



**SCHELDT  
DELTA**

ASPIRING  
UNESCO  
GLOBAL  
GEOPARK



# **GEOSITES TELL OUR STORY**

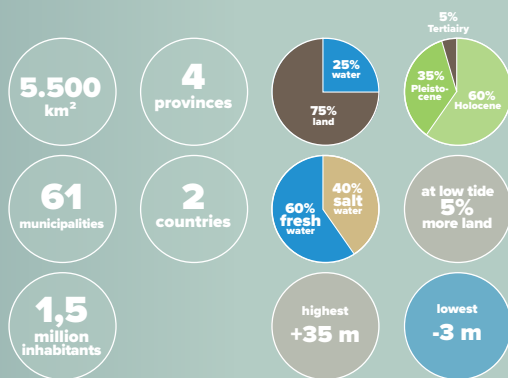


On the tides of  
time and climate



# ASPIRING GEOPARK SCHELDT DELTA

## Facts and figures



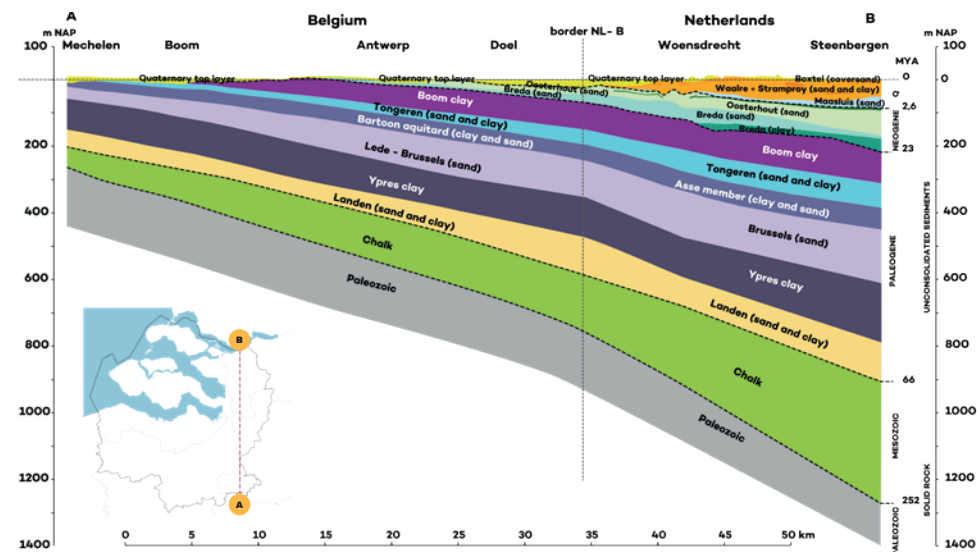
## Unique in its kind

Along with the sea, the river Scheldt has strongly influenced the landscape in the Scheldt Delta (on the border of Belgium and The Netherlands). In the last millions of years, this area has changed constantly. Sea-level fluctuations, partly the result of climate change, effected the area and later also the residents. Exactly that interaction between geological processes and

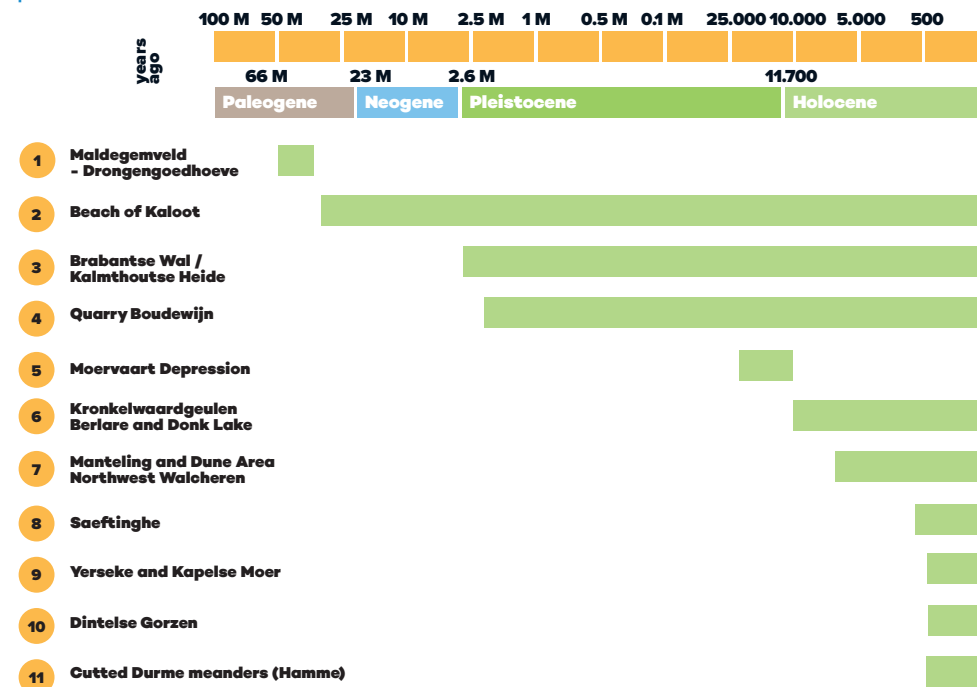
the various human interventions makes this delta area, actually an estuary, unique in its kind.

On a global scale, it is part of the most vulnerable areas for climate change and sea level growth in the world. We are not only looking at the past, but also towards the future, where new big challenges await.

## Profile Mechelen - Antwerp - Steenberg



## Geological time scale







## On scale of the time

**In the penultimate Ice Age (Saale – 238,000 to 126,000 years ago) the forerunner of the Scheldt scoures a deep valley (Flemish Valley) and finds a new way – westwards – towards the sea.**

Earlier deposits, which are now also skewed, are eroded away and transported to the sea. Only at the edges of the valley, hills (cuestas) still witnesses in the landscape of deposits, which covered the area in earlier periods. These mostly clayey deposits have an age of 37 to almost 50 million years. On the Cuesta of Meetjesland, near Knesselare, the clayey subsoil caused a late exploitation

of the land. After all, the heavy clay made this area little attractive to live in. In the Middle Ages there were attempts to convert it into field and pasture, but that attempt largely failed. The large mining farms of the capital-powerful abbeys disappeared (oldest Drongengoedhoeve) or degraded to ordinary farmhouses (Papinglo). So it remained a heathland, only interrupted by fish ponds. At the end of the 18th-early 19th century, a new attempt at exploitation was undertaken

that eventually succeeded. People divided the land in square blocks (checkerboard pattern), lined with lanes: the Maldegemveld.



### Geological museum in Maldegemveld

In the Drongengoedhoeve, which is located on top of the Cuesta, a geological museum is present, which further explains the origins of the Cuesta and its relation to the erosive effect of the river Scheldt.



## Fossils on the beach

**On the north side of the Western Scheldt lies Kaloot: a three kilometre long beach sandwiched between the nuclear power plant of Borssele and the Sloehaven.**

This beach is known for its great diversity of fossils, which can be found along the flood line, such as shells, whalebones, shark teeth and stingrays. The fossils are carved out of several sedimentary deposits, which are cut tens of meters deep by the tidal channels of the Western Scheldt. These layers date from both the Quaternary and Tertiary, allowing found fossils to have a variety of ages. The oldest

fossils are found in Paleogene deposits that are raised by the deepest gullies of the Western Scheldt and are deposited to the beach (especially in stormy conditions) by tidal currents. In

addition to the sandy deposits, Holocene clay banks are also visible at low tide on the beach. In addition to fossils, flint and later bone remains of mammals can also be found.



**Kaloot**, part of a Natura2000 area, is a natural and high-contrast buffer between the Western Scheldt and the industrial area Vlissingen-Oost. The dune landscape of Kaloot is constantly evolving, which causes the supply of new fossils and interesting geomorphological processes.

## Sand and Clay

**A large part of Flanders and The Netherlands was covered by a sea at the start of the Quaternary (2.6 million years ago). At the beginning of the Quaternary, the sea gradually withdrew. Around 2 million years ago a coastal plain was created where rivers, precursors of the rivers Rhine and Meuse, debouched. These rivers deposited layers of both clay and sand, which are now still discoverable as layers in the substrate.**

Glacials (cold periods) and Interglacials (warmer periods) succeeded each other. Powerful northwinds supplied sand from the dry North Sea during the coldest part of the last Ice Age (70,000-15,000

years ago). At the very end of this Ice Age (15,000 - 12,000) elongated coversand ridges arose. In the same period, the Scheldt gradually shifted its course to the east, via Antwerp, to find a new way to the sea. The Scheldt eroded a clear steep edge in earlier sandy and clayey deposits. Nowadays this edge, locally known as the “Brabantse Wal”, forms a clear transition between the higher sandy soils and the lower coastal plain of the Scheldt Delta.

At the beginning of the Holocene (11,500 - 10,500 years ago) river dunes were formed out of the denudation plain of the Scheldt and were

blown on top of the Brabantse Wal. These dunes can be found at a large scale, up to Kalmthout in Belgium.

After the Ice Age it became warmer and the plant growth expanded. The landscape consisted of dense deciduous forests on the high sandy soils and vast peat marshes and open water on the lower parts. Nowadays a varied heath landscape is present on the east side of the Brabantse Wal with open sand, dry and wet heaths, fens and forests. This Natura2000 area, locally known as “Kalmthoutse Heide”, is one of the last truly vast heath areas of Flanders.





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**QUARRY BOUDEWIJN**

🕒 2.4 million years - present



# Layer by Layer

**The quarry Boudewijn near Ossendrecht is located in a very diverse area on the “Brabantse Wal”. Vast heathlands, forests and fens give the surrounding area its character.**

The former lime sand quarry was in operation for the purpose of the limestone fabrication. The original altitude was 25m, but is nowadays 12m, due to the mining of sandy layers. The quarry gives a good overview of the geological history of the Brabantse Wal and adjacent Belgium. The edge of the quarry terrain shows the original twisted landscape



(15,000 to 10.500 years ago) are visible at the foot of the wall. The old clay layers of the local Waalre formation (2.4 to 1.8 million years old), can only be observed very locally. In Roman times, this old clay was already used to bake roof and floor tiles.

formed by medieval sand drift and dune formation. In the remaining quarry wall, drift sands can be seen with two interconnected podzol soils. The underlying cover sands and river dunes dated from the last cold period of the Ice Age and start of the Holocene

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**MOERVAARTDEPRESSIE**

🕒 20.000 - 11.000 years ago



# Disappeared Freshwater Lake

**At the end of the last Ice Age (15,000-12,000 years ago), large sand dunes were drifted from the coastal plain to elongated East-West pointed coversand ridges.**

One of the largest, the coversand ridge Maldegem-Stekene, dammed the northern end of the Flemish Valley, the primebed of the rivers Scheldt, Leie and Rupel and connected the Waasland Cuesta with the Cuesta of Meetjesland. At the same time the Scheldt with its tributaries shifted its river

bed to the east. And found a new way to the sea though the ‘valley of Hoboken’ in the direction of Antwerp.

During a short warmer period (around 14,650 years ago), permafrost slowly began to melt and the groundwater level began to rise. The low-lying area, dammed on the north side by a large sand ridge, ran full of water and formed a vast shallow fresh water

lake. In the subsoil marsh lime (gyttja) were formed, locally up to a metre thick layer, which is sometimes ploughed by peasants.

**The Durme**

12,700 years ago during the last cold revival of the Ice Age the fresh water dried up. In the successive warmer period, at the start of the Holocene (from 11,500 years ago), the river Durme were formed, which drained the depression towards the Scheldt. Nowadays this is a low-lying area with wet meadows known as the “Moervaart Valley”.



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## KRONKELWAARDGEULEN BERLARE AND DONK LAKE

🕒 11.000 years ago - 19th century

# Old River courses and peat extraction

**The strong improvement of the climate at the beginning of the Holocene (11,500 years ago) changed the river Scheldt strongly. She turned into a wide, meandering river with a discharge five times larger as the current river.**

The wide river bends continued to shed further on the banks of the river's outer bend, while the floods in the winter caused the emergence of sandy ramparts.

The latter remained on the inner bend side and formed

a pattern of successive heights (*kronkelwaardruggen*) and lownesses (*kronkelwaardgeulen*). Although they also occur in other places in the Scheldt Valley, such as Kalkense Meersen, they are best recognizable near Berlare.

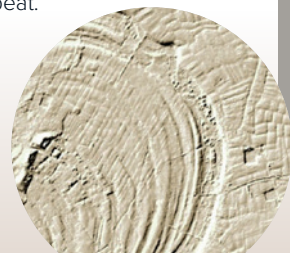
At this place the last river course of the Scheldt, which was finally cut off some 10,000 years ago, is now only preserved as a partially swampy residual trench. Because of the increasingly warmer climate, the peat growth began and old channels were mostly filled with peat.

Peat pits  
arise



### Donk Lake

The present lake in Donk, near Berlare, was created at the end of the 18th and early 19th century. Peat was extracted from the rest of the trench to use as fuel. The various peat wells have been connected to each other over time and have thus shaped the Donk lake. The lake has long been a well-known tourist destination in Flanders, due to the possibilities for water sports and the presence of hiking and cycling routes.



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## MANTELING AND DUNE AREA NORTHWEST WALCHEREN

🕒 6.000 years ago - present

# Oaks on the Dunes

**The Manteling of Walcheren is a dune area with Natura2000 status on the northwest edge of the former island Walcheren (old land, with both clay and peat areas cut through tidal inversion ridges). Around 6000 years ago, when the sea-level rise decreased, longshore bars grew into barriers along the coastal zone, due to sand transport and the breaking of waves.**

These barriers have gradually grown in time. Nowadays the resulting barriers have been displaced several kilometers inland by gradual sea level

rise. Under influence of wind, sand was displaced and the coastal barriers grew into dunes. After a new primary dune row was formed, the older (more inland) dunes were transformed by wind into a dune area with a complex morphology with blowing pits and parabola dunes. Under the influence of changing currents, the coast has been a declining coast for many hundreds of years. And so the coastline has been moved a few kilometres inland in the course of time. This makes the zone with primary dunes extremely narrow or completely lacking with

old dunes on a very short distance from the coastline. Northeast of Oostkapelle, in the Oranjezon area, a series of beach hooks have been formed over the centuries, on which dunes have also been created. In the area several moist dune valleys and a trimmed beach plain are present. Primary dune formation takes place on the beach from embryonic dunes.



### Old oak forests

In the western part of the dune area, not far behind the sea line, old dune oak forests form a natural forest boundary. It is unique for Europe to have deciduous trees growing so close to the coast. These trees are literally shaved and formed by the salty sea breeze. Traditionally, the Manteling of Walcheren is characterized by stately mansions and woods with "Stinze plants" (plants from gardens of castles) in the inner dune ridge. The Manteling of Walcheren is a classic outdoor area with woods, stretches of dune, straight lanes and pendulum paths. From the 17th to the 19th century, the elite from Middelburg (merchants and notables) lived here in the summer. With respect for nature, the area is accessible to hikers and cyclists. In the middle of the area is another 200 year old yew tree that would have been a model for the famous Mondrian painting.



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## Drowned land

**The drowned Land of Saeftinghe was once an old polder with both clay and peat, where in the Late Middle Ages the manor of Saeftinghe was located, with prosperous fertile farmland polders, villages and even a castle: Slot Saeftinghe.**

Several storm floods in the 14th and 16th centuries devoured large pieces of the embanked land. At the end of the 16th century the country

is fully influenced by the sea. First by a major flood, known as "Allerheiligenvloed" (in 1570), but especially later in 1584 by a military inundation to defense the city of Antwerp against the Spaniards.

As a result of tidal operations, a finely branched network of active creeks has emerged, continuously changing their courses, creating a wide area with creeks and ramparts. This gives a beautiful picture of the

former landscape of Zeeland. Besides creeks and ramparts also sand plates, gullies, vegetated salt marshes, bald tidal flats (intertidal area) can be seen. The sedimentary deposits in the drowned Land of Saeftinghe, which still continues nowadays, are representative of the young Holocene sea deposits in the southwestern Delta.

*Most extensive salt marshes and swallowing area*



### Salt marshes

Nowadays, this protected nature reserve (Natura2000) and Geological Monument is the most extensive brackish area in Western Europe with tidal flats and salt marshes, where natural processes are undisturbed. Over the years, more than 200 different bird species have been observed.



From the **Saeftinghe visitor centre**, guided tours are organized to discover the unique nature reserve. There are also two walking routes, which can be walked without guides, also during (normal) high tides.

## Salt and marshes

**Yerseke and Kapelse Moer are among the oldest "old-land" areas of Zeeland. It originated under the influence of the sea. Human interventions have drawn the landscape. Nowadays, this area is one of the most valuable natural and cultural landscapes of Zeeland.**

About 2000 years ago, large parts of Zeeland and also this area consisted of a thick package of peat. Partly by Roman dewatering techniques, subsidence of the peat took place, which brought it under the influence of the sea. Around 350 A.D. the sea scoured deep creeks in the peat and the clay and sand layers underneath. Later, these creeks silted gradually up with sand. The surrounding peat area was covered by a thick layer of clay and thus clinched even further. The sand-filled creeks

became so-called creek ridges, which are nowadays higher in the landscape. Around the year 800 A.D. these dry creek ridges were put into use for habitation by shepherds. Slowly, small settlements and roads arose on the creek ridges as well as some farming. The lower lying wet clay and peat areas (*poelgronden*) remained in use as grassland. Around the year 1000 A.D., the area became part of the first embanked rural areas in Zeeland.

In the 15th century, a large part of the Yerseke and Kapelse Moer (peatland) was completely altered: the salt that was present in the peat was worth a lot of money. These days, salt had an important function as a food preservative. Zeeland became even the number



*Moeraning  
extraction of  
salt from the peat*

one salt supplier of Europe. Where the peat was removed, the excavated clayey top layer was thrown back sloppy. Nowadays, this peat excavation has given the area a bumpy appearance. This relief is still recognizable in the landscape. The creek ridges itself also provide relief. The old, small-scale subdivision and extraction pattern is still recognizable in the field. The salty environment by salt-water ensures the presence of special plants and animals.





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**DINTELSE GORZEN**

🕒 15th century - present

# Salt and fresh

**Dintelse Gorzen is a unique nature area thanks to the mix of salt and fresh water. The traces of the tidal creeks in the former area of salt marshes and tidal flats are still clearly visible in the landscape.**

After the completion of the storm surge barrier in the Eastern Scheldt (1986), the Philipsdam was built (1987) to

maintain sufficient tidal force in the Eastern Scheldt.

The Dintelse Gorzen, lying behind the Philipsdam, got dry by the lack of tidal influence behind the dam. This resulted in many new gradients of altitude, salinity and soil type and special nature. The soil in the nature reserve has alternately fresh and salt water and this produces versatile

vegetation. Nowadays, the former tidal flats are clearly distinguishable from the former salt marshes, as the soils in the former salt marsh area are already more desalinated because of their higher altitude, which makes the vegetation stronger (a.o. willows and dune reeds). In the lower lying former tidal flats you still find salt-loving samphire and sea lavender.



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**CUTTED DURME MEANDERS (HAMME)**

🕒 500 years ago - present

# Cutted river and steep slope

**The Durme is a relatively small river that originally got its water from the Kalevallei (through the Moervaart depression).**

By digging the predecessor of the canal from Ghent to Terneuzen (early 19th century) and especially by the damming of the Durme in Lokeren (1955), the river has received less water over time. Because the Durme is drained off on the (Sea) Scheldt, it is on high influence of tides in its downstream part. From a meaningless silted up stream it turns into a 80 m wide river, in just a distance of a few kilometres.

With the straightening of the river Durme near Hamme in 1934-1935 four kilometers of old meanders where cutted off, which are now largely preserved as open water. The valley has largely preserved its open character, with alder groves between meadows. More downstream, many reed fields are present on

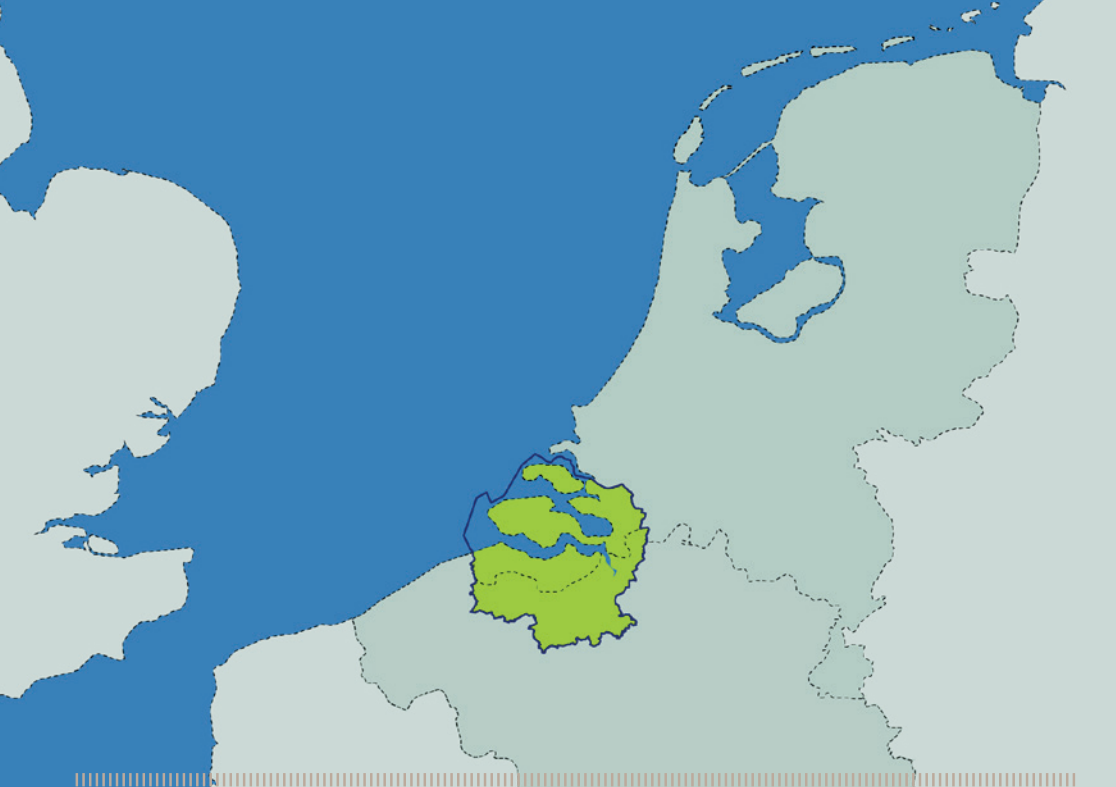
the salt marshes, relics of the formed reed industry from earlier centuries. This rare freshwater biotope exhibits typical marshland vegetation. The numerous fish pits are remnants of peat extraction wells.

*Boom clay has been a good foundation for brick since the Romans*

**Boom clay**

On the north side, the valley is bounded by the strongly accented cuestafront (cuesta of Waasland), with a maximum height of 35 meters. The gently descending layers of the Boom clay to the northeast caused this distinctive relief. This Boom clay is excellent for the fabrication of brick and roof tiles, which has been in use since the Roman era until the end of last century. Nowadays the exploitation and production is still active in the Rupelstreek.





**MORE INFORMATION** [info@schelddelta.eu](mailto:info@schelddelta.eu) en [www.schelddelta.eu](http://www.schelddelta.eu)

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