QUATERNARY GEOLOGY LITHOLOGY OF THE SURFACE DEPOSITS

The map of the Quaternary geology has been prepared from the detailed soil maps published by the Soil Survey Centre under the direction of R. TAVERNIER and afterwards of G. HANOTIAUX under the auspices of the Institute for the Encouragement of Scientific Research in Industry and Agriculture (IRSIA). Data of soil maps surveyed subsequently and partly still unpublished of Belgian Lorraine, the Entre-Sambre-et-Meuse region and Limburg have also been taken into account.

The map of the Quaternary largely corresponds to a lithological map of the surface deposits. It has been completed with data concerning the deeper Quaternary deposits, such as the subsoil of the polder areas or the older Quaternary deposits of the Campine.

The manuscript of the map was prepared in 1981 at the scale of 1:160 000. For the Atlas map in four sheets at the 1:250 000 scale the outlines have been adapted to a more recent topographic base. The map has been printed at the request of the Belgian Geological Service (Director J. BOUCKAERT, Inspector General; R. PAEPE, Chief Geologist, Director).

Remarks concerning the map of the soil associations (sheet 11b of the first Atlas of Belgium, R. MARECHAL and R. TAVERNIER, 1970) and the soil suitability map (sheet VIII.10 of the second Atlas, R. MARECHAL, 1988) equally apply to the map of the Quaternary geology. The Quaternary deposits have such variability that is is impossible to represent them precisely as to extent, thickness or composition on a map at the scale of 1:250 000. It is impossible, for example, to show in Middle and High Belgium the details of the very dense and strongly ramified network of depressions, both wet and dry, and the narrow valleys to which they are linked.

HOLOCENE

COASTAL PLAIN

The formation of the coastal plain is due to the rise of the sea level during the postglacial period. A first phase of inundation occurred about 4500 BC and lasted until about 2800 BC. The Calais clay and sand deposits date from this phase as well as a line of ancient dunes. Peat was formed behind this barrier. This barrier was disrupted, the coastal plain was flooded again and the Dunkirk deposits were formed. These inundations occurred in successive phases: the Dunkirk I phase of rather limited extension from about 300 BC until the beginning of our era; the Dunkirk II phase, from the 3rd to the 8th centuries AD, which was by far the most important and during which the coastal plain was almost entirely submerged, particularly the part situated in Western Flanders; the Dunkirk III phase, in the 11th century, which resulted from two zones of breakthrough, the Zwin and the Yzer embayment. During these various phases the present day dunes gradually developed.

The deposits of the Dunkirk I phase have no outcrops; the zones where the surface beds consist of Dunkirk II

deposits are called the old polders, whilst the Dunkirk III deposits underly the middle polders. The two breakthrough areas, the Yzer embayment and the Zwin, have been diked mainly in the 12th and 13th centuries and constitute the recent polders. The later submerged zones and those inundated for strategic reasons during wartime in the neighbourhood of Ostend and especially in Zeeland Flanders and the bordering regions, are called the historical polders.

As a result of the drainage of the polders the areas with a peaty subsoil settled, whilst the tidal channels where the peat had been eroded and which were filled with sandy sediments, do not present this phenomenon: they are now at a slightly higher level than that of the areas with a peaty subsoil. This inversion of relief is particularly clear in the old polders.

The outcrop zones of deposits which are normally found under the peat are called moeres; their origin is mostly attributed to the exploitation of the peat in areas where the Dunkirk deposits were very thin or even completely absent.

Unit 1 consists of the recent dunes, formed during the Dunkirk phases and composed of dune sands that are still calcareous. It includes the higher still mobile dunes as well as the lower and less undulating dunes (e.g. «pannes»), the leveled dunes (Lombardsijde) and the transition zones, where dune sands rest on polder deposits.

Unit 2 corresponds to the older dune sands, often decalcified at the surface, considered to be the remnants of the dunes of the Calais period; they are only found to the west of Adinkerke.

Unit 3 includes the zones where the surface deposits consist of Dunkirk III or more recent clays, occasionally passing into sands in the breakthrough zones and tidal channels; peat occurs only rarely at a shallow depth; these polders, sometimes with partially filled or even open channels, have been diked in narrow strips (in the recent polders) or in blocks (in the historical polders).

In *unit 4* the Dunkirk III clay often rests at a shallow depth on the deposits of Dunkirk II age, either sand or clay with a peat subsoil. The channels of the Dunkirk III phase are for the most part of little importance, filled with clay and not showing relief inversion.

In *unit 5* the Dunkirk II clay sediments are found at the surface; they pass into the Dunkirk II sands in the channels or rest at a shallow depth on peat; as a result an inversion of relief is clearly visible.

In the three preceding units *additional signs* indicate areas where an abnormal subsoil appears at a shallow depth (< 1 m):

- *Dunkirk I deposits at a shallow depth:* to the east of Ostend, where sediments considered as Dunkirk I (principally clay) are found between the Dunkirk II deposits and the peat;
- *Peat at a shallow depth:* in many sites outside the tidal channels, principally in the units 4 and 5, including areas where the peat has been stripped off;
- *Calais deposits at a shallow depth:* in the region between the old dunes and the recent dunes between De Panne and Adinkerke, where the Dunkirk II deposits rest on the Calais deposits, without peat intercalation;
- *Pleistocene deposits at a shallow depth:* in the border zone, where Dunkirk deposits rest on Pleistocene sand or sandy loam at a shallow depth.

Unit 6 includes the Moeres to the south of Adinkerke, where the Calais deposits are outcropping. The small area

to the west of Bruges mapped as *unit 7* is due to the exploitation of peat resting on a sandy Pleistocene subsoil.

INTERIOR

Compared to those of the coastal plain, the Holocene deposits in the interior of the country are only of limited importance. They are grouped in three mapping units.

Unit 8 includes recent alluvial deposits. At the surface they are either mainly clay (in Low Belgium and in the principal valleys of Middle Belgium) or loam (in the less important valleys of Middle Belgium and in High Belgium). In the principal valleys of Low Belgium levee sediments close to the river courses are rather fine textured (sandy loam), whilst those at a greater distance from the river are even finer (clay). Along the Limburg section of the Meuse abandoned channels meander in a loamy alluvial plain.

In this unit specifications about the subsoil are also indicated by *additional marks:*
Calcareous tufa at a shallow depth, particularly in the alluvial plain of the Moervaart;
Peat at a shallow depth, in numerous valleys of the Campine as well as in some depressions of the alluvial plains in Low and Middle Belgium;
Gravel subsoil, mainly in the valleys of High Belgium and along the Limburg Meuse.

Unit 9 includes dunes extending along rivers. These dunes were formed since Early Holocene, when the rivers were still deeply incised and the neighbouring sandy areas subjected to excessively dry conditions. These are particularly found to the east of the valleys, along the Lys, Scheldt, Durme, Dyle and Demer. In the Campine the dune sands are very widespread, not only on the rather dry interfluvial zones but also on the higher plateaus.

Unit 10 consists almost exclusively of high peat bogs (with sphagnum). The thickness of the peat reaches at least several decimetres; it was previously much thicker but it has been for the most part exploited. Zones where it is intact occupy only small areas. By far the main areas of these peat bogs are situated on the high plateaus of the Ardenne, the Hautes Fagnes and to a lesser extent the Tailles Plateau. A *special symbol* indicates the less important zones of peat bogs.

PLEISTOCENE

The subdivision of the Pleistocene has been rather arbitrarily fixed. The Late Pleistocene corresponds essentially to deposits dating from the last glaciation (Weichselian). Terrace deposits which date from different mostly earlier periods have been considered as being of Middle Pleistocene age. Finally, undeniably much older deposits have been classified as Early Pleistocene; for some of them there has been and there still is controversy as to their exact stratigraphic position (Pleistocene or Pliocene).

LATE PLEISTOCENE

The main Quaternary deposits, namely the cover sands of Low Belgium, the loessic silt loams of Middle Belgium and the stony loams of High Belgium are for the most part of Weichselian age.

The major variations in the composition of these Weichselian deposits are attributed to eolian transport: coming from the North Sea Basin, at this time mainly dry, the materials were carried eastwards: sandy material, mainly transported by saltation, has to a large part been deposited on the plains of Low Belgium (cover sands), loessic («loam») material transported in suspension was deposited on the more undulating regions of Middle Belgium and even of High Belgium.

Run off and solifluction processes have influenced the genesis of this mantle: material of local origin has been reworked and mixed with eolian material. The stony loams of High Belgium have been formed in this way.

In the plains the sediments have often been reworked by water and exhibit a distinct but irregular stratification. The large Pleistocene valleys, e.g. the Flemish Valley to the north of Ghent, were to a great extent filled with sediments of this type, so forming vast infill plains.

The Weichselian mantle is extremely variable in thickness: it is considerable in the plains and on the large plateau areas, minimal or even absent on the steep slopes or relief convexities. In the undulating areas the mantle is relatively thick on the gentle slopes facing the north or east, relatively thin on the steep slopes facing the west or south.

Coarse elements (pebbles and rock debris) are often found concentrated at the base of the Quaternary deposits.

Locally, especially along the present day coastal plain, the Weichselian deposits may be underlain by older estuarine and wadden materials dating from interglacial periods with a high sea level (Eemian or Holsteinian).

Six units have been defined for the Late Pleistocene, depending on the texture of the surface beds. Rather important textural changes occur with depth, but it is difficult to represent on a map such irregular variations.

Unit 11 includes regions in the northern part of the country with sands or loamy sands, the so-called cover sands. For the most part these sand vary in thickness from 2 to 10 metres.

This unit extends north of the line Dixmude-Ghent-Malines and the valleys of the Dyle and the Demer. Between Ghent and Deinze it penetrates southwards along the Lys and the Scheldt. Further south a wide belt of sandy materials borders the northern flank of the Haine depression between Antoing and Mons.

In the west the topographic level is mostly less than 20 metres; the higher areas generally only have a thin sand

cover. Towards the east the areas above 20 metres correspond to enclaves of light sandy loam or sandy loam inside the sand region, as e.g. in the southern part of the Waasland. Still further east, in the Campine, the sand cover is less thick, but reaches higher levels well over 50 metres.

In *unit 12* the surface beds consist of light sandy loam with minor inclusions of sandy loam. The zone so defined forms part of the transition zone between the sand belt and the loam belt, generally known by the name of the sandy loam region. The relief becomes more undulating reaching higher altitudes than in the sandy region. In Western Flanders where heights of 50 metres are often exceeded, the Quaternary cover is generally thinner (rarely more than 10 metres) or even completely absent. Outside Western Flanders this unit only occupies a narrow and often discontinuous transition fringe.

Unit 13 consists of zones where the surface beds are of sandy loam texture. Its width varies mostly from 2 to 10 km. It penetrates towards the south along the principal valleys. It forms the core of the sandy loam enclaves of the Waasland and the region south of Antwerp. The thickness of the Quaternary cover is extremely variable; near the surface it consists of sandy loam but its texture is greatly variable with depth. Along the valleys the sandy loam is localized on the eastern flank, which is generally quite steep and where the Quaternary cover is less thick, as for example along the Upper Scheldt and the Dender.

Unit 14 includes the main part of the loam belt and covers almost all of Middle Belgium. In High Belgium it occurs only in discontinuous areas. The texture of the loam becomes generally finer in a southern direction. The clay content varies as a function of the pedogenetic processes and reaches its highest values in the textural B horizon, formerly known as «brick earth». The thickness of the loam cover is variable and can reach 20 metres in zones little affected by erosion. On steeper slopes or on convex parts of the landscape this loam can be completely missing.

It is generally agreed that the loam has an eolian origin (loess), certainly when the material is very homogeneous. Nevertheless, the loam frequently contains thin intercalations of sandy, clayey or stony material, whose origin has been attributed to run off or solifluction. The relative importance of these beds increases as the thickness of the loam decreases.

The loam cover dates mainly from the last glacial period (Weichselian) and the soil profile in the topzone, with its most characteristic horizon, namely the textural B horizon, has been considered to be of Holocene age. At greater depths in the loam cover, however, buried soil profiles may be observed. In some cases they appear in the midst of non-altered loam as thin beds of humiferous materials, which are attributable to less cold episodes called interstadials. Elsewhere loam layers occurring in depth are reminiscent of the texture and structure of textural B horizon and suggest for that reason that they were formed during longer periods of relatively temperate conditions, known as interglacials. Besides the Holocene profile developed on top of the Weichselian loam, one or two well developed profiles, often truncated, can be observed in deeper parts. They probably date from the last or the penultimate interglacial (Eemian, Holsteinian). These profiles are developed in loam dating from older glacial periods (Saalian, Elsterian). Sometimes thin peaty deposits are associated with these horizons or soil profiles.

Symbols and additional marks are used to indicate

particular characteristics of units 11 to 14.

An overprint of small dots in units 11 and 12 indicates the presence of *local cover sands*, i.e. of sands to light sandy loams which have been reworked by wind during the Late Glacial period.

An example of these local cover sands is found along the present day rivers. This phenomonon is typical along the Lys and the Scheldt upstream from Ghent, where the sands contrast clearly with the heavier soils situated further from the rivers. The sandy zone to the north of the Haine can also be regarded as a sand cover of this type.

A second example is characteristic for homogeneous sand areas, where the sand has been reworked by eolian processes to form low ridges with a general WSW-ENE alignment. This is particularly visible in the large sand plain to the north and northeast of Ghent. One such ridge, markedly more important, extends from near Gistel across the Bruges region and the north of Eastern Flanders to the Waasland polders near Kieldrecht.

In the Campine, sands of this type are located on the higher parts of the interfluves.

The line showing the *extent of the thick Pleistocene deposits in the Flemish Valley* borders a region where the Quaternary cover reaches a thickness of at least 10 metres and in some cases even more than 30 metres. During the Late Pleistocene, the rivers were eroding strongly; this phenomenon probably started in the Saalian or even in the Elsterian, but it was amplified again at the start of the Weichselian. The infill dates partly from the Eemian, but mainly from the later phases of the Weichselian. To a great extent the filling in of these valleys took place in cold climates and for this reason it is nowadays often described as fluvio-periglacial.

This infill plain called the «Flemish Valley» reaches its greatest width to the north of Ghent. The western limit corresponds nearly to the diversion canal of the Lys, the northeastern limit to the border of the Waasland, whilst the southeastern limit approximately corresponds to the Scheldt between Gavere and Dendermonde. This plain branches into several tributaries: the plain of the Lys, the plain of the Upper Scheldt between Gavere and Tournai, the Plain of the Dender as far as Geraardsbergen and in particular the plain (which might be called pre-Rupel plain) between Dendermonde and Malines.

The materials in this plain consist mainly of sand at the surface, more rarely of sandy loam or loam, but in depth they have a texture which varies greatly: fine sand, coarse sand, sometimes even gravel or peat. For the most part they are of Weichselian age, but in the deeper parts coarse materials have been considered as estuarine deposits of Eemian age. At the border of this infill plain remnants of older deposits belonging to the Eemian, the Saalian or even the Holsteinian may be found.

Unit 15 is limited almost exclusively to the extensive Ardenne plateaus of gentle relief. The loam material could have been brought here by eolian processes, like that of neighbouring regions. In part the Quaternary cover is here of a local origin too; it contains weathering products from the local bedrock; the sandy loam, loam or clay is mixed with more or less friable rock fragments (shales, phyllites or sandstones) and occasionally with slightly altered fragments of resistant rocks, such as quartzites or vein quartzes. The content of rock fragments, however, is generally fairly low (5 to 15%).

It is thought that these materials were mixed up by solifluction and cryoturbation. In this unit the thickness of the heterogeneous loam cover mostly exceeds 1 metre. The content of coarse fragments generally increases with depth. Reddish coloured materials are occasionally found, taken to be evidence of an older pedogenesis or weathering, perhaps of Tertiary age. It is often difficult to decipher the difference between solifluction layers and material which has been weathered *in situ*.

Unit 16 includes older alluvial materials with clearly marked soil profiles and which probably date from the Weichselian or at least the Late Glacial.

Symbols indicate the presence of particular deposits at the base of the Weichselian cover.

The *Meetkerke deposits* occur in the region of Jabbeke, Bruges and Eeklo, nearly at the same level as the present day coastal plain deposits, which they strongly resemble. They generally rest on a Tertiary substratum and are covered by sands of Weichselian age, themselves often overlain by recent polder deposits. They are considered as deposits of the coastal plain of Eemian age.

The *Izenberge deposits* have been found in the basin of the Yzer, principally on the Izenberge plateau, at levels between 5 to 15 metres. They consist of sandy material with numerous shells of *Cardium edule*. They rest on the Ypresian clay and are covered by sandy loam of Weichselian age. They are attributed to the Holsteinian.

MIDDLE PLEISTOCENE

Terrace deposits are mainly included under this heading. Especially in High Belgium, these fluviatile deposits occur as shelves along valley flanks at different levels above the present river. In Low Belgium they are also found on the summits of crest lines. The principal terrace deposits occupy the low plateau of the eastern Campine, where they were deposited as part of the Meuse or Rhine gravel train.

In *unit 17* the surface deposits are composed of gravel materials embedded in a sand or sandy clay matrix. They cover small areas along the principal valleys (Meuse, Sambre, Lesse, Ourthe, Semois). Some incised meanders have also been related to this unit. A large gravel train caps the watershed between the basins of the Yser and the Lys in the region of Ypres.

In *units 17a en 17b* the terrace deposits are covered by a thin and sometimes gravelly sand cover (about 1 metre). The distinction between the two units is based solely on their topographic position: unit 17a is limited to the lower levels (less than 50 metres) to the east and northeast of the low plateau of the eastern Campine, whilst unit 17b includes the major part of this low plateau, at levels ranging between 100 metres in the southeast and 50 metres in the northwest. The terrace of the low plateau of the eastern Campine is mostly dated as Menapian or Cromerian, whilst the lower levels are considered to be of Elsterian, Saalian, or even younger age. The western limit of the gravel terraces of the Campine is indicated by a *distinctive line* on the map.

Unit 17c includes the areas with terrace gravels overlain by a loam cover at least 1 metre thick. They correspond to several large terraces along the Sambre and the Meuse between Charleroi, Namur, Liège and the Dutch frontier.

EARLY PLEISTOCENE OR PLIOCENE

Under this heading deposits are grouped, that are generally agreed to be of older Pleistocene age or that have been alternatively regarded as being of either older Pleistocene or Pliocene.

The silicified oolite deposits of *unit 18* consist of well rounded and well sorted small milky quartz pebbles with occasional silicified oolites, bedded in a reddish mottled sandy clay. These gravels are located principally along the summit crest of Middle Belgium, situated immediately north of the Meuse valley between Namur and Liège. Analogous deposits are found locally on the plateaus to the south and southwest of Liège, where the gravel fraction is mainly composed of rather poorly rounded quartzite pebbles. In both cases these deposits are considered to be the erosion products of a deeply weathered continent. Nowadays they are usually considered as Pliocene.

In the Meuse region these deposits are found on broad plateaus covered with a thick loam layer; they are mapped as *unit 18a*.

The Campine clay of *unit 19* appears in the north of the Campine. Actually it comprises a mixture of sands and clays, obviously formed on a coastal plain and generally considered to be of early Pleistocene age (Tiglian).

The Brasschaat sand of *unit 20* is outcropping to the south of the Campine clay. It is composed of slightly glauconitic sands of uncertain origin.

Unit 21 corresponds to the Mol sands. In the type-region these sands are very pure, perfectly white, with local intercalations of lignite. Their continental origin is generally agreed. They occupy a zone to the east of the Brasschaat sands. The relations between these two deposits are still unclear and it is quite likely that there is a lateral transition between them. There has long been a controversy about their age, but nowadays there is a trend to attribute them to the Pliocene.

In the Campine the deposits mentioned above are generally covered by a Weichselian sand cover of variable thickness. They are only shown on the map if they appear at shallow depth (< 1 m).

The extension of these deposits towards the south is shown by *distinctive lines*.

REGIONS WITHOUT OR WITH A THIN QUATERNARY COVER

Units 22 to 35 include regions where the Quaternary cover is relatively thin (< 1 m) or even completely absent. In Low and Middle Belgium they occur in isolated areas of variable extent, whilst in High Belgium they cover vast continuous zones.

QUATERNARY COVER PRINCIPALLY SAND

The Quaternary cover consists of sands including a variable proportion of residual elements (gravel, rock fragments) or fragments derived from the subsoil. *Unit 22* includes zones with a substratum of Tertiary sands or clays within the sandy region, *unit 23* the zone with a chalk or marl substratum of Senonian and Turonian age on the northern border of the Haine basin.

QUATERNARY COVER PRINCIPALLY SANDY LOAM OR LOAM

Unit 24, located especially in Middle Belgium, consists of zones where pre-Quaternary sands or clays are outcropping or overlain only by a thin Quaternary cover of loam, sandy loam or clay texture mixed up with local or residual elements (sand, clay, gravel, rock fragments).

Units 25 to 28 correspond to zones where the subsoil is Mesozoic. *Unit 25* is characterized by a chalk substratum either outcropping or underlying a thin loam bed containing local materials (fragments of chalk and flint, weathering clay). In *unit 26* the subsoil is marl or clay; often the surface layers are clayey, mixed with a certain proportion of loam. *Unit 27* is localized in Belgian Lorraine; the Jurassic sandstones are often altered to a sandy material covered or not by a thin layer of sandy loam material. The macignos

(ferruginous calcareous sandstones) are generally weathered to clay, stony loam or sandy loam. Finally *unit 28* includes the zones with Jurassic limestones altered to a more or less stony clay sometimes covered by a thin loam layer.

QUATERNARY COVER PRINCIPALLY STONY LOAM

The last units (29-35) correspond to zones where a solid rock is found at a shallow depth, generally beneath a thin (< 1 m) cover of stony loam, where the rock fragments reflect the more or less altered local bedrock.

For *unit 29* the bedrock consists of conglomerates and marls (Permian, Triassic), the cover of gravelly loam. It is found in the Malmédy graben and along the northern border of Belgian Lorraine.

Unit 30 groups zones where the bedrock is shale of variable age. In general these zones have been affected by intense erosion and the slightly altered bedrock is here found at a shallow depth. The loam cover, mixed with many small shale fragments, is relatively thin. This is especially the case in the Famenne and the Fagne on the Middle and Upper Devonian shales. On the Upper Carboniferous and the Silurian shales the alteration is often deeper and the Quaternary cover thicker, more clayey and less stony.

The zones where the bedrock is calcareous are grouped in *unit 31*. The cover consists of loam, often mixed with weathering clay and limestone fragments, silicified or not. The limestones appear in two major stratigraphic units: the Lower Carboniferous (Dinantian, «Carboniferous Limestone») mainly in Condroz and along the Sambre-Meuse Furrow; the Middle and Upper Devonian (Frasnian, Givetian and Couvinian) mainly along the southern border of the Famenne and the Fagne. In general the Carboniferous limestones are more deeply weathered than the Devonian limestones. In the latter case the Quaternary cover is often nearly absent.

Unit 32 marks the transition zone between the shales (or eventually the psammites) and the limestones. The bedrock consists of calcareous shales and argillaceous limestones. This unit is mainly located in the Famenne and in the Fagne, on Middle or Upper Devonian strata. Often the bedrock has been slightly altered and the Quaternary cover is very thin.

In *unit 33*, typical of Condroz, the bedrock consists of thinly stratified micaceous feldspathic sandstones («psammites»). On the plateaus this bedrock is often deeply weathered to a micaceous clayey sand. The quaternary cover is often quite thick (60-100 cm) and usually of sandy loam texture.

Unit 34 is intercalated between unit 33 (on psammites) and 30 (on shales) in the transition zone between Condroz and Famenne. The bedrock is composed of fissile psammites or sandy shales. It is often slightly altered and only overlain by a thin very stony cover.

Unit 35 includes by far the major part of High Belgium; it covers almost the entire Ardenne region, with the exception of zones mapped as unit 15. The difference between the two units is furthermore relatively slight; in unit 15 the stony loam cover is generally thicker and less stony. In unit 35 the cover mainly has a sandy loam texture containing shale, slate, phyllite, sandstone or quartzite fragments, as well as weathering products from these rocks. The thickness of the stony loam cover often reaches 60-100 cm. The bedrock consists of shales, phyllites or sandstones of early Devonian or Cambro-Ordovician age.

ALTERATION FACIES

The pre-Quaternary substratum has very often been affected by weathering phenomena, such as decalcification of sandy or clayey sediments, oxidation of ferruginous materials or fragmentation of solid rocks. Only three weathering facies have been indicated owing to their typical characteristics and their presence in the surface layers.

Limonitic sandstone is formed by the alteration of glauconitic sands. This facies is frequent on the Diestian sands of the Hageland and the southern Campine. Some limonitic sandstones are also found in the east of Brabant on the Brussels sands, but their extension is less well known and they only rarely occur in the surface layers. For these reasons they do not figure on the map.

Flint or silicified limestone occurs very frequently; on chalk the insoluble flint is concentrated in deep weathering facies («clay with flint») or they are scattered throughout the Quaternary loam or sandy loam cover. On the Condroz plateau the limestones are often deeply altered and silicified. Fragments of silicified limestone are also reworked in the weathering zones, often at the same time as Tertiary sand or clay, and from there into the loam cover. On the chalk and especially on the limestone the thickness of the alteration zone can often be very considerable, particularly in solution pockets.

The *superficial alteration clay* appears in the Famenne and Fagne regions with shale bedrock. It is not linked with older alteration processes as in the two preceeding cases, but is a recent phenomenon tied up with very flat relief and poor drainage. The layer of weathering clay everywhere remains relatively thin (20-40 cm).

UNDIFFERENTIATED UNITS

Particularly in Middle and High Belgium *river and stream deposits in narrow bands* are indicated, when they represent important sections of the hydrographic network, irrespective of their width. The dry valleys are not indicated, although in certain areas they form a very dense and

sometimes strongly ramified network, especially in the regions with a permeable subsoil (sand in Brabant, chalk in Hesbaye, limestone in Condroz).

Deposits on steep slopes are not differentiated. The steep slopes of the valleys in High Belgium are generally mapped as such. This unit includes outcrops of solid rocks, zones with a very stony cover resting on a slightly or non altered bedrock as well as zones with a thicker stony cover in the concave segments or at the foot of slopes.