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Géographie physique et Quaternaire, vol. 42, n° 1, 1988, p. 89-96.

Géographie physique et Quaternaire, 1988, vol. 42, n° 1, p. 89-96, 8 fig., 4 tabl.

NOTES ON THE MORPHOLOGY AND GENESIS OF MUD POLYGONS ON MOUNT KENYA, EAST AFRICA*

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ABSTRACT Mud polygons forming in a valley train deposit in Teleki Valley on Mount Kenya were studied with respect to their physical, mineralogical, chemical and biological characteristics. Developing in fine-grained alluvium of postglacial age, those polygonal systems are composed of numerous, and nearly isomorphous units, that appear close to existing drainages in areas stripped of vegetation cover. Stream erosion and animal activity (particularly rodents and Mount Kenya hyrax, *e.g.* cony) appear to be primarily responsible for the loss of plant cover. Field tests show that periodic wetting and drying results in closure and reopening of polygonal cracks; freeze thaw activity was not observed to assist in developing polygonal ground shape. Subsequent laboratory tests on several samples confirm that the lack of expandable clay minerals might inhibit wetting-drying activity in individual polygon samples.

RÉSUMÉ *Notes sur la morphologie et la genèse des polygones de boue sur le mont Kenya, Afrique de l'Est.* Les polygones de boue, qui se forment dans les dépôts fluvio-glaciaires dans la vallée de Teleki sur le mont Kenya, ont été étudiés en fonction de leurs caractéristiques physiques, minéralogiques, chimiques et biologiques. Ces réseaux polygonaux, qui se développent dans des alluvions postglaciaires fins, sont composés de plusieurs unités presque isomorphes qui apparaissent près des chenaux d'écoulement là où il n'y a plus de couvert végétal. L'érosion fluviatile et l'activité animale (en particulier celle des rongeurs et le daman du mont Kenya) semblent être les principales causes de la perte du couvert végétal. Les expériences de terrain démontrent que les cycles mouillage-assèchement provoquent la fermeture et la réouverture des fissures polygonales; le phénomène gel-dégel ne semble pas contribuer au développement des sols polygonaux. Les tests de laboratoire subséquents faits sur plusieurs échantillons confirment le fait que l'absence de minéraux argileux dilatables peut empêcher l'opération mouillage-séchage de se produire dans les échantillons de polygones pris isolément.

INTRODUCTION

Mount Kenya, one of the principal mountains in East Africa, rises to 5199 m. It is situated about 180 km north of Nairobi, to the east of the Rift Valley and the fissured volcanic pile of the Aberdare Range (Fig. 1). It has been intensively glaciated at least five times during the Quaternary Period, and most U-shaped valleys are floored with late glacial or postglacial valley trains (Baker, 1967; Mahaney, 1979, 1981, 1982a and b, and 1984a and b). The formation of soil frost phenomena on Mount Kenya has been described by many investigators (Troll, 1958; Hedberg, 1964; Zeuner, 1949; Hastenrath, 1973, 1984), but no experimental work has been carried out to determine more about the physical setting and process by which mud polygons form in the Afroalpine area. Reconnaissance mapping in all the major glaciated drainages shows that mud polygon development in outwash deposits tends to increase in drainages with large populations of hyrax. In Teleki Valley (Naro Moru Drainage, Fig. 1a and b) a mud polygon system at site TV38 was studied along with the local soil flora (Site TV4), and fauna to determine the factors controlling the development of these interesting geomorphic features.

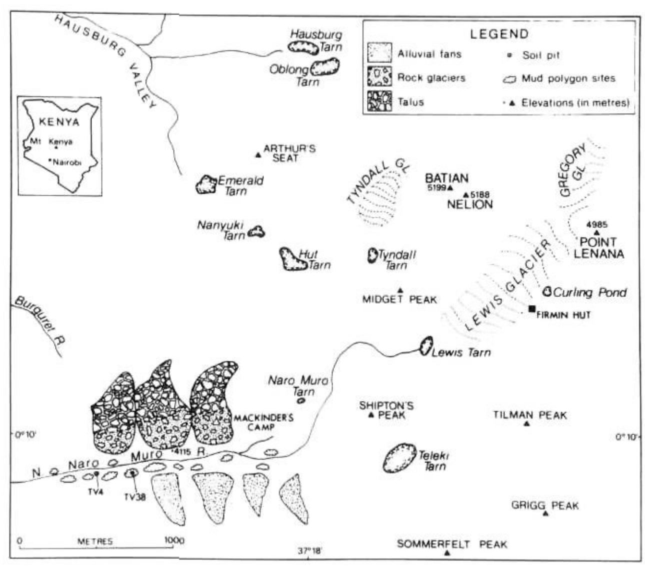

FIGURE 1a. Location of Mount Kenya and the study site.
Carte de localisation du mont Kenya et du site à l'étude.

FIELD AREA

Teleki Valley (Fig. 1a) is one of the classic U-shaped drainages radiating to the west from the Central Peaks area of Mount Kenya. Along the floor of this valley several mud polygon systems have formed in clay loam alluvium deposited sometime after 2000 years ago (Mahaney, 1984a and b). The gently

* Contribution du premier symposium de la CANQUA sous la direction de René W. Barendregt

Manuscrit reçu le 2 novembre 1986; manuscrit révisé accepté le 18 décembre 1986

sloping valley train surface merges with alluvial fan deposits which form the toeslopes and footslopes of the valley side topography (Mahaney, 1981, 1982a and b, 1984b). The bedrock in the Central Peaks area (Fig. 1a) consists of syenite, phonolite and porphyritic phonolite surrounded by basalt, tuff, and agglomerate which is presently being modified by intensive mass wasting (Mahaney, 1984a and b).

Climate

The Afroalpine area rises from ~3200 m to the summit of Mount Kenya at 5199 m (Fig. 1a). Precipitation derived from the Indian Ocean is delivered by the tropical easterly wind belt and classical and Atlantic monsoons. The southeast slopes are wettest with rainfall reaching 2500 mm (at 2250 m); the northern slopes are dry with ~1,000 mm annually. On the western flank of the mountain, precipitation increases from ~500 at Naro Moru (2000 m) to ~1000 mm on the high moorland (~3500 m), and then drops in the central peaks of the study area (~4300 m) to ~740-800 mm (Coetzee, 1967). Evapotranspiration data are not available for Mount Kenya. Temperature extrapolations (Coe, 1967; Thompson, 1966) suggest that temperatures at 4200 m average 3.1 to 3.6°C (from observations taken during two periods in 1948; Coetzee, 1967; Hedberg, 1964). The drop in precipitation from the western to the northern flanks (Pedgley, 1966) affects the water availability in the soil systems, which is substantiated by field reconnaissances carried out in 1976 and 1983/84 (Mahaney, 1984a and b).

Vegetation

Above the heather zone (3200-3300 m) the lower Afroalpine zone is dominated by *Senecio brassica* which merges (3750 m) with the upper Afroalpine zone characterized by *Senecio keniodendron*. The Upper Afroalpine zone merges with vegetation of the nival zone at ~4500 m (Coe, 1967; Hedberg, 1957, 1964).

METHODS

The mud polygon system (Site TV38) and associated vegetation assemblage (Fig. 1b) were mapped in the field and samples from the soil profile (Site TV4) in which these polygons develop were collected for laboratory study, including mineral, chemical, and microbiological properties. A sample from a buried soil beneath the polygonal networks was collected with an Oakfield auger, treated with great circumspection, dried on metal plates, stored frozen and shipped frozen to Gakushuin University, Japan, for ^{14}C dating.

Soil descriptions follow procedures outlined by the Soil Survey Staff (1951, 1975), Birkeland (1984), and Mahaney *et al.* (1984). Soil colors follow Oyama and Takehara (1970).

Particle size analyses (Folk, 1968) were performed on the < 2 mm fractions; coarse grade sizes (> 63 µm) were determined by sieving, whereas fine grained sizes (< 63 µm) were calculated by sedimentation following procedures established by Bouyoucos (1962) and Day (1965). Chemical analyses of the < 2 mm fractions include pH on a 1:1 paste, total organic nitrogen by the Kjeldahl method (Bremner, 1965),

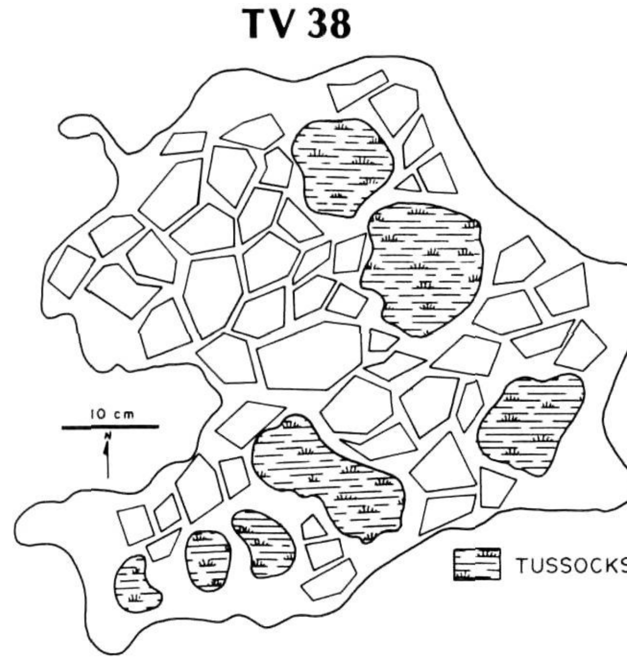

FIGURE 1b. Surface view of typical polygon depressions. Tussocks are the same height as surrounding vegetation and are composed of mixed grasses and sedges of which *Festuca pilgera* and *Agrostis trachyphylla* predominate.

Vue en plan de dépressions de polygones typiques. Les touffes gazonnantes sont à la même hauteur que la végétation environnante et se composent d'un mélange d'herbes et de carex dominés par Festuca pilgera *et* Agrotis trachyphylla.

cation exchange capacity and extractable cations with 1N NH_4OAc (Peech *et al.*, 1947; and Schollenberger and Simon, 1945). Organic carbon was determined by the Walkley Black (1934) method. Iron was extracted with sodium dithionite-citrate (Fe_d) according to procedures outlined by Holmgren (1967), using atomic absorption spectrophotometry.

The mineralogy of the < 2 µm grade size was determined by agitating samples with a cell dismembrator and pretreating with H_2O_2. Clay was centrifuged onto ceramic tiles, air dried, and X-rayed following procedures established by Whittig (1965).

Vegetation was identified following Hedberg (1957, 1964) and species percent cover was estimated along a series of four randomly placed 50 m transects laid out with strings. Species lying directly under the transects were measured and the proportion of the total length used as an estimate of cover.

RESULTS AND DISCUSSION

POLYGON CHARACTERISTICS

The mud polygon site was chosen for study because it is representative of many sites on valley train deposits in upper Teleki Valley (Fig. 1a). The incidence of mud polygon formation appears to be higher in Teleki Valley than on valley train deposits in other drainages on Mount Kenya. During the course of our investigations we observed small herbivorous mammals removing surface vegetation, followed by erosion through overbank flooding or deflation by wind activity, so that surface depressions could form. In these depressions (depth of 30 ± 10 cm) polygons formed in drainages above 3700 m (Fig. 1a).

The mud polygon site (TV38) shown in Figure 1b grades into undisturbed turf-covered soil (Site TV4; Fig. 2) (Table I). This compound paleosol has a complex history and two mutually reinforcing dates, derived from thermoluminescence (T/L) and radiocarbon, are available to place the ground soil at less than 2000 years old. A radiocarbon date of 1940 ± 120 years BP (GaK-8273) on the Ab horizon is substantiated by a T/L date of 1300 ± 300 yrs. (D. Huntley, Simon Fraser Univ., pers. commun., 1985). The ^{14}C date suggests that the buried soil in clay loam alluvium formed prior to 1940 years ago, and was subsequently covered by fresh sandy and clayey sediment. The ground soil formed in this alluvium developed into an Inceptisol that is the youngest radiometrically dated soil on Mount Kenya with a cambic (color B) horizon (Mahaney, 1982a, 1984a and b).

Particle size data for the compound paleosol reveal variations in sand, silt and clay that result from original stratification in the deposit (Table II). The mix of textures (Tables I and II) reflects these rather broad ranges in sand, silt, and clay ratios. The clay loam texture in the Cox horizon appears representative for the formation of mud polygons shown in Figures 2, 3 and 4.

The shapes and sizes of the mud polygons (Figs. 1b, 3 and 4) are related to position; the largest entities are located in the center of each mud polygon zone (Fig. 4). Towards the periphery of the depression the polygons are reduced in size, the smallest measuring approximately 5 cm × 5 cm. Polygon size does not appear to affect shape as some large polygons also have only four sides. While it is impossible to determine the rate at which large polygons form at the expense of small ones, it was obvious from field observations that expansion and contraction around the periphery of the mud polygon depressions added new organic materials to the fine clay-rich material there.

Determinations of mineralogical composition in the (< 2 μm) fraction of the materials in profile TV4 showed only trace amounts of illite and kaolinite, with moderate to small amounts of albite, anorthoclase, olivine, and quartz reflecting the nature of the country rock in the transported regolith from which this soil formed. Outside of a trace amount of illite nothing in the clay mineral composition exists to suggest that expansion and contraction after wetting and drying is assisted by expandable minerals.

The chemistry at site TV4 (Table III) yields important information on the soil in which mud polygons tend to form. The uniform pH with depth and exchangeable cation data indicate that this surface is poorly drained and not well leached. In fact, the presence of Na in such high quantities (2.95 meq/100 g in the Cox horizon) suggests that one of the most mobile cations tends to increase in the subsurface horizon where mud polygons form after the surface cover is stripped. The cation data reflect higher Na_2O, CaO, and MgO in most of the local rock, while the cation exchange capacity at depth reflects the textural changes shown in Table II. Data for the

TABLE I

Soil profile TV4 (for location, see Fig. 1)

Horizon	Depth (cm)	Description[a]
A1	0-8	Brownish black (10YR 2/3m, 3/2d) silt loam, weak granular structure, friable consistence, plastic and sticky
B2	8-29	Brown (7.5YR 4/4m) and dull yellowish brown (10YR 5/3d) loamy sand, pebbly weak blocky structure, loose consistence, nonplastic and nonsticky
Cox	29-59	Greyish brown (7.5YR 5/2m), dark reddish brown (5YR 3/3m) and greyish yellow brown (10YR 6/2d) clay loam, massive, firm consistence, plastic and sticky
Ab	59-62	Brownish black (10YR 2/3m) and greyish yellow brown (10YR 5/2d) loam, granular structure, firm to friable consistence, plastic and slightly sticky. ^{14}C dated at 1940 ± 120 yrs BP (GaK-8273)
C1b	62-78	Greyish yellow brown (10YR 4/2m, 6/2d) clay loam, massive, friable consistence, plastic and slightly sticky
C2b	78-85	Dark brown (7.5YR 3/4m), dull yellow orange (10YR 6/3d) and light grey (10YR 7/1d) pebbly coarse sand, massive, loose consistence, non-plastic and nonsticky
Cub	85+	Dark greyish yellow (2.5Y 4/2m) and greyish yellow (2.5Y 6/2d) sandy loam, massive, friable consistence, plastic and slightly sticky

a. Soil descriptions follow Birkeland (1984) and Soil Survey Staff (1951, 1975). Colors were taken from Oyama and Takehara (1970) in the moist (m) and dry (d) states. Consistence is given in the moist state.

FIGURE 2. Outwash surface with tussocks of *Carex monostachya* and associated grasses. The vegetation is cropped in patches by the Mount Kenya hyrax (mattock = 55 cm).

Surface d'épandage fluvio-glaciaire sur laquelle croissent des touffes de Carex monostachya *et les herbes qui lui sont associées. La végétation est tondue par plaques par le daman du mont Kenya (le marteau mesure 55 cm).*

FIGURE 3. Mud polygons formed in depressions with raised islands of tussock grasses and mosses. These are resistant to erosion or undercutting once exposed (knife = 30 cm in lenght).

Formation de polygones de boue dans les dépressions colonisées par des îlots de touffes d'herbe et de mousse. Même exposées, celles-ci résistent à l'érosion et au sapement. Le couteau mesure 30 cm de long.

FIGURE 4. Close up of mud polygons at site TV38. Some are 4-sided and 5-sided, white others are 6-sided or of "classical" polygonal form (knife = 30 cm long).

Gros plan des polygones de boue au site TV38. Certains polygones ont quatre ou cinq côtés, tandis que d'autres en ont six ou prennent la forme polygonale caractéristique (le couteau mesure 30 cm de long).

TABLE II

Particle size data for the TV4 soil profile

Site	Horizon	Depth (cm)	Sand % (2 mm-63 μm)	Silt % 63 μm-2 μm)	Clay % (< 2 μm)
TV4	A1	0-8	16.7	64.8	18.5
	B2	8-29	86.5	7.0	6.5
	Cox	29-59	25.1	48.4	26.5
	Ab	59-62	37.4	45.6	17.0
	C1b	62-78	26.5	54.5	19.0
	C2b	78-85	90.0	6.1	3.9
	Cub	85+	67.3	24.2	8.5

ground soil suggest only minor translocations of organic matter downward in the pedon; this pattern is complicated by the presence of the buried soil which tends to contribute some carbon and nitrogen for downward movement into the C1b horizon. The data for total salts show higher amounts in the A1 and B horizons followed by uniform distributions below. Base saturation, which is slightly higher in the surface, drops off in the subsoil of the ground soil, and in the paleosolum of the buried soil, to rise again with depth. The values for "free" Fe_2O_3 in these soils are within the ranges expected for soils of this age in the Afroalpine zone on Mount Kenya (Mahaney, 1984a and b).

To determine how these mud polygons react to saturation the site was flooded with water. Within 30 minutes the polygons expanded and most were fully closed (Fig. 5). Within ninety minutes the surface began drying out and cracking, along the already predefined planes of weakness (Fig. 6). While we do not have instrumental meteorological data for sites on Mount Kenya, limited data are available on nightime temperatures (Coe, 1967; Coetzee, 1967; Mahaney, 1980) which suggest that surface temperatures routinely drop to -5°C nearly every night rising to between $+8$ and $+15$°C everyday. Following a period of desiccation (3 hours) and a night with air temperatures of -6°C, we observed no appreciable change in

TABLE III

Selected soil chemical properties of profile TV4 formed in outwash in Teleki Valley, Mount Kenya Afroalpine area

Site	Horizon	Depth (cm)	pH (1:1)	Exchangeable Cation Ca	Mg (meq/100 g)	Na	K	Cation Exchange Capacity	Organic Carbon (%)	Nitrogen (%)	C:N	E.C. mmhos/ 25°C	Base Saturation (%)	Fe_2O_3 (%)
TV4	A1	0-6	5.40	10.54	4.69	0.84	1.42	57.2	16.56	1.390	11.9	3.00	30.6	0.60
	B2	6-26	5.60	2.05	0.69	0.35	0.51	11.1	1.85	0.128	14.5	0.30	32.4	0.92
	Cox	26-54	5.80	1.30	0.33	2.95	0.18	22.5	0.62	0.341	1.8	0.10	21.1	0.60
	Ab	54-63	5.60	2.35	0.30	2.44	0.12	38.2	7.59	0.577	13.2	0.15	13.6	0.31
	C1b	63-67	5.85	1.30	0.16	2.95	0.13	24.6	4.03	0.316	28.6	0.15	18.5	0.34
	C2b	67-70	5.55	0.75	0.11	1.66	0.17	9.5	3.70	0.059	62.7	0.15	28.3	0.55
	Cub	70-86	5.75	0.65	0.10	2.35	0.28	13.4	1.69	0.126	13.4	0.15	25.2	0.38

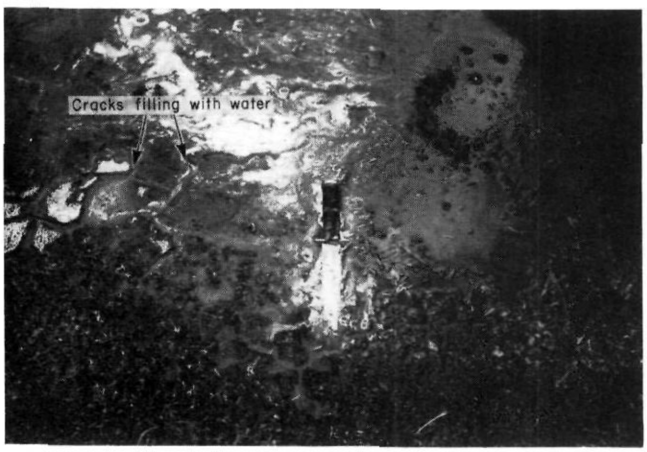

FIGURE 5. *Flooded polygonal areas showing closure of crack systems after ½ hour.* Small seedlings of *Subularia monticola* tend to cover entire polygons (lower right and left) and migrate outward along crack systems (knife = 30 cm long).

Polygones noyés montrant la fermeture des fissures après ½ heure. Les jeunes plants de Subularia monticola *viennent à couvrir entièrement les polygones (en bas à droite et à gauche) et à migrer vers l'extérieur le long des fissures (le couteau mesure 30 cm de long).*

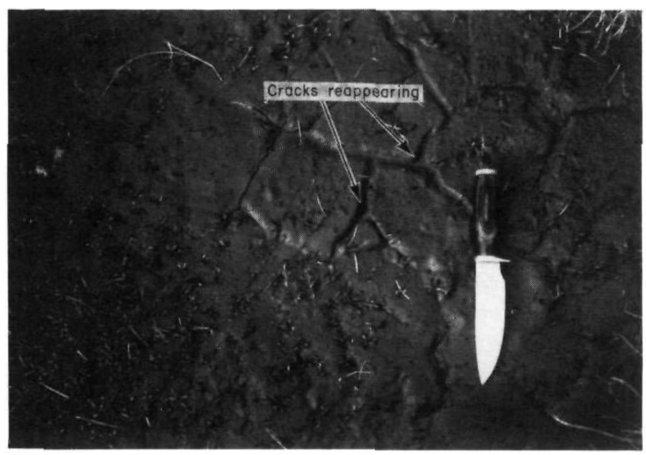

FIGURE 6. *Dessication induced cracking in flooded polygon surface* (1 ½ hours). Seedlings of *Subularia monticola* are prominent (lower left) (knife = 25 cm).

La dessication a provoqué la fissuration de la surface des polygones (1 ½ h). Les plants de Subularia monticola *sont en évidence (en bas à gauche) (le couteau mesure 25 cm).*

mud polygon form, *i.e.* they remained open although some needle ice had formed in places. From these observations we conclude that diurnal freezing and thawing appears incapable of generating mud polygons, although needle ice forms quite well in these finer sediments as well as in other coarser-grained sediments on Mount Kenya.

VEGETATION CHARACTERISTICS

The vegetation is characteristic of wet-mesic sites of the upper Afroalpine region of Mount Kenya at approximately 4000 m (Coe, 1967; Hedberg, 1964). The valley walls, dominated by stands of *Senecio keniodendron* or *S. brassica* with an understory of *Alchimella argyrophylla* and *Festuca pilgera*, give way on the valley floor to a flora of grasses, sedges and forbs in which acaulescent cushion-like forms predominate (Hedberg, 1964). The important grasses and sedges include *F. pilgera, Agrostis trachyphylla* and *Carex monostachya*. The first species is greatly reduced in size compared with the more typical form observed in drier sites. Others of rare occurrence include *Luzula abyssinica, Poa schimperiana* and *Juncus* sp. Of forbs the predominant species are *Ranunculus oreophytus, Haplocarpha rueppellii* and much more rarely *Carduus platyphyllus, Haplosciadium abyssinicum* and juvenile forms of *S. brassica*. Only one species of shrub is present, *Alchimella johnstonii*, a form adapted to wet soils and solifluction terraces and exhibiting a nearly prostrate habit at the base of cushions or reduced tufts of grasses or sedges. Within the polygon depressions many seedlings of *Subularia monticola* are observed. Islands of vegetation (Fig. 1b and 3) are dominated by grasses mostly *F. pilgera* and *A. trachyphylla*. *C. monostachya* is less frequently observed.

A total of two hundred meters of transects assigned randomly on both sides of the polygon depressions were scored for species cover (Table IV). The predominant species are grasses and sedges accounting for approximately 90 percent of the cover. The three dominant species: *A. trachyphylla*, *F. pilgera* and *C. monostachya* are cropped intensively by colonies of hyrax and rodents (Fig. 2).

TABLE IV

Percent cover for principle species of the valley floor in proximity to polygon depressions

Species	Total Cover (%)
Agrostis trachyphylla	60
Festuca pilgera	14
Carex monostachya	10
Alchimella johnstonii	8
Ranunculus oreophytus	7
Haplocarpha rueppellii	3
Luzula abyssinica	2
Carduus platyphyllus	2
Poa schimperiana	2
Senecio brassica (seedlings)	1
Senecio keniodendron (seedlings)	1
Mosses	2
Bare ground	11

FIGURE 7. Hyrax (*Procavia johnstoni mackinderi)* foraging in upper Teleki valley and cropped tussocks of *Carex monostachya.*

Daman (Procavia johnstoni mackinderi) *fourrageant dans la vallée supérieure du Teleki et touffes de* Carex monostachya.

The mud polygon depression site is located in close proximity to the rock glacier deposits described previously by Mahaney (1980; Fig. 1G). The latter is a favored habitat of colonies of the Mount Kenya hyrax (Fig. 7) and the surrounding bottomland vegetation of the polygon site had been severely cropped as a result of their feeding activities (Fig. 7). *F. pilgera, A. trachyphylla* and *C. monostachya* were selectively grazed. Burrows and trails of the groove-toothed rat (*Otomys orestes orestes*) are also exceptionally common among the cushions of grasses and sedges, the trails worn bare and covered in fecal pellets. Both skulls and bone fragments of these two species were collected on site.

Two patterns of movement and feeding habits of these herbivorous mammals are probably sufficient to initiate the changes leading to development of depressions, and eventually to mud polygon activity. Seedlings and fresh growth of *F. pilgera* and other grasses and sedges stimulated by grazing are favored by the hyrax over coarse tussocks or cushions. As a result vegetation becomes patchy — a system of overgrazed grassland, barren soil, and scattered islands of uncropped tussocks (Fig. 7). By feeding on the fibrous roots of grasses where exposed and further eroding the vegetation through their nocturnal activities, the grooved-toothed rat probably accelerates the process. Population densities of both animals may be enhanced by the presence of refuse left by tourists.

With the vegetation suppressed or killed, enhanced needle ice activity prevents reseeding or colonization. Erosive forces sufficient to create the depressions may arise from both wind and water. Periodic flooding of the terraces has been observed (Mahaney, 1979, 1982a) and the annual influx of waterborne seeds of *Subularia monticola*, germinating on the polygons, supports water as an important agent of erosion.

The polygon depressions (Fig. 1b) appear to be of a generally uniform size. Tussocks of grasses, principally *F. pilgera*, are always present in considerable numbers and they are of a size and distribution compatible with our perception of the grazing patterns described previously. The tussocks are extremely resistant to displacement; their fibrous root systems bind the soil tenaciously, and the exposed sides are often covered in mosses. Where undercutting is evident among tussocks it is not unidirectional contributing to the conclusion that once formed the system is probably quasi-stable over short periods of time.

DEVELOPMENT OF MUD POLYGONS

We conclude that there are four stages (Fig. 8) in the development of mud polygon complexes in the Mount Kenya Afroalpine area. Stage 1 requires the suppression or elimination of vegetation by cropping so that the soil surface is bared. In Stage 2 once vegetation cover is removed, flooding and or aeolian activity can erode surface sediments. Erosion leading to the development of small depressions (Stage 3) provides a quasi-stable environment in which mud polygons may form (Stage 4).

Evaporation of water between soil grains creates tension which stretches blocks of soil, creating near-uniformly distributed stress across exposed surfaces leading to contraction. The contraction force is created by surface tension between grains; as more water is lost the top surface of water pulls grains away from one another. Because some of these grains have electrically charged surfaces (where cation exchange capacities are high) they may be pulled together by electrical forces attracting clays, organic micelles, and cations. The contraction process places the topmost layer of mud under stress which is later relieved by strain producing the polygon. Since the cracks do not appear simultaneously, the tensile stress must not be uniformly distributed across the exposed soil surface, and correspondingly centers of contraction are not uniformly spaced. Even though these mud polygon cracks do not intersect always at 120° angles they do tend to produce a combination of random and regular polygonal patterns.

Because these polygonal systems are three dimensional it may be that mud polygon formation is the result of tensile and shearing stresses working horizontally and vertically. In the horizontal axis contraction occurring in response to tensile

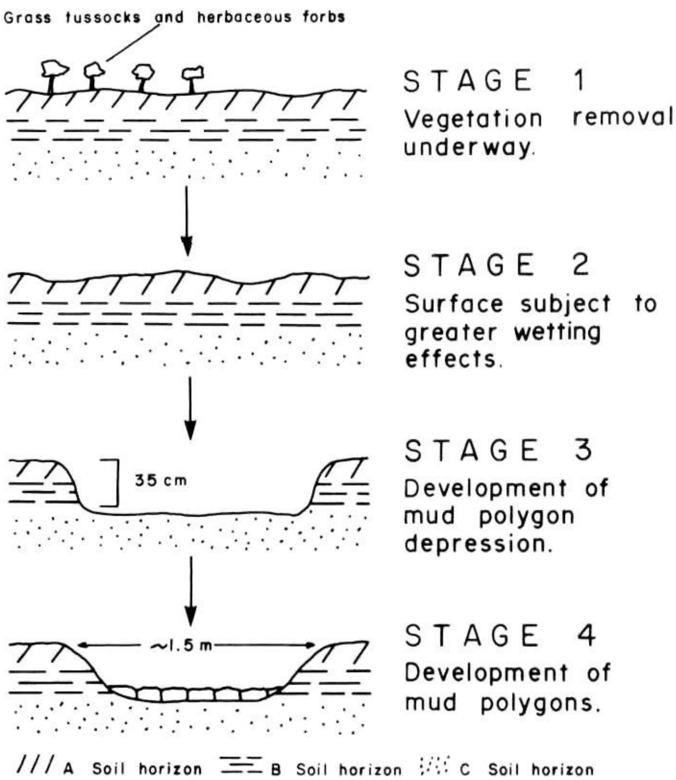

FIGURE 8. Stages in the development of a mud polygon complex.
Les stades d'élaboration d'un complexe de polygones de boue.

stress may place an adjoining area under shearing stress. Along the vertical axis, faces sliding past one another would create new shearing stresses, the combination of which might produce polygonal cracks intersecting between ~90° and 120°.

No curling was observed on these mud polygons which may be related to the relatively slow rate of evaporation in the Afroalpine environment creating insufficient stress on the surfaces, or to the particle size distributions.

CONCLUSIONS

The grazing habits of Mount Kenya hyrax and grooved-toothed rat are considered essential in the formation of mud polygons in upper Teleki Valley on Mount Kenya. Through selective over-grazing of vegetation leading to the loss of plant cover, the following succession occurs: vegetation removal → bare ground → depression → mud polygon formation.

While particle size ratios are important in terms of controlling the water-holding capacity, the absence of expandable clay minerals is not seen as a limiting factor in the development of mud polygons. Soil chemical data, especially organic matter relationships, show that organic constituents might be important in influencing the water-holding capacity. Flooding of the polygons prove they automatically congeal after wetting and contract upon drying out, with the contraction cracks assuming nearly their pre-flooding shape. While wetting and drying of these samples showed that clay-rich material forms small polygonal shapes, further laboratory work is required to determine the number of wetting-drying cycles required to reproduce the forms seen on Mount Kenya in 1983-84.

ACKNOWLEDGEMENTS

This research was supported by grants from the Natural Sciences and Engineering Research Council (Ottawa), and the National Geographic Society, (Washington, D.C.) and York University. Field work was authorized by the Office of the President, Geological Survey, and Mountain National Parks, Republic of Kenya. We thank Linda Mahaney, Don Halvorson, Larry Gowland, and students in my Mountain Geomorphology field schools (1976 and 1983) for assistance in the field. Laboratory analyses were completed with the help of Mike Bardecki, Rick Boyer and Drew Clarke in the Geomorphology and Pedology Laboratory in Atkinson College. B.D. Fahey (Forest Research Institute, Christchurch, New Zealand) and an anonymous reviewer offered several helpful suggestions and criticisms.

We are particularly indebted to Willie and Didi Curry, formerly of Naro Moru River Lodge, for logistical support; and to P. M. Snyder (formerly Assistant Warden) and F. W. Woodley (Warden, Tsavo Park) for assisting in the course of the field work.

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