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ORSTOM, Cayenne

R. m. Westerink
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REPORT ON A 10-DAYS VISIT TO ORSTOM, CAYENNE - FRENCH GUIANA
(1 - 10 March 1989)

R. M. WESTERINK

Leysweg, Paramaribo, Suriname

March 1st : Arrival in French Guiana; orientation at ORSTOM Cayenne.

March 2nd : Meeting with the three soil scientists of ORSTOM:
(Barthes, Grimaldi, Veillon)

a. Discussion i.a. about the origin of the S.D.B. (Upper Coesewijne Formation in Suriname). The french pedologists consider the SDB mainly the result of pedogenesis of weathered hardrock of the Guyana Shield. In French Guiana the SDB has mainly developed itself in bleached sand plateaus (Veillon, Boulet et Lucas 1988). Prove for their theory is that there are no discontinuities in the profiles, which points to one parent material. Also they found bulges of rotten rock in the subsoil of the profiles. Westerink, and also the other Surinamese soil scientists consider the SDB a sedimentary deposit because of the following arguments:

- Krook en Mulder (1971) have found sedimentary structures in the SDB, pointing to deposition in running water (braided rivers).
- The SDB forms a belt, from French Guiana in the east to Guyana in the west (Brinkman and Pons 1968). Everywhere this belt is bordered by the old Coastal Plain in the north and the Guyana Shield in the south. In Suriname it has been shown that the SDB dives away under the Old and Young Coastal Plain (Coropina and Demerara Formation). Drillings near Paramaribo have shown that there are hundreds of meters of tertiary sediments under the SDB.
- Krook (1979) has shown that the heavy mineral composition of the SDB changes from west to east in Suriname, corresponding with the variation of rocks in the Guyana Shield south of the SDB belt, which indicates a local sand supply formed by the rivers streaming from south to north.
- If the SDB was only a pedogenetic phenomenon, why do the SDB occur only in a small elongated belt in the western part of French Guiana? why does the SDB not occur in the east of French Guiana or more in the interior?

b. The fine sandy deposits of the Old Coastal Plain, in Suriname regarded as cheniers are interpreted in French Guiana as offshore bars. It's still not obvious why this name "off shore bars" is used. (sedimentary structures?)

March 3rd : Excursion to Kourou and Sinnemary

- a. South of the road Cayenne - Kourou, 150 m west of the bridge over the Cayenne River there is vertical alternation of fine sandy layers (several meters in thickness) and ripened, strongly mottled clay (several decimeters). Discussion about the genesis: terrace deposit (Eemian age, higher sealevel) or off-shore bar deposit ?
Westerink remarks that surinamese fluviomarine deposits are characterised by:
 - a higher silt content
 - a strong red mottling
 - soilunit boundaries parallel to the river
- b. Road Cayenne - Kourou, 1 km west of Tonate, 50 meters north of the road. Transition of Young Coastal Plain (clay) to the Old Coastal Plain (sand). Height difference ± 3 m. About 150 m south of this transition black earth with shell (fragments) has been found. Because in Suriname only the youngest deposits (0-3000 years B.P.) contain shells, it may be concluded that this is a recent deposit. Because of the great distance to the Young Coastal Plain it cannot be the result of wave action. It is possible that Amerindian dug up this ground further north in the Young Coastal Plain and brought it here to raise the soil fertility.
- c. Bifurcation old and new road Tonate - Kourou. Old road follows coarse sandy ridge which marks the transition between the Old and the Young Coastal Plain.
- d. Kourou, hotel Les Roches. Outcrop of hard rock (metamorphised granite and pegmatite), surrounded by holocene clay deposits.
According to Froidefond and Prost (1985) in 1984 coastal accretion (mudflat) occurred in this area. About 1 year ago severe erosion began to take place, with i.a. washing away of the jogging court. The coast is now protected by big boulders.
- e. Sinnemary, old road (D7) to Kourou, 0.25 km north of Canal Philippou. Sandpit in (very) coarse sand with gravel layers (up to 3 cm in diameter). Few shell fragments Parallel lamination. NW-SE orientated ridge of the Moleson fase (length 20-30 km).

- f. Plage Dégonde (beach, old road (D7) Sinnemary - Kourou, ± 16 km east of Sinnemary. In this area there has been up til now coastal erosion: in the area west of plage Dégonde about 2 km in 10 years (Happen coast). At the seaward side of plage Dégonde remains of (almost) ripened clay are found, dated 3550 yr B.P..
- At the landward side of the beach there is a cliff of about 1 m showing brown very fine sand without shells (Coropina Formation ? Wanica phase ?) On top of the beach occur concentrations of heavy minerals (stauroilite, garnet, toermaline) as well as many pebbles (up to 10 cm; often imbricated). They probably come from the outcrops of hardrock, which occur often here. This means a short distance transport, which explains the slight rounding of some stones. A few kilometers further to the west the stones are absent.
- g. Sandpit north of the road Sinnemary-Iracoubou (300 m east of cross road to St. Elie). Giant podzol with bleached sand to several meters (with pebbles up to 3 cm), underlain by an illuvial iron-humus horizon. Interpretation: holocene chenier. Westerink remarks that it possibly is a SDB deposit, because of the great resemblance of the material and the abnormal thickness of the podzol. Detailed soil survey as well as geomorphological research can probably give the solution for this problem.
- h. Crossroad to St. Elie; ± 1 km south of the road Sinnemary- Iracoubou. Off-shore bars of the Old Coastal Plain; ± 100 m wide ridges seperated by elongated depressions. Grass-savannah vegetation. Soil profiles: very poorly drained bleached sand with at a dept of ± 1 m an illuvial humus-iron horizon.
- At several meters depth: old seaclay. Further to the south, in the direction of the farm an erosion gully can be seen.
- i. Cross road to St. Elie, at the bifurcation left.
- Rising up from the Guyana Shield in a steep slope, Soils: red gravelly clay. At the top of the slope transition to a undulating plateau with SDB profiles: bleached sands and unbleached sandy loam, often gravelly. The unbleached profiles show much resemblance with weathering profiles in granite in Suriname. Probably this is a thin (eroded) cover of SDB, mixed by homogenisation with the weathering profile in the Guyana Shield underneath. At the foot of the steep slope SDB has also been found.

March 5th : Cayenne key area:

In spite of the fact that in 1984 a mud-accretionary coast was present along the Cayenne peninsula, nowadays only a mudflat is present in front of Cayenne town. This indicates a displacement faster than the by Lointier and Prost (1988) mentioned values of 0,3-1,2 km/year. The reason for this is still not known. Because of the disappearance of the protecting mudflats, the beaches east of Cayenne are characterized by the occurrence of high waves (till 2,5 m) and a strong erosion, which leads to the formation of wash-over fans on the clay deposits on the landward side of the ridges. In places where older deposits outcrop, cliffs are formed (erosion of gardens, uprooted trees). It is striking that, in contrast with Suriname, shells are almost absent. On the other hand heavy minerals are abundant in the beachsands. Probably they come from nearby wave eroded cliffs.

On the left bank of the Mahury River a elongated sandspit is present, beginning off Pnte Mahury and at the moment almost reaching to Dégrad des Cannes. The wave-refraction probably generates a longshore current in a WSW direction, which transports sand upstream after which the waves accumulate the sand on the spit. The origin of the sand is still obscure but it is known that the Mahury river supplies some sand.

March 7th-9th : Mana and surroundings

a. Coastal situation. After a long period of a strong westward accretion of Point d'Isère, the last 15-20 years a strong erosion took place. West of Mana coastal erosion has been 100-200 m/year at many places. East of this erosioncoast the Magnan mudflat occurs, untill the first canal west of the main irrigationcanal of the rice company of Van Uden (personal observation during low altitude flight) East of the mudflat, untill about 2 km west of canal 22 a straight erosioncoast with a beach of ± 50 m width occurs, after which a happen coast follows with clear erosion phenomena: dead and uprooted parwatrees, accumulations of wreckwood, coffeegrass (fine organic matter), a cliff in the clay deposits, clay-balls and arched inlets of several hundreds of meters in width (happen with on the HHW-level) sand deposits.

The sand has been washed out of the clay during erosion.

b. The rice estate of Van Uden.

This ± 1500 ha rice estate is situated east of Mana, north of road D8 to Organabo. Soils: flat clayflats of the Comowine Phase (see carte 1, Lointier and Prost 1988).

Road D8 is situated on a broad ridge which extends a few meters above the clayflats. Near the main buildings of Van Uden, this ridge shows a soil profile of bleached medium coarse sand (0-80 cm) a podzol -B (80-95 cm) and yellow-brown medium coarse sand. We can follow this ridge over tens of kilometers, until Les Hattes on the other side of the Mana River. A few kilometers to the north a low and narrow (±30 m) east-west orientated ridge occurs over about 5 km (soil: bleached medium coarse sand). Irrigation water is supplied by a north-south orientated canal, taking water of the Mana River 4 km east of Terre Rouge. Yields are about 4,5 ton/ha/harvest.

The most important soil scientific problems are:

- The low permeability (in comparison to the rice fields of Kalloe) which causes too wet fields. Probably the low permeability is caused by the low structure stability. (normal sea clay soils).
- Incomplete ripening (half ripened or nearly unripened). This caused the almost complete subsidence of several machines.
- The high salt content, especially in the northern part, which causes the red colouring of the rice. Solution: washing out of the salts by rain- and irrigation water.
- Coastal erosion: In the last years, new rice areas have been reclaimed (between canal 12 and canal 22). Off canal 22 the distance between the end of the canal and the ocean is just ± 400 m. For this part of the coast a yearly erosion of 100/200 m/year can occur. During a survey it could be clearly seen that severe erosion takes place. The coastal erosion will be strongly stimulated by digging north-south orientated canals, by removal of the protecting mangrove vegetation and by the subsidence caused by drainage (max. 0,7 m in Suriname). The conclusion which can be drawn is that the rice company is in danger, the more so as may be assumed that the coastal erosion will continue in the following years because no mudflat is approaching. At the moment erosion takes place almost all over the coast till the Kourou bank.

The construction of dikes as we know from Holland, seems not to be feasible, besides it would sink down in the weak subsoil. A claydike, as constructed in Coconie (Suriname) is absolute inadequate (burst through within one year).

c. The rice estate of Kalloe

This ± 1000 ha estate is situated W of Mana, south of road D22 to Les Hattes. Soils: flat clay soils of the Mara phase. One of the problems of the company is the locally occurrence of acid-sulphate soils (±25% of the area). In these areas an obvious worsen growth and therefore a very low yield can be observed. The remains of the soils consist of pseudo-acid sulphate soils, characterised by a good structure stability and permeability, which is favourable for the yield. Mean yield: 4,5 ton/ha/harvest.

d. Mana-Aouara-Les Hattes

From the village of Aouara it's clearly visible that the sandspit of Kawana (Point d'Isère) on the 1:50.000 map still indicated, has been eroded completely. Because of this, high waves can reach the village and cause severe coastal erosion: the old road to Les Hattes has been eroded over tenths of meters.

On the beach of Les Hattes (a few kilometers westward) thin (a few cm's) redbrown coloured sand layers of heavy minerals (i.a. garnet, staurolite) occur in the white-yellow beachsands. The heavy minerals have been accumulated by the process of swash and backwash. The fact that the chenier sands on this beach are medium coarse just like the rest of French Guiana, as well as in east Suriname, can be explained by the occurrence of only a small coastal plain in French Guiana, this in contradiction to Suriname where, especially in the west a very broad coastal plain is present. Comparing the length profiles of the rivers of Suriname and French Guiana we see that the latter have a relatively steep gradient till the Atlantic Ocean. Therefore they are capable to transport coarse sand (and some gravel) to the sea. This coarse material originates from the regolith on the hard rock (Guyana Shield) as well as the SDB. In Suriname these coarse sands do not come further than tens of kilometers stream upward (In the Saramacca River till km 169, Krook 1979). A second source for the coarse sands can be found in the numerous promontories (exposures of hard rock) along the coast of French Guiana.

Another marked difference with the surinamese sands is the almost complete absence of shells in the beach sands of French Guiana. Maybe this can be explained by the supply of sand transported by the rivers of French Guiana.

- e. Acarouany: Laotian settlement of about 600 people who live here since 1979. Around the village about 400 ha is in use for small scale agriculture; orange, lemon, bananas, maracoucha, onions, tomatoes, partly in greenhouses (irrigated). The french government helped them by clearing the forest and the construction of the houses. At the moment, they are self-supporting.
- f. Ferme Manioc: West of road D9 Mana-St.Laurent, 2 km south of crossroad to Acarouany. Owner: Mr. Mateo. This estate started in 1979, an area of \pm 75 ha. Yields: about 30 ton/ha/year (moist), which is just feasible. The harvest is mechanised, every 12 to 16 months. Because of the low soil fertility and very low pH a good manuring is very important. By use of dolomite the pH has been raised from 4,0 till 5,7.
Soils: coarse sandy clay loam, from 50 cm very gravelly.

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