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CREEK MORPHOLOGY IN THE SCELDTPOLDERS NEAR ZELZATE.

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SAMENVATTING. - Talrijke kreken met verschillende morfologische en landschappelijke kenmerken komen voor in de Scheldepolders tussen Zelzate en Aardenburg nabij de poldergrens. In dit artikel worden de diverse kreektypes, kreeksedimenten en kreekpatronen besproken. Een orthogonaal haakvormig kreekpatroon kan worden gerekonstrueerd door middel van detailgeomorfologische kartering. Het verband tussen dit uitzonderlijk kreekpatroon en het onderliggend fossiel perceleringspatroon wordt nagegaan.

ABSTRACT. - Several creeks with different morphological and landscape characteristics occur in the Sceldtpolders area near the polderlimit between Zelzate en Aardenburg. In this paper diverse fossil creektypes, creeksediments and creekpatterns are discussed. An orthogonal creek pattern can be reconstructed by detailed geomorphological mapping. The relation is examined between this exceptional creekpattern and the underlying fossile parcelpattern.

INTRODUCTION

The Belgian Sceldtpolders near Zelzate (SYS C.& VAN DENHOUDT H., 1974, p. 12), between the villages St-Laureins, Boekhoute, St. Margriet, occupy a specific landscape position, they show a special morphology and are genetically rather simple. These randompolders are situated at the northern limit of the Flemish Valley and are partly influenced by the underlying pleistocene microrelief (I.HEYSE 1975). A mozaic of different creektypes, of which the "Boerenkreek" and the "Blokcreek" are the most striking ones, occurs in these flat-clayey region, divided in separate polderblocks by rectilinear dikes. Only one transgression (Dunkirk III b, TAVERNIER R. & AMERYCKX J., 1970), which was characterized by several marine invasions (GOTTSCHALK, 1955) was responsible for the formation of this marine accumulation landscape. No interference with older Dunkirk transgressions occured in the margin of these polders (VAN RUMMELEN, 1965).

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GEOLOGICAL SUCCESSION

The buried fluvioperiglacial sediments (upon 25 m thick) in the Flemish Valley are dominantly sandy and alternate with loamy and peaty layers in the topzone. They are partly covered by a thin eolian coversandblanket of less than 0,5 m, which is partly developed as small coversandridges of more than 2 m (G. DE MOOR & I. HEYSE, 1972, TAVERNIER R. & DE MOOR G., 1974, HEYSE I., 1975). The paleorelief of the young pleistocene sediments is sloping downwards in northern direction and is locally below +4 covered by a peat veneer (oppervlakteveen - surface peat) of max. 0,5 m in this polderarea (I. HEYSE, 1975). The peat passes southwards towards the Flemish Valley into a humeous sand (culture layer) and northwards towards the Netherlands it is thickening until more than 2 m (VAN RUMMELEN, 1965).

The Dunkirk III b marine tidal flat sediments (generally between 0-2 m), overlying directly the peat and the humeous sand, are clayey near the surface and pass gradually into a more sandy sediment to their base. Near the state limit the thickness exceeds sometimes more than 5 m. Locally the peat is lacking, indicating a superficial erosion during the beginning of the transgression phase.

The Dunkirk III b channelsediments cut the peat and the humeous sand entirely and erode the underlying sediments deeply. The channelsediments are lithologically heterogeneous and consist of coarse, medium and fine sand, silt, weakly consolidated loam, clay and peat. The main channels (main creeks) of more than 10 m deep contrast with the creeklets, which are much smaller as well in broadth as in depth.

PHYSICAL GEOGRAPHICAL CHARACTERISTICS

The general altitude of these flat Sceldtpolderregion is situated at about +3 O.P., some levels at +3 are exceptional. The relatively low creekbottoms occur generally at +1 or +2. Sandy pleistocene patches represent the highest natural zones and reach easily +5 and +6.

Micromorphological differences in height between the separate polders* are frequent. The "Oude Haantjesgatpolder" lays about 15 cm higher than the "Beooster Edepolder" and the Roeselarepolder; the "Nieuw Haantjesgatpolder" is about 30 cm higher than the Kleine Boompolder and the Roeselarepolder. The Brandkreekpolder dominates also the St. Kruispolder and the St. Lievenspolder by a 40 cm higher level. These differences are directly related to the active accretion period.

The dikes represent an asymmetrical transversal profile by their different side slopes. Their height of 2-3 m hinders the panoramic view. Only the dormant dikes (slapersdijken) are partly levelled or dissected at regular places for the access of fiels. The Graaf Jansdike is built as a seawall on the higher pleistocene ridge of St. Laureins. The other dikes such as the Oostpolderdike, the Mariapolderdike, the St. Janspolderdike are built for land reclamation. Breaches are sporadiacally, e. g. in the neighbourhood of Krabbe, north of Bentille, the Houtlanddike was cut.

The creekrelicts and the fossil tidal channels of various sizes are the most striking reliefvariation in these polders. They are discussed more in detail in the following chapter.

(*) The maximum height of the salt marsh tidal flat is compared by detailed levelling.

CREEKTYPES (Fig. 1)

The creeks are mapped on a pure qualitative base and the distinction between creeks and creeklets is based ond an empiric way.The term creek corresponds with the main tidal channels, "geul" used by VANSTRAATEN 1964, and creeklet corresponds with the sidebranches of the tidal channels and is related as well as to the term "priel" for the intertidal zone as well as to the term "kreek" only used by VANSTRAATEN 1964 for the high tide salt marsh gullies.

The further differentiation of creeks and creeklets is made on physical geographical and micromorphological data such as breadth, depth, randommorphology of the creek, accretion stage, vegetation cover, the presence of gullies and tidal levees.

The sedimentological data are based on borings and excavations.

CREEKS

- watercreek with taludborder (type 1)

the creekbottom is permanently filled up with water, which lays 2 m lower than the adjacent polderlevel. The creekborder is mostly very steep and is accentuated by a talud, which is temporarely affected by slumping due to wind and wave action. The nearby poldersurface is sloping very slightly towards the taludborder. The creeksediments are sandy. A small reedrim is sometimes present. The Blokcreek, Boerecreek, Oostpoldercreek and the Bentillecreek are type examples.

- sandcreek with taludborder (type 2)

the completely colmatated creekbottom lays about 1 or 2 m below the adjacent polderlevel. A rest gully associated with natural levees is present. Sand is outcropping in the gully bottom and heavy clays are deposited in the depression behind the natural levees. The sandy sediments are characterized by shellbanks (e.g. Mytilus). Some sections of the Brandcreek correspond with this creektype.

- claycreek with knickpointborder (type 3)

the relatively low lying clayey creekbottom passes gradually to the higher adjacent polderlevel. The creekborder is indicated by a rather indistinct knickpoint. A rest gully is mostly present. The silty and loamy creeksediments are finely laminated. The base creeksediments are sandy and contain reworked claylaminae and claypebbles. The creektypes occur in the Oude Haantjesgatpolder and the Nieuwe Haantjesgatpolder.

CREEKLETS

- Reedcreek with taludborder (type-4)

the marshy creekbottom is overgrown by a reed vegetation, where in small ponds sporadically occur. The talud border of mostly 1 m marks very well the creeklimit. The creeksediments are dominantly peaty and alternate with fine, laminated silt. The erosive creekbase is covered by a sandy debris with claypebbles. The creekbottom is never cultivated.

- Siltcreek with taludborder (type 5)

the most silty creekbottom is well limited by a steep talud of 1

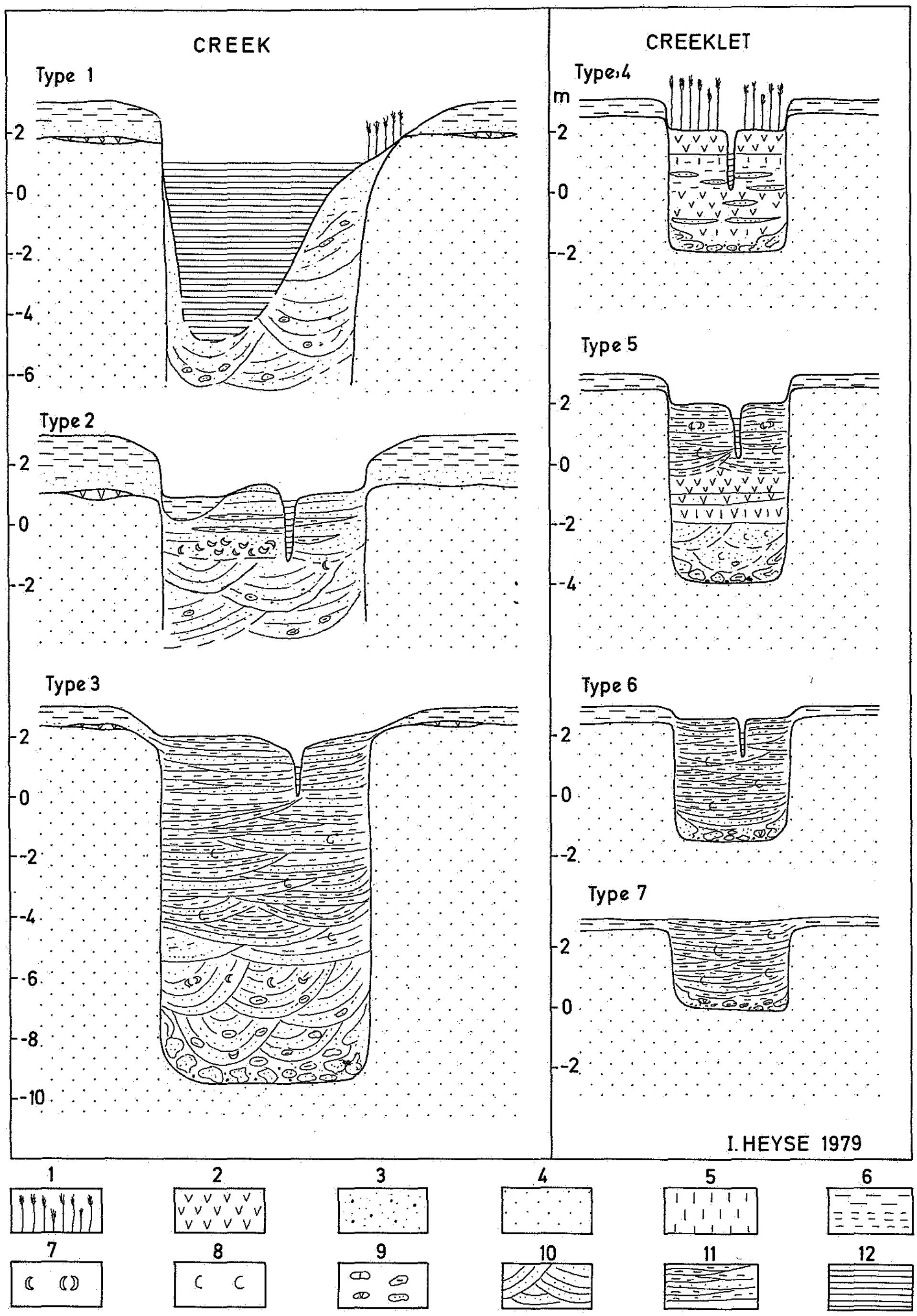

Fig. 1 - Creektypes

Legend :

1. reed
2. peat
3. sand
4. pleistocene sand
5. loam-silt
6. clay
7. marine shells
   - shellfragment
   - bivalves
8. calcareous
9. lenses of loam, clay, peat or sand
10. troughlike sedimentary structures
11. clay lamellation
12. water.

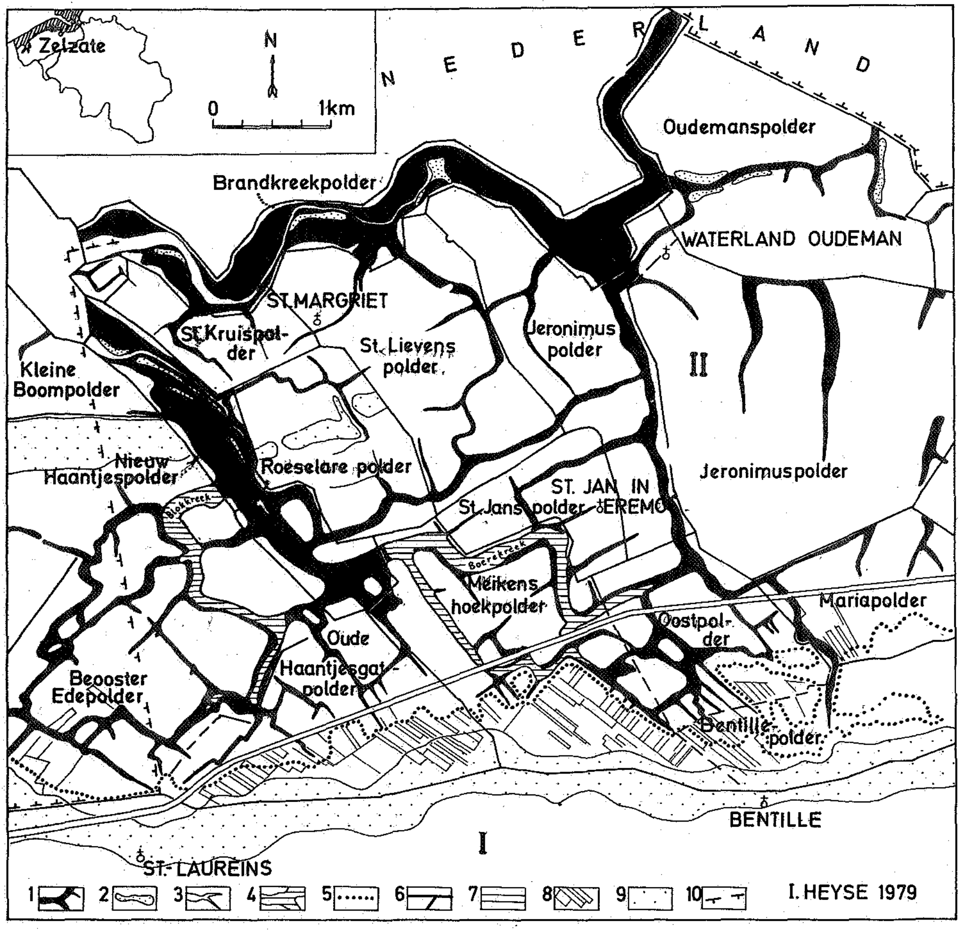

Fig. 2 - Creekpattern

Legend :
1. creek
2. tidal levee
3. rest creek
4. water creek
5. polder limit
6. dike pattern
7. Leopoldcanal
8. parcelpattern
9. pleistocene coversandridge
10. state limit

or 1,5 m. The silty sediments with bivalves of Scrobiculariaplana are not consolidated and alternate with peaty levels. The lower creekbase sediments are sandy and consist partly of a debris. Only meadows occur in these badly drained soils.

- Claycreek with borderlimit (type 6)

the relatively low clayey creekbottom passes gradually into the adjacent clayey tidal flat sediments. The creekborder is continuous but morphologically rather indistinct. A fine clayey lamination dominates the creekinfilling and passes to a more consolidated topclay. Only the creekbase is covered by a debris. Agriculture is common in this creektype.

- Claycreek without borderlimit (type 7)

the clayey creekbottom lays nearly at the same level as the nearby clayey tidal flat sediments. The creekborder is morphologically very indistinct by lacking a borderlimit, and the boundary is only based on secondary phenomena such as wet zones or moist patches. Laminated clay and silt characterize this creektype, which is always cultivated.

CREEKPATTERN (Fig. 2)

The mapping of the creekpattern on morphological base was very easy for the creektypes 1 and 4, rather easy for the creektypes 2, 3, 5, 6 and very difficult for the completely buried creeks of type 7. It is possible that some creeks of the last type were not observed so that fig. 2 must be interpreted as a minimum creekpattern. It was nevertheless possible by this qualitative fieldmapping method to reconstruct the original creekpattern.

A system of large branches and channels with numerous side branches appears. A sinusoidal pattern is only clear in the Brandcreek near the Belgian statelimit. The most striking phenomena is nevertheless a rectilinear orthogonal creekpattern, which is very clear north of St. Laureins and Zelzate near the polderlimit and continues southwards Aardenburg. The distinct relationship with the buried parcelpattern, already mapped between 1971-1974 was further worked out by Th. DEMUYNCK on the base of air photo interpretation (1977). The buried parcelpattern is still reflected in the actual soil by drainage differences and vegetation indications of the crops.

The main question arises, which process and mechanism is responsible on the one side for the exceptional orthogonal creekpattern in the polderrandom zone and the more normal dendrietic creekpattern more northwards towards the Sceldt estuary.

INTERPRETATION AND GEOMORPHOLOGICAL EVOLUTION

The dominantly east-west running pleistocene coversandridges of the Flemish valley, acting as natural sea-walls were cut by the Dunkirk III b transgression in the early 15e century (1375-1404) GOTTSCHALK 1955 - DE MUYNCK Th. 1977. Especially the autumn and winter storms were responsible for the different marine invasions. The original protected low laying peatland and the higher flat cultivated area were flooded twice a day by springtime. The eventual peat digging lowered still the natural level and accelerated the inundation. Also the storms of the 16e century (1516, 1530, 1532, 1570) were very destructive and the strategic inundations of 1583 and 1584 (1583-1621 Eighty Years War) have still accelerated the process. During the springflood the water was preferably canalized by the ditch pattern of the parcels in the cultivated area. More northwards in the real peatland a normal dentritic tidal channel pattern originated. The reversion of the eb and floodstreams resulted in a periodical vertical erosion of some ditches in the transgressionrandomzone. Some ditches knew an accelerated vertical deepening and widening and were transformed into broad tidal channels and creeks with orthogonal pattern. This is the case for the "Blokcreek", the "Boerecreek" and the "Bentillecreek", which were linked together to one big creeksystem. The streamvelocity permitted vertical erosion near the transgression limit but was insufficient for lateral migration of the channels. More seawards however the hydrodynamic stream system was more rigoureous, characterized by higher extreme stream velocities, resulting in a morphological subaquateous intertidal active zone with lateral migrating tidal channels. The eventual orthogonal creekpattern disappeared quickly. It is however likely that the ditchpattern was more lacking in the peatland and that the original orthogonal creekpattern was less developped in that area. The Brandcreeksystem belongs to this area. The lithologic boundary between the peatarea and the humeous sandy area is situated near St. Margriet and follows an east-west direction. It continues in western direction south of Aardenburg (VAN RUMMELLEN, 1965).

In the large tidal channels and creeks sandy sediments were transported dominantly. Clayey and silty material was fixed in the creeklets and creeksidebranches as a result of the low streamvelocities, the long sedimentation rate and the fixation of suspensionmaterial by a salt marsh vegetation.

In constructing dikes for land reclamation (16e, 17e, 18e century) some creeks and creeklets were cut off artificially from the natural tidal channel system and their evolution was stopped suddenly.

The watercreeks and the reedcreeks were isolated in this way. The further evolution of the remaining tidal channels was accelerated by silt accretion not only upon the tidal flats but also in some main creeks as a consequence of the artifical change hydrodynamic system by dike building (e. g. type 2 and 3, Oude Haantjesgatpolder, Nieuw Haantjesgatpolder). The colmatation of the main creekbranches ended with a small restcreek associated with natural levees and extra high tidal flat sedimentation. Further land reclamation resulted in relatively higher situated polderlevels. Some polders were inundated again as a consequence of a breach. Hereby a thin silt blanket could be deposited. Ringdikes around the breach were constructed and closed depressions with ponds are the nowedays morphological relicts.

The polders near the transgression limit knew a relatively short silting up period and represent a low laying badly drained zone. The originally natural draining in northern direction was reversed by the excavation of the Leopoldskanaal, which solved the draining definitely in western direction to Maldegem and Heist.

CONCLUSION

The active creektype morphology depends upon the position in the interdidal zone (slikke-schorre). In the slikke large intertidal channels main creekbranches or creeks occur; and in the schorre minor intertidal channels creeklets are dominant.

The actual fossil creektype morphology in the polder area near Zelzate depends also upon the colmation stage, the vegetation, the sedimentcover and the reclaiming moment. The actual orthogonal creekpattern near the polderlimiy was induced by ditches of a fossil parcelpattern and is of anthropogeneous origin. More seawards in the peatare, the normal dendritic creekpattern dominates and is of natural origin.

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