GEOCHEMICAL SURVEY ROCKS AND QUARRIES AROUND OUAGADOUGOU, BURKINA FASO

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Introduction

In the framework of the project "Women Food Entrepreneurs in Kenya and Burkina Faso: Building inclusive business models for food security in the city slums of Kisumu and Ouagadougou" a geochemical survey was carried out in Burkina Faso in order to find rocks suitable for producing powder for soil conditioning. The survey was carried out in the period October 25th to November 2nd 2016 by Janvier Kini and Huig Bergsma.

The same as for the survey in Kisumu in September, the search was for rocks that could be used as a soil conditioner in a zone no more than 100km from the capital city, Ouagadougou. Although the area immediately surrounding Ouagadougou is underlain entirely by granite, east of Ouagadougou runs a S–N oriented zone of volcanic-related rocks, which bends eastward and curls around the north of Ouagadougou.

As far as the mining industry is concerned, Burkina Faso is well known for its gold and base metal (Cu, Zn, Ni) mining. Dimension stone and gravel are mainly produced in granite, laterite and clay quarries. Unfortunately, these rocks are not very suitable for the production of agricultural rock dust. Fortunately we managed to locate two tuff quarries near Boussouma, one of which was active, the other abandoned. Tuff is a very friable rock that sometimes contains zeolites, a well-known soil conditioner. In the same area, two outcrops of calcium- and magnesium-rich basalts were found (Tamiga and Lougouma), indicating a potential for future rock dust production. Although granite may not seem to be a very useful rock at first glance, it was decided to sample some granite outcrops that contained biotite. Biotite is a K-rich mineral frequently found in granites and a very efficient fertilizer. The most promising samples were taken from a very large, artisanal quarry named Pissy, where 5cm-large biotite flakes were found whilst just walking around. In this quarry many women and children work under harsh conditions. If a sufficiently rich biotite concentrate could be produced from their sand product, it could be sold as a local alternative to expensive potash fertilizers.

All together seventeen locations were sampled and analysed by Handheld XRF, and five of them were taken to the Netherlands for further analyses and experiments.

In terms of geology, the sampled rocks can be divided in three groups:

- Basalts
- Tuff
- Granite

Samples were analysed using a Niton Goldd+ Portable XRF and compared to Lurgi/Portanef and Vulkatec, a nepheline syenite concentrate and a basanite. K and Ca were used to discriminate potential useful rocks from less useful rocks.

Locations visited

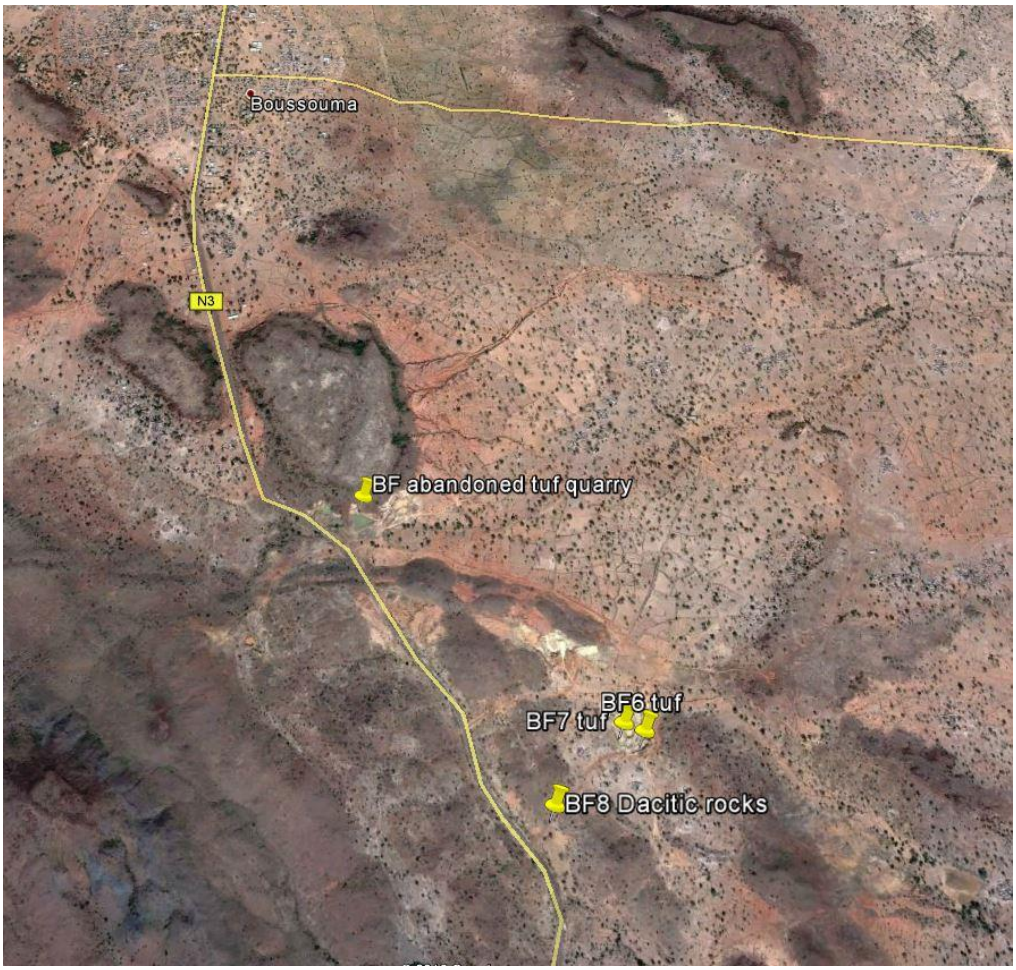
Tamiga

The coordinates of Tamiga were found in the study done by Peters (2013)[1]. First samples (BF1 and BF2) were taken on the west slope on the hill just north of Tamiga village. The outside of the rock was black, the inside pink/reddish. This rock was extremely low in Ca an K. Samples were left on site. Samples BF3 and BF4 were taken further west further in the direction where sample G12-02-053 (Peters, 2013) was located. BF3 and BF4 were very hard, big, green boulders between patches of cropland. The rock was fine grained and contained no phenocrysts.

[1] Peters (2013), *The Volcanology, Geochemistry and Metallogenic Potential of the Goren Volcano–Sedimentary Belt, Northeast Burkina Faso, West Africa*

Boussouma

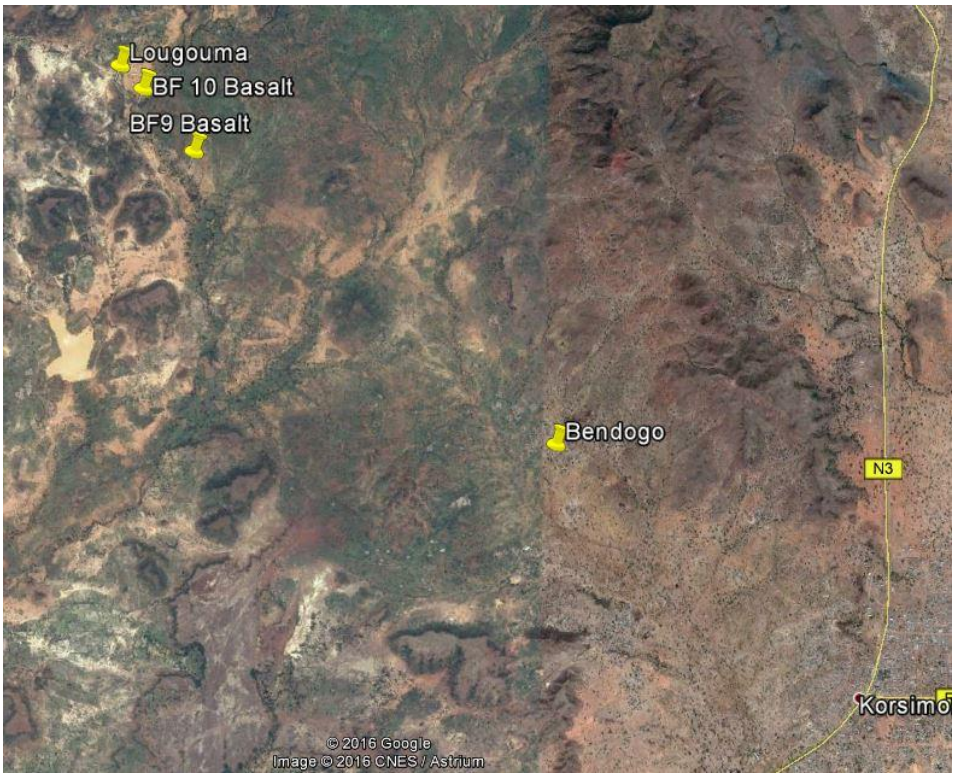
Two tuff quarries were identified in the report from Moore and Stephens (2012)[2]. BF5 was sampled in the smaller quarry close to the road. The tuff was off-white, soft and had perfect straight cleavage. BF6 was sampled further south in the bigger quarry. Access by car turned out to be difficult as the bridge from the main road was destroyed. The BF6 rock seems more coarse and yellowish than BF5. In some parts the rock was fairly wet. Tuff is mainly quarried as raw material for the production of cement. BF7 and BF8 were dacitic rocks sampled halfway between the main road and the quarry.



[2] Moore & Stephens LLp (2012), *Rapport de Conciliation des Paiements des Societes Minieres a l'Etat et des Recettes Perçues par l'Etat des Dites Societes pour l'Exercice 2012*

Lougouma

The coordinates for the sampling location at Lougouma (G12-02-30) were also found in Peters (2013). Sample BF9 was the first large outcrop of basalt we found. BF10 was sampled near the village of Lougouma, just before a small stream and probably from the same outcrop as sampled by Peters (2013). Here the most primitive (that is high in CaO and MgO) basalt was found. Our preliminary results confirm the data presented by Peters.



Pissy

Pissy is a large, artisanal quarry in the western outskirts of Ouagadougou, close to the N1 road. The rock here is classified as granodiorite, tonalite and diorite. The gravel produced contains biotite and is very inhomogenous. Hand specimens varied from leucogranite to diorite high in dark coloured minerals. Sand from this mine is occasionally sold as a seed carrier. More dark pieces were collected (BF11), and biotite was successfully separated from this sample back in the Netherlands.

Ramongo Poa

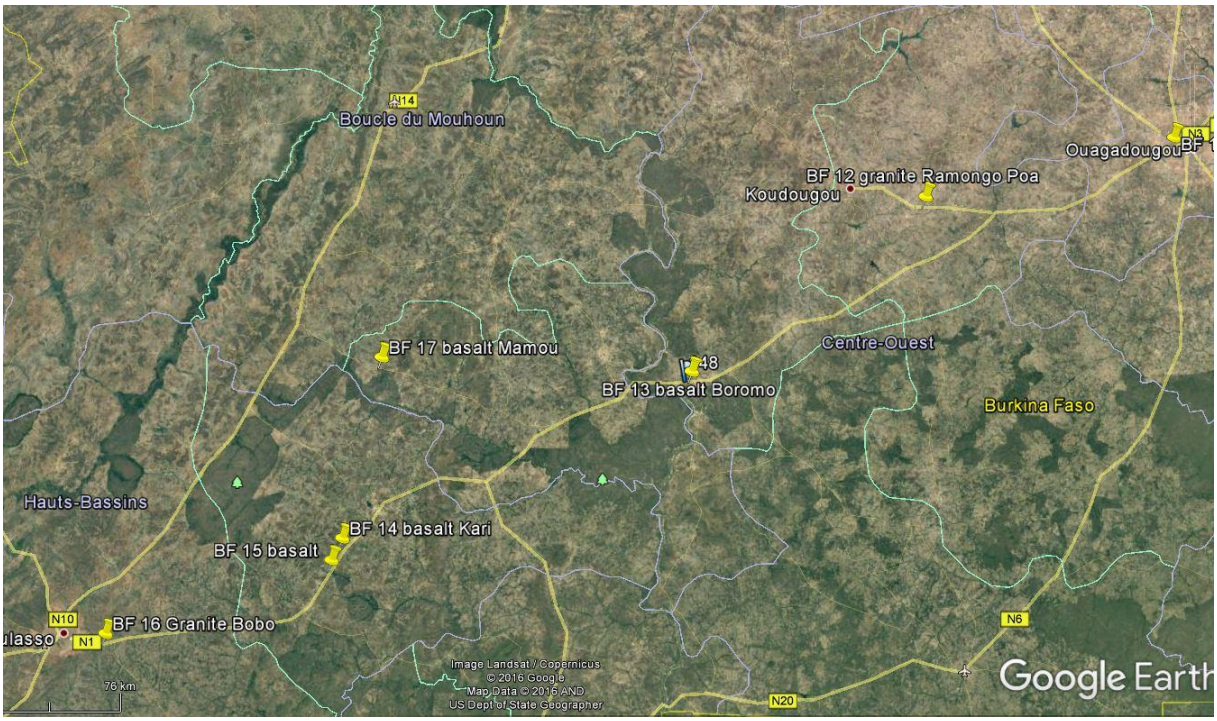
Deserted granite quarry where the rock contained fewer dark minerals than the rock from Pissy. More pink feldspar (sample BF12).

Boromo

Roadside sample BF13 was taken about 15km east of Boromo. The rock is basalt with some quartz veins, laminated. It has a fine crystalline, glistening surface and a dark green/blue colour.

Kari/Hounde

Two basalt samples were collected along the roadside in an area that, according the geological map of Burkina, should have Gabbro rocks. The rocks were fine grained with 2–3mm dark phenocrysts, probably pyroxenes. Sample BF14 is dark grey with a smooth cleavage, fine sandpaper texture and few pyroxene phenocrysts. Sample BF15 is a lighter rock with irregular fracture and more phenocrysts.



Bobo–Dioulasso

Roadside sampling of granite (BF16).

Mamou

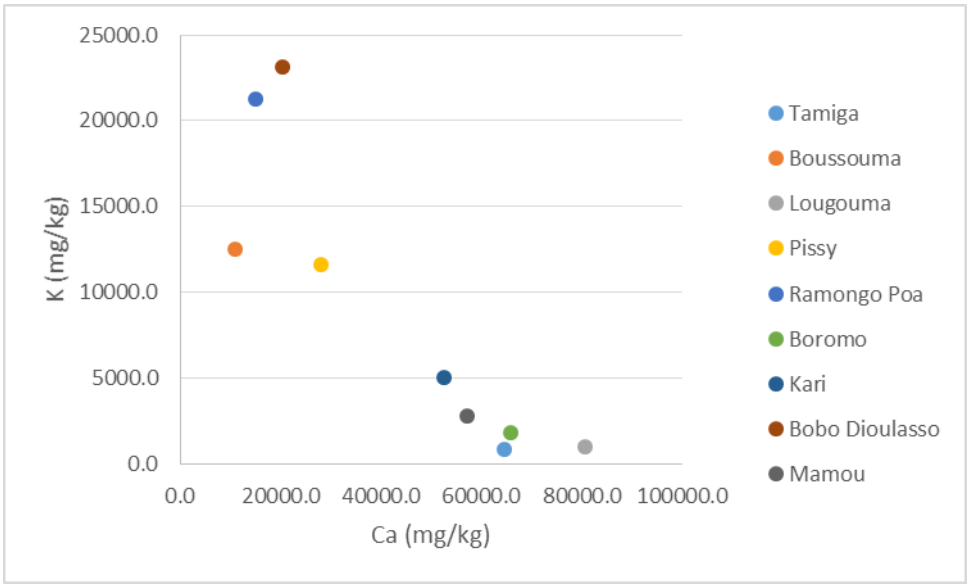
The roadside sample BF17 was basalt with pyroxene and plagioclase phenocrysts. Very fine grained, irregular fracture, dark green/blue grey. Similar to BF13.

Analytical results

All samples were measured separately four to five times. In the table, averages are given. In those locations where more samples were taken (Tamiga, Lougoumou, Kari/Hounde) averages were calculated. In Boussouma, the results from the dacite and tuff were combined.

SAMPLE location	CaO (%)	K_2O (%)	MgO (%)	Fe_2O_3 (%)	Zn (mg/kg)	Cu (mg/kg)	Ni (mg/kg)
Tamiga	9.1	0.1	++	12.4	62.7	187.5	91.7
Boussouma	1.5	1.5	0	5.4	49.3	46.1	
Lougouma	11.3	0.1	++	10.6	62.0	206.4	114.5
Pissy	3.9	1.4	+	4.2	67.6		
Ramongo Poa	2.1	2.6	0	2.5	87.9		
Boromo	9.2	0.2	++	13.6	145.4		111.0
Kari	7.4	0.6	++	11.1	73.3	69.0	108.1
Bobo Dioulasso	2.8	2.8	0	3.0	25.3		
Mamou	8.0	0.3	++	10.8	64.4	82.1	150.3

It is clear that the most useful basalts can be found in the Lougouma area. Samples BF9 and BF10 were selected for transport to the Netherlands, being the highest in Ca, Mg and micronutrients. The tuff from Boussouma (sample BF7) was selected because, although its nutrient content seems low, its mineralogy (zeolite) could be useful. Besides this, processing it should be low cost and there is an infrastructure present. Sample BF11 from the Pissy quarry was selected because it is fairly rich in nutrients, it has potential for biotite extraction and it could help people in the quarry increase their income. Sample BF16 was additionally chosen because the sample from the Pissy quarry that we were allowed to take was small.



Follow up

1. Milled and homogenized samples have to be analysed on XRD (mineralogy), XRF (whole rock) and ICP-MS HF/HCl/HCLO4/HNO3 (micronutrients).
2. Decision has to be made which rock to use for incubation, pot and field tests.