Natural stone: today

Many of the buildings described have been standing for centuries; not that the use of natural stone has died out. On the contrary, today we use rocks that weren't available in the Netherlands in ancient times and the Middle Ages. There are various reasons for this. For instance, it has become easier to transport material across the world, whereas the use of some materials, such as sandstone, is prohibited; others cannot be supplied. Twentieth-century buildings, in particular, use a wide range of natural stone. In general, natural stone is now used for decorative purposes but not for load-bearing structures.

Interior of the TNO building/ Geological Survey of the Netherlands, Utrecht.

Geological Time table

Million years			
2.5	Cenozoic	Quaternary	Holocene
			Pleistocene
		Tertiary	Pliocene
			Miocene
			Oligocene
			Eocene
65			Paleocene
	Mesozoic	Cretaceous	Upper-Cretaceous
			Lower-Cretaceous
146		Jurassic	
207		Triassic	Upper-Triassic Keuper
			Middle-Triassic Muschelkalk
245			Lower-Triassic Bontzandsteen
		Permian	
290	Paleozoic	Carboniferous	Upper-Carboniferous
362			Lower-Carboniferous
		Devonian	
408		Silurian	
440		Ordovician	
510		Cambrian	
570	Precambrian		

Multifaceted Dom Tower

Many different types of rock were used in the original building of the Dom Tower (1321-1384) and in later restoration works. White Portland limestone from England has been used in the 19th century for the base of the Tower. Above that, the outside is covered mainly with tuff surrounding a brick centre. Various types of sandstone have been used for ornaments and cornerstones, both cream-coloured and red sandstone. Basalt and trachyte has been used during restorations.

Oudegracht 1,000 years

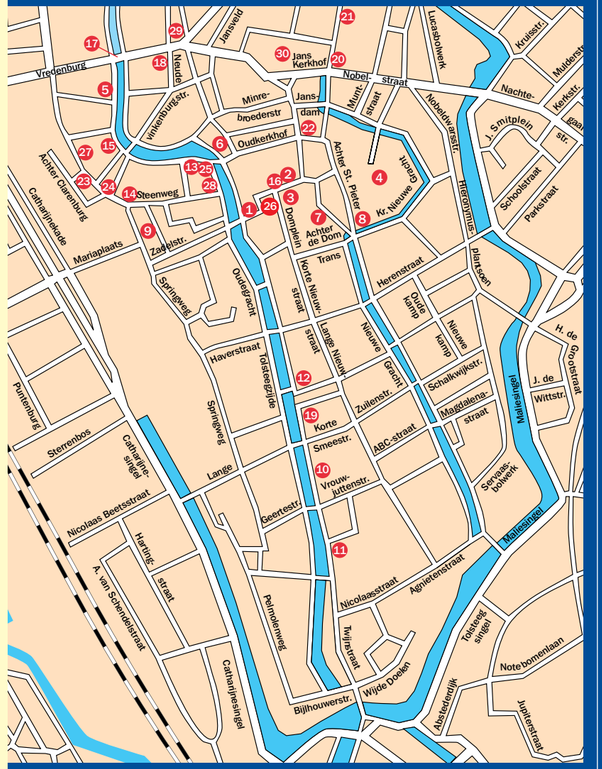
The oldest part of the Oudegracht dates from around the year 1,000. At that time the Old Rhine silted up to such an extent that trade was hindered. To solve this problem, a canal was dug to the River Vecht. Parts of both the Oude and the Nieuwegracht, such as the Kromme Nieuwegracht, follow original meanders in the course of the Rhine.

Also worthy of attention (see the town map right):

20. **Drift 9**, early 20th century, Obernkirchen sandstone
21. **Utrecht University, Drift 25**, 18th century bluestone
22. **Brandmeesters, Korte Janstraat 1-5**, early 20th century, bluestone
23. **Lange Elisabethstraat 20**, yellow-brown fossil-rich Jurassic limestone
24. **Siebel, Bakkerstraat 27-29**, early 20th century, almost solid black plutonic rock (gabbro)
25. **Oudegracht Library and Broese Bookshop**, 1933, sandstone
26. **Dom,** Drachenfels trachyt, Bentheim sandstone, red sandstone and Udelfangen sandstone. Dom Tower (plinth) white Portland limestone
27. **Lange Elisabethstraat 25, 2001**, light-coloured granite gneiss with red garnets
28. **Jap Exclusives, Choorstraat 14**, Jugendstil, red granite
29. **Chemist, Voorstraat 6**, Jugendstil, bluestone
30. **Janskerk, Janskerkhof**, 11th century, bricks and tuff

Coloured photograph Janskerk ca. 1905-1907 30
Utrechts Archief

Town map Utrecht



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Rocks around the clock

A walk through 2,000 years of Utrecht's history and hunderds of millions of years of natural history

TNO | Knowledge for business

Utrecht as a Roman fort

The history of the city of Utrecht began in the first century A.D., when the Roman Emperor Claudius decided that the Rhine would form the northern border of his empire. One of the forts built along the river to defend this border was named Trajectum or 'Ford'. It was situated at a shallow part of the Rhine on what is now the site of Dom Square 3. Utrecht grew up around this focal point. The foundations and part of the walls of the Roman fort, made of natural stone, are still visible in Café het Weeshuis 1 and at the Utrecht Centre for the Arts 2, two buildings on Dom Square. See the City map for location of the buildings.

Natural stone

People have been using natural stone as a building material for many thousands of years. It is safer than, say, wood and also more expensive, a popular trait with building owners wishing to show off their prosperity. Furthermore, natural stone is a good material for making ornaments and sculptures to decorate buildings. All these characteristics make natural stone the perfect material for buildings intended to last for a very long time. Natural stone is scarce in the Netherlands. Pretty much the only materials that occur at the surface here are loose materials such as gravel, sand and clay. While South Limburg and the Achterhoek in the east are the only areas in the Netherlands where natural stones are found at the surface, they are present in places close by such as Bad Bentheim and the Eifel region of Germany and in the Ardennes in Belgium. Traditionally, the Maas and the Rhine rivers, which flow through these mountain areas and the Netherlands, have been used to transport natural stone to the Netherlands.

Principal type: Sedimentary rocks

Sedimentary rocks are formed from the erosion material of other rocks or by (bio-)chemical precipitation of salts like carbonate ansd sulfate. Loose particles such as sand, gravel and fossils bind together to form a solid material. This type of rock is often recognisable by the presence of ('sand') grains or fossils and by its layered structure.

Tuff


4

The Romans chose tuff as the building material for their castella and other important buildings. Throughout the Roman period, this 'Römer Tuf' from the Brohldal in the Eifel region remained the most important building stone. A fine example of the use of tuff is visible in the Pieterskerk , at the Pieterskerkhof 4, which dates from the first half of the eleventh century.

Tuff is a very porous rock. It consists of cemented light-coloured volcanic ash containing larger, often darker volcanic rock fragments. The 'Römer Tuf' was formed about 12,800 years ago during volcanic eruptions in the Eifel region.

Brick


5

Tuff was expensive, primarily because it had to be transported a great distance and so the Romans introduced other building materials. Clay was present in abundance in the Utrecht area and was used as a raw material for ceramic products. The Romans baked bricks and tiles, including roof tiles, from this building material that was both cheap and fire resistant.

Brick has been much used as a building material since the Middle Ages, on its own and in combination with natural stone. An early application of brick can be found in the walls of Stadskasteel Oudaen 5, built in 1276, at Oudegracht 99.

Clastic material is created when rocks erode and from this sedimentary rocks are formed. Clay is the finest clastic material. Its grains are less than 2 micrometers in diameter. Clay comprises clay minerals (kaolinite, illite, montmorrilonite), quartz, feldspars, calcite and iron minerals. In the Utrecht area during the Holocene period river clay was deposited by meandering rivers that breached their banks. When the water flowed into basins and later came to a rest, the clay was deposited.

Sandstone


7

The introduction of tolls on the Rhine in the Middle Ages drove the cost of transporting tuff still higher. That made the sandstone from Bentheim, east of Oldenzaal just across the border in Germany, an attractive alternative. It was easy to transport this stone to the city of Utrecht via the River IJssel, the Zuider Zee and the River Vecht. Bentheim sandstone was used e.g. at Dom Church and in the Pandhof of the Dom 7 (Dom Square, between Dom Church and the University's Academie-gebouw). Micaceous Udelfangen sandstone was also used in the Pandhof, where centuries of weathering have exposed the sedimentary layers in the sandstone. The façade of the Town Hall (Stadhuis) 6 consists of Bentheim sandstone.

Bentheim sandstone is a cream-coloured sedimentary rock. As it consists of sand grains deposited in shelf sea and nearshore areas during the Lower Cretaceous, more than 95% of it is the mineral quartz. The ripples that are sometimes visible were formed long ago by flows and waves at sea. Other types of much-used sandstone are the Cretaceous Obernkirchen, also cream coloured but a little finer with remains of small mollusc shells, the Udelfangen sandstone and the Red Sandstone (from the Triassic period).

Limestone


8

A wide range of limestones is found in Belgium. On the basis of age and colour, we can distinguish blue limestones, dating from the Carboniferous period, and white limestones or calcareous sandstones from the Eocene. Blue limestones are still used for pavement stones, windowsills, doorsteps, floor tiling, façade cladding and bollards. The white ones are used particularly as façade cladding and together with bricks. The alternation of red and white layers resembles the appearance of bacon and is therefore in Dutch called 'speklaag', which translates as 'bacon layer'.
Where do we see limestone used? White limestone or calcareous sandstone has been used in the Paushuize 8 (on the Paus Dam). Here, Gobertange has been used, a calcareous sandstone from the Eocene. The white of the limestone contrasts nicely with the red brickwork. This property dates from the first half of the sixteenth century and was built for Pope Adrian VI who came from Utrecht. Limestone can also be seen at Huis Zoudenbalch, 9 Donkerstraat 15-19. The façade of this property is built of Namur stone, a grey, fine-grained limestone from the Lower Carboniferous that was extracted in the Maas valley near the Belgian city of Namur. The façade was built in the second half of the fifteenth century. The coat of arms in the façade is made of 'mergel', a fine-grained


9


6

limestone from the Upper Cretaceous that occurs at the surface in South Limburg.
The most-used Belgian limestone is bluestone (Lower Carboniferous). This rock is also known as 'petit granit'. Geologically, this name is incorrect since unlike real granite this rock wasn't formed out of molten material. However, the presence of crystalline fossils does create something of the appearance of an igneous rock. The following fossils are recognisable: shells, snail shells, corals (honeycomb structure or cones with a radial structure) and the stems of sea lilies (little white circles with a dark centre). At the beginning of the nineteenth century, the Stadhuis 6 got a new façade. This consists of bluestone at ground-floor level and sandstone above. Whereas the fossils in this bluestone are no longer easy to spot due to weathering, similar fossils can still be seen in pavements throughout the city centre.

Travertine


10

Travertine is a limestone that is formed when lime is deposited by supersaturated water from hot springs. Twigs, leaves and other materials that fall into the water and later decay of the organic material create the pores characteristic of travertine. In Tivoli to the east of Rome, there is a major travertine deposit. The rock there was formed during the Pleistocene. Travertine can be seen in the façade of Oudegracht 322-326 10.

Principal type: Igneous rocks

Igneous rocks are created when minerals crystallise from molten rock. There are two main types. Volcanic rocks solidify at the surface from lava and plutonic rocks solidify in the earth from magma. In the first case, the molten material cools quickly and the majority of the resulting crystals are too small to be visible with the naked eye. In the second case, the rock cools much more slowly. This gives the crystals the time to become much larger. The presence of crystals, often of a uniform size, is thus the most important characteristic of this type of rock. Drachenfels trachyt and Niedermendig basalt are building stones from the Eifel volcanic area in Germany.

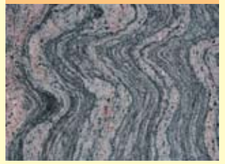

11

Boulders

Roughly 150,000 years ago, during the penultimate ice age, ice caps propelled large amounts of material along ahead of them. These ice-pushed ridges now form the Utrechtse Heuvelrug and the Veluwe. As well as a lot of fine material, the ice cap transported boulders that reach up to 2 meter in diameter. Since most of the ice came from the north, these boulders were often blocks of Scandinavian granite or other plutonic rocks. Boulders of other types of rock also reached the Netherlands during the ice ages by travelling inside ice flows via the Meuse and the Rhine rivers. One use of these boulders was as 'guard stones'. These are stones placed at the corners of houses to afford protection against cartwheels. An example exists at the house De gesloten steen (Oudegracht 364) 11. Legend has it that at night devils used to play marbles with this block of red and grey granite. They made so much noise that in about 1520 the stone had to be chained up. Notice, too, the very light-coloured granite façade of the property to which the stone is chained.

Granite

Granite is a plutonic rock. This material is used in both its raw and polished forms as a construction material and as façade cladding. Plutonic rocks come in a wide variety of colours. This is due to differences in mineralogical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16

composition that stem from the way in which the rock was formed. A wide variety of plutonic rocks can be seen in Utrecht. Light-coloured granites have been used in the shop fronts of Oudegracht 256-264 12 and Oudegracht 163 13. Larvikite, a variety with black, grey and blue minerals from the Norwegian town of Larvik, can be seen next to the bluestone in the façade from 1906 at Steenweg 65 14. A special variety is migmatite. This rock became partially molten after it was created. This caused the various minerals to form separate layers that subsequently folded over one another. A grey, red migmatite can be seen in the façade of the shop at Oudegracht 123 15. A wide range of igneous rocks has been used in the paving of the Dom Square. A wide variety of colours and internal structures can be seen in front of the door of the Information Office RonDom 16.

Basalt


17

Basalt is an example of rock that is formed when lava solidifies at the earth's surface. Basalt often has a characteristic hexagonal column structure. This was formed when the rock contracted as it was cooling. This natural form makes basalt an ideal stone for bollards, some of which can be seen along the bridge between City Hall and the Winkel van Sinkel and on the Lange Viebrug 17.

Principal type: Metamorphic rocks

As well as sedimentary and igneous rocks, there is a third principal type, metamorphic rocks. These are formed under high pressure and/or at high temperatures from the other two principal types. The most well-known rocks in this group are marble (metamorphic limestone) and slate (metamorphic clay stone) that shows a perfect cleavage. Each initial material results in a corresponding metamorphic endproduct whose particulars are determined by the conditions under which the transformation takes place. This accounts for the wide variety of rocks in this group.

Marble

Marble comes in many different colours. The most well-known sort is white marble from Carrara in Italy, a marble much used by sculptors. There are also green, red and black varieties. Marble is less suitable than other rocks for use outdoors in the Netherlands but is much used in interiors, especially in halls in older houses. The floors in the Hoog Catharijne shopping centre and in the Neude post office (Postkantoor) 18 often are called marble in stone industry. Geologically they are non-metamorphic limestones.

Slate

In the thirteenth century slate was already being mined in the Meuse valley near the town of Fumay (France). Slate is commonly seen on older buildings where it has been used as a roofing material. Its finegrained, dense structure ensures that it is water tight, making it well suited to this application. Slates tend to be dark grey and flat, just like the old school slates. However, it is also possible for slate to look like the Norwegian slate in the façade of Oudegracht 276 19. Slate's appearance depends on the material from which it is made and the conditions under which it was formed.