviews were used. Besides farmers, key informants such as extension frontline staff, district extension officers, district veterinary officers, and teachers in the study locations were interviewed.

Data collection

The surveys were carried out in the wet and dry seasons of 1995 and 1996. In each region, translation was provided by a member of the team comprising a socio-economist, horticulturist, and animal scientist. Discussions centered around the indigenous uses of 'siella', location of 'siella' spots, folklore and local names of the clay. A checklist was drawn as a guideline for the purpose. The team, together with farmer representatives or cattle herders, visited the 'siella' spots known as 'sielbaa', to gain a fair understanding of their location in the agro-ecological system.

'Siella' samples were collected from over 18 'siella' sites (Fig. 1) and packed in polythene bags for chemical analysis.

Chemical analyses

The 'siella' samples collected were air-dried in shade, ground in a mortar, passed through a 2-mm sieve and analyzed for pH, P, Ca, magnesium (Mg), K, Na, manganese (Mn), Zn and Cu. The minerals were analyzed at the Chemistry Laboratory of Savannah Agricultural Research Institute (SARI) according to Perkin-Elmer Corp. (1968) procedures. The pH was determined in 0.01 M CaCl₂. Exchangeable cations (Ca, Mg, K, and Na) were extracted with neutral (pH=7.0) ammonium acetate, while Zn and Cu were extracted with 0.1 M HCl. The Ca, Mg, Zn, and Cu concentrations were determined by using the Perkin-Elmer Model 1100 Atomic Absorption Spectro-photometer (AAS) flame technique. The Eppendorf Flame

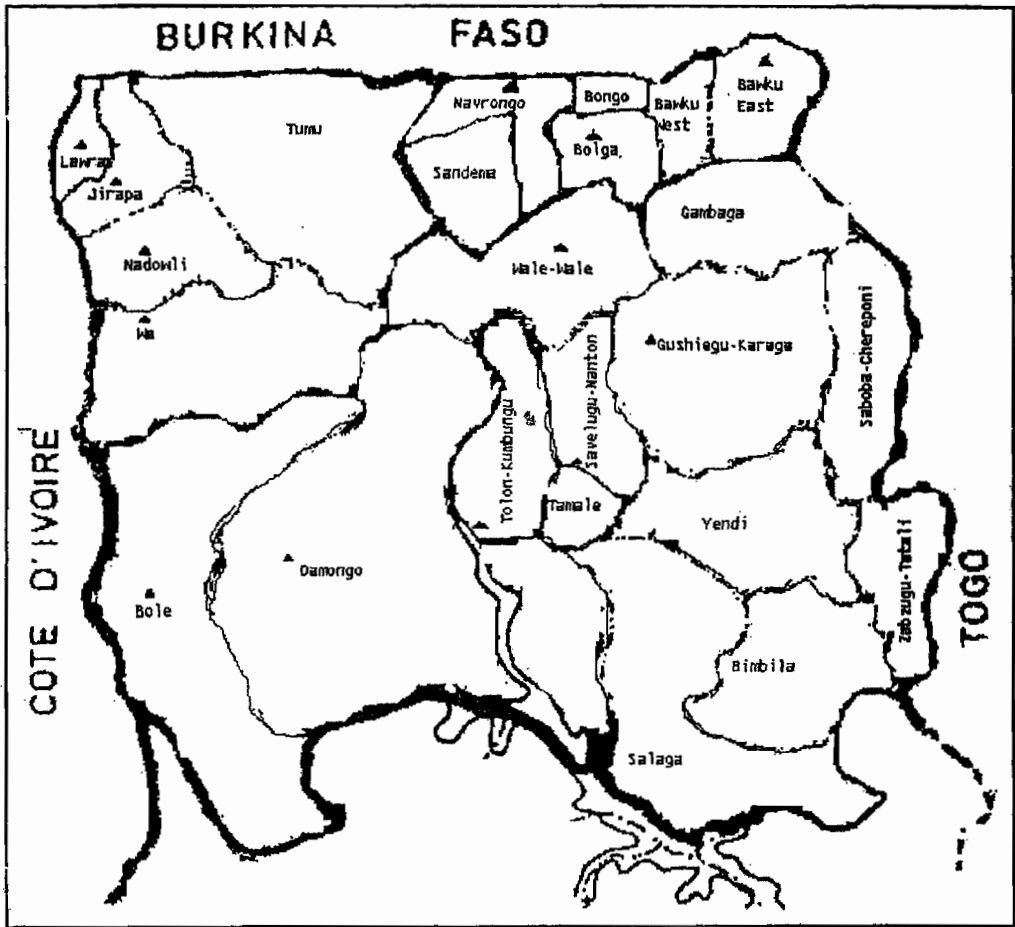


Fig. 1. Sketch map of northern Ghana indicating survey districts of 'siella' locations.

- | | | | | |
|------------------------|-------------------|-----------------------|------------------------|------------------------|
| Lawra | Nadowli | Kasena-Nankana | Tolon-Kumbungu | Gushiegu-Karaga |
| ● Gorziiri | ● Goli | ● Naakong | ● Dundo | ● Digbilla |
| ● Olbiri | ● Tabiasi | ● Naaga | ● Balinkpen | |
| ● Zinkaa | ● Serekpere | | ● Wayamba | |
| ● Tanchara | ● Tangasie | Bawku East | Savelugu-Nanton | Bole |
| ● Zimuopari | ● Issah | ● Naanbina | ● Tampion | ● Nyange |
| | | ● Ninkong | ● Diare | |
| Jarapa/Lambusie | Wa | ● Garu | ● Zoonayili | |
| ● Tigboro | ● Busa | ● Tahin | | |
| ● Akoro | ● Mangwe | | | |
| ● Yaga | ● Gorpie | Damongo | West Mamprusi | |
| ● Dahile | | ● Mole Game Reserve | ● Walewale | |
| ● Lambusie | Bolgatanga | | | |
| ● Dandanprugu | ● Zanlergu | | | |
| | ● Tongo | | | |

photometer was used to determine Na and K concentrations. Available P was extracted by using the Bray-1 extraction method. The P concentration was determined by using a Philips UV-Visible single beam spectrophotometer (PU 8600 series).

Data analysis

The data from the participatory discussions were treated to a qualitative descriptive analysis.

Interview and questionnaire responses were transformed into sample frequencies and expressed as percentages. Quantitative data from the chemical analysis of 'siella' were assembled in table form for comparison.

The variation between 'siella' spots in macro- and micro-mineral content was assessed by computing simple arithmetic means, standard deviations (SD), ranges, and coefficient of variation (CV).

Results and discussion

Local nomenclature

The soil, which is well known locally, is called 'siella' in Dagaari and 'lela' in the Sisala language of the UWR. Names in the UER include 'dindali', 'dielim' and 'daarim' in Kussal, 'mura' in Kassena, 'dagliga' in Nankana, and 'nagdaga' in Dagbani language of the Northern Region (Table 1). The name used for 'siella' in the different languages is not the same as the word for other ordinary clays. Particularly in some parts of the UWR and UER, distinction is made between 'da-arim' or 'siella' and 'dogo', 'yagdi' or 'yagra', the ordinary type of clay used for pottery and eaten by humans and not by animals. The literary meaning of these names in the local language could not be explained.

However, 'lela' ('siella' in Sisali) suggests a licking substance.

Characteristics of 'siella' spots

Physically, 'siella' is smooth, soft to the touch, and has very slow permeability. Most 'siella' spots were found in flood-prone areas and their colour varied from place to place. 'Siella' deposits in valleys were white while those on hills or upland areas tended to be reddish brown. Eighty-nine per cent of all 'siella' spots visited were located in valleys. Licking starts on the soil surface and openings created could reach depths of more than 2 m. In areas with many ebony trees, 'siella' tended to be black. Some 'siella' spots were relatively

TABLE 1
Survey Areas in Northern Ghana and Local Names of 'Siella'

Region	District	Village	Local name
Northern	Tolon Kumbugu	Nyankpala	Nagdaga
		Wayamba	Nagdaga
	Savelugu Nanton	Tampion	Nagdaga
		Zoonayili	Nagdaga
Upper West	Gushiegu Karaga	Digbilla	Nagdaga
		Jirapa/Lambussie	Siella
	Lawra	Akoro	Siella
		Yaga	Siella
		Lambussie	Lela
		Dahile	Siella
		Dandanprugu	Lela
		Goziir	Siella
	Nadowli	Betaglo	Siella
		Ko	Siella
		Zinkaa	Siella
		Tanchara	Siella
Goli		Siella	
Tabiasi		Siella	
Upper East	Bawku East	Nadowli	Siella
		Serekpere	Siella
		Tangasia	Siella
		Issah	Siella
	Kassena Nankana	Garu	Dandali, dielim and/or darim
		Tanhin	Dandali, dielim and/or darim
		Naanbina	Dandali, dielim and/or darim
		Ninkong	Dandali, dielim and/or darim
		China	Mura
		Naakong	Mura
Bolga	Korlogu	Mura	
	Naaga	Mura	
	Zalergu	Dielim	
	Tongo	Dindali	

close to the village, while others were about 3.5 - 4 km from the village. Animals that had been newly brought into a village had no problem locating 'siella' spots. Animals instinctively find 'siella' spots, but are not easily identifiable by humans unless first located by animals.

The grass cover at most 'siella' spots was minimal with patchy bare ground dominating. Trees and shrubs found to be common at the various sites were *Balanite aegyptica*, *Diospyrus* sp., three different species of *Acacia* (known as 'Gorpela', 'Gorsebla' and 'Gorzie' in Dagarti) and *Anogeissus leicarpus*. When arranged in order of decreasing frequency of occurrence, the arrangement was as follows:

'Gorpela' > 'Gorzie' > Ebony > *Balanite*
> 'Gorsebla' > *Anogeissus*.

Vegetation, especially grasses, does not grow directly on 'siella' spots presumably due to the high salt/mineral content.

However, high grazing pressure due to the heavy presence of wild life and domestic animals could also account for the loss of most plant species at 'siella' spots. Farmers also believed that most crops when planted close to or on 'siella' sites do not survive. This could be attributed to the high concentration of various salts/minerals in these areas. Such spots are therefore usually not cropped. The frequent passage of animals to 'siella' spots usually creates special paths to the spots especially noticeable in the cropping season.

Chemical composition of 'siella'

Table 2 presents the chemical analysis of 'siella'. 'Siella' was generally found to be basic. The pH ranges from 4.1 (extremely acidic) to 9.0 (strongly alkaline). However, only 11 per cent of samples had pH between 4.1 and 4.6. The pH of the remaining 89 per cent was between 7.6 and 9.1. The available P content of the 'siella' deposits was found to be low, with 55 per cent of the samples being totally devoid of the available mineral. The highest P content at Gorpie (UWR) was 6.83 mg/kg. The Na content of 'siella' ranged from 309.63

to 15287.77 mg/kg. There was similar variation in K, Ca, and Mg contents. The macro-mineral contents in 'siella' for Na and K were found to be 10-15 times higher than those in ordinary soils in the zone. This most probably explains why animals tend to lick 'siella' and not other soil types.

The concentration of available micro-minerals, Mn, Zn and Cu, was found to be relatively low in all samples, compared to normal dietary requirements for animals. However, since 'siella' is consumed *ad libitum* by ruminants as supplement to grazing, the cumulative effect could be useful to the animals *via* the rumen endoecology.

Use of 'siella' by animals

Animal behaviour. 'Siella' is eaten by cattle, sheep and goats, though it is thought to be most preferred by cattle. Animals need to be introduced to more orthodox commercial salt licks. However, they naturally accept 'siella'. In the rainy season animals are herded to 'siella' spots to avoid crop damage, but go there on their own in the dry season when herding is not practised. Some respondents (50 %) to the questionnaire used at Nadowli indicated that equal use was made of 'siella' during the dry and the wet seasons. Others felt that 'siella' was mostly used during the dry season. Animals naturally pick up the 'scent' of 'siella' and rush to it.

'Siella' is consumed only after grazing and usually towards the afternoon. Animals tend to sleep immediately afterwards, a sign of contentment. This appears to coincide with the rest period during grazing and could enhance rumen activity for effective digestion of forages consumed during the morning part of the grazing day. Fig. 2 shows the general pattern of grazing and visiting of the 'siella' spots. During the rainy season, water covering a 'siella' spot is usually drunk first before other water sources are visited.

Lost animals can often be found at 'siella' spots. This fact is made use of by cattle rustlers to trap lost 'siella' spots as a place to steal mature animals. Hunters use such spots to trap wild animals.

TABLE 2
pH, Macro- and Micro-mineral Concentration in 'Siella' (n = 18)

Sample	pH	P	Macro-minerals (mg/kg)				Micro-minerals (mg/kg)		
			Ca	K	Na	Mg	Mn	Zn	Cu
1	7.64	4.58	4161.67	898.74	918.71	723.99	29.86	0.7	6.0
2	8.06	0.42	3572.50	103.85	2545.42	574.20	18.57	1.1	3.1
3	4.57	1.22	189.77	154.81	309.63	80.40	3.30	0.2	0.9
4	4.10	1.05	264.18	149.82	58.93	59.93	14.08	0.2	1.0
5	8.36	0.0	1087.13	244.80	15287.77	711.93	24.98	1.1	0.8
6	9.09	0.0	1460.95	214.7	6540.84	399.50	40.14	0.7	1.3
7	8.40	0.0	6227.51	169.93	3548.58	369.77	33.69	1.1	3.5
8	8.78	6.83	6176.35	898.74	4693.43	863.79	72.40	0.5	1.2
9	8.54	0.56	7485.52	1921.92	4392.97	908.55	145.77	1.6	2.3
10	8.86	0.0	5303.26	499.60	6045.16	794.36	85.43	0.9	2.3
11	8.45	0.83	2762.24	229.77	3396.60	536.96	35.76	0.5	1.8
12	8.64	0.0	571.04	47.96	2897.68	409.67	4.70	0.5	1.0
13	8.68	0.0	415.75	69.96	4447.33	542.17	5.90	1.1	0.7
14	9.12	0.0	1194.57	224.73	5693.17	656.71	6.39	1.7	2.0
15	8.74	0.0	607.65	63.91	3495.11	384.46	17.08	0.6	1.2
16	7.82	0.0	64.97	31.99	409.84	39.48	0.00	0.1	0.4
17	7.81	0.0	3791.21	349.65	6043.96	631.87	22.78	0.9	2.5
18	7.92	0.07	4338.93	339.52	3295.39	691.53	28.16	0.8	2.6
Range	4.1-9.09	0-6.83	64.97-7485.5	47.96-1921.92	58.93-15287.77	39.48-908.55	0-145.77	0.2-1.7	0.4-6.0
Mean	7.98	0.86	2759.73	367.46	4112.25	521.07	34.30	0.79	1.92
SD	1.36	1.79	2364.43	451.75	3349.04	257.19	36.69	0.44	1.34
CV %	17.0	208.0	85.6	123.0	81.4	49.4	106.97	55.70	69.79

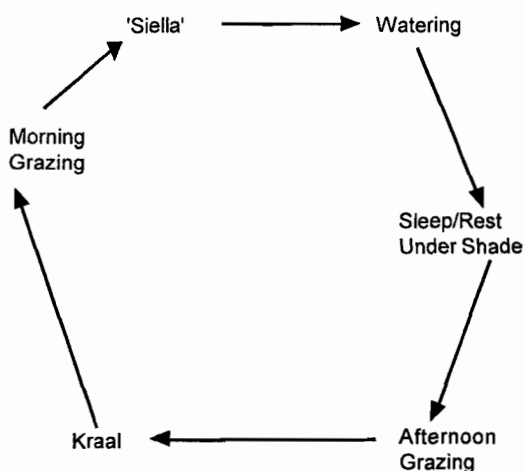


Fig. 2. Approximate grazing pattern and use of 'siella' by cattle.

areas like the Mole Park, 'siella' spots are heavily watched by game warders to prevent poaching.

The general opinion was that consumption of 'siella' gave some form of satisfaction to the animals. Some interviewees also believed some minerals in 'siella', when ingested by licking or through drinking water, were good for the health of the animal.

A Fulani herdsman interviewed at Manwe (UWR) indicated that his animals tended to rush to 'siella' spots when denied salt at home for a period of 2-3 months. The practice of tethering, which is widely used during the rainy season to prevent animals from destroying crops, restricts the animals to a few grazing plots and limits their access to 'siella' for a period of up to 5 months.

Effect on animals. 'Siella' is believed to prevent animals from straying. It also makes them heavier

and healthier. Those consuming it have glossier hair coats and give birth to heavier calves. Cows with access to 'siella' are better milkers and their milk is tastier. According to cow herders, mainly young boys, 'siella' smeared on the udder of a cow for a few hours 'tamed' the cow. 'Siella' also has a softening effect on the udder so that milking becomes less painful. A 'siella' solution is used as 'milk' to nurture orphaned kids. Premature kids are placed in pots sealed with 'siella' for a period of 3 days, as a sort of incubation procedure. The mechanism of the effect of 'siella' on premature kids or babies could not be immediately explained. The indication by Fulani herdsmen that 'siella', together with an epiphyte, when eaten by cattle improves reproduction could also not be readily explained. However, it is known that in cattle a direct relationship exists between saliva Na and K concentrations and fertility rate (Kalnitski, 1985). The feeding of common salt also improved ovulation in sheep (Wiesner, 1976). Karbo, Alebekiya & Bruce (1996) also observed more twinning in ewes fed on salt lick block compared to those denied the block.

Despite the good effects of 'siella' on animals, 'siella' is not collected and supplied to the animals at the farmstead for varied reasons. At Dahili in the Jirapa/Lambussie district of the UWR, for example, it is believed that something in 'siella' would evaporate when it is removed from its natural location such that it would lose its good characteristics. Others believed that the clay would lose its appeal if brought home while others indicated that the sheer quantities required would make it difficult to transport. Some farmers believed once the soil was available locally to the animals, there was no reason for going through the laborious process of conveying 'siella' to the homestead. However, at Dandampurgu (UWR), a centenarian indicated that until the early 20th century, lick blocks of 'siella' were made and kept at home to ensure that the animals always returned home. Horses were also provided with 'siella'. At that time, 'siella' could be purchased from the open market with 'mobi puma' (white cowrie shells) which

was then the medium of exchange.

Medicinal value. 'Siella' is widely believed to have some medicinal properties. It is used to stop diarrhoea, due most likely to its salt content which acts like Oral Rehydration Salt (ORS). At Tanli (UER), it was said that the direct consumption of 'siella' not only stopped diarrhoea, but also actually caused constipation if fed in excess quantity. It was further stated that when drunk in solution, 'siella' stopped diarrhoea without causing constipation. In an on-station study, 'siella' solution successfully stopped diarrhoea in 10 lambs and eight young rams (Karbo, 1996, unpubl. data).

'Siella' is also supposed to be a cure for stomach-ache. The survey in Dandampurgu and Tongo showed that people who ate 'siella' were generally strong and healthy. Farmers believed it enhanced physical fitness for farm work and delayed tiredness associated with physical exertion. It was lamented that weakness in old age which was considered to be common in the present generation was due to the excessive use of common salt and other artificial spices and additives.

Other uses of 'siella'

'Siella' dissolved in water is drunk by cow herders to quell hunger. Several comparisons were made indicating that 'siella' is seen as a form of milk for humans as well. The 'siella' locations also serve as meeting places for the shepherd boys for various contests and entertainment. The soil is also eaten in some areas by expectant women. At Naaga (UER), it can be purchased from the market.

Historically, 'siella' was used as salt in the UER and UWR before common salt appeared on the market from the south or Daboya in NR. It was not clear whether the Mossi traders at the time brought in common salt from the north. However, it is known that they returned from the south with salt and cola. To make use of the salt in 'siella', a suspension of it was filtered in calabashes or pots designed for the purpose. The resultant effluent was then used in making soup. Other sources

from locations in the UER and UWR indicated that powdered 'siella' mixed with ash from compacted animal droppings, mixed with water and drained served as salt. This was even traded in olden times. At Korlugu (UER), 'siella' water was also used to cook bean leaves. Women in certain areas in Korlugu and Zanlerigu (UER) still use 'siella' in their soups.

The use of fresh cow dung as building material for plastering walls of houses is well known in northern Ghana. This activity is often carried out solely by women. Women declared cowdung containing 'siella' as unsuitable for the purpose. They explained that 'siella' hardens the dung and reduces its elasticity and binding effect. Men in the survey area who also use cowdung (dried) for trapping termites also find it unsuitable when it contains 'siella'.

Folklore and proverbs

Many references are made to 'siella' in the local languages. Surprisingly, the use of the local words for 'siella' in proverbs was found only in the Dagaari language (Table 3).

Conclusion

Indigenous knowledge from the surveys carried out suggests that 'siella' could be a source of minerals (sodium salt) and other derivatives for

animals and humans. The licking of this clay by animals should, therefore, not be interpreted as a mere sign of mineral deficiency. 'Siella' could be a supplemental dietary mineral source. There is the need to conduct detailed economic and biological studies on the use of 'siella' by livestock to confirm and/or improve upon the traditional knowledge base.

Environmental considerations under the present management systems of 'siella' spots require urgent attention. 'Siella' sites are often the site of severe erosion due to animal activity. Local technologies to promote the controlled and sustainable use of these sites by animals and humans are at present lacking.

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TABLE 3
Local Sayings or Proverbs Involving 'Siella'

<i>Vernacular</i>	<i>Literal translation</i>	<i>Meaning</i>
Siella nuo na baar bar	Sweet 'siella' will finish goats	Some degree of danger is associated with sweet things, e.g. goats or other animals are easily stolen from 'siella' spots
Sielborg na beli bur	The 'siella' spot or site can deceive goats	This speaks of how humans or animals can easily be attracted by sweet things
Naab ton siella	A cow has accessed or touched or found 'siella'	A sign of satisfaction usually said when belching after a meal or drink
Na-zug mybaa sielbaan ba ga ka u ti wul zugri	The animal without a tail at the 'siella' spot has not gone there to display its tail	One must be focused or purposeful in life or in whatever one is doing

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