

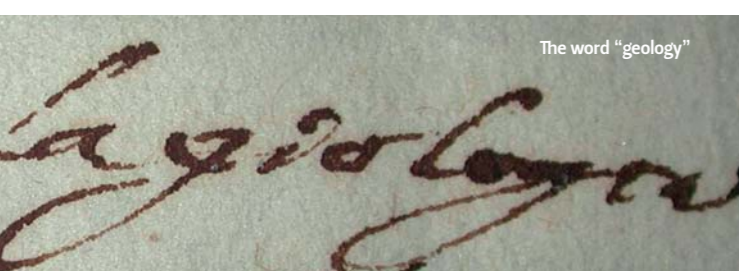
and nodular limestone from Verona. Istrian limestone, extracted since the Roman period, is widespread throughout the city, where it arrived from the quarries of Croatia, going through Trieste, Venice, Ravenna and reaching Bologna by river.



Santo Stefano Cloister.
Nodular limestone from Verona

8. Piazza Aldrovandi

We enter the square named after Ulisse Aldrovandi (1522–1605), the father of modern geology. The word *geology* in Bologna originated from him. On the 10th of November 1603 Aldrovandi decides in his will that the discipline whose modernization he and Leonardo Da Vinci had contributed to will be called *Geology* or *de fossilibus*.



The word "geology"

9. Via San Vitale

Here visitors can catch a glimpse of the second circle of the walls of Bologna: the gate *Serraglio di San Vitale* of the circle called *Cerchia dei Torresotti*, dating back to the last thirty years of the XII century. This part of the wall is made of terracotta and the arch is made of selenite blocks.

10. Via Zamboni

Here are two important museums of the nineteenth century, inaugurated in the golden period of geology in Bologna. The Geological Museum *G. Capellini* was set up in 1860, when Giovanni Capellini was called by the University of Bologna to hold the first chair of Geology in Italy. The museum shows finds from the regional and national territory and rich collections of rocks, plants, invertebrates and fossil vertebrates, among which the skeleton of a diplodocus, 26 metres in length and 4 metres in height, donated by Vittorio Emanuele III and found in 1899 in Wyoming. The Museum of Mineralogy and Petrography *Luigi Bombicci* was founded in 1861 when Bombicci was entrusted with the first chair of Mineralogy of the University of Bologna. About ten thousand pieces are exhibited in the museum, about one fifth of the total heritage of the collections, and are divided into sections. A very interesting section is the section on the Bologna phosphorus stone, a worldwide known variety of barite that is found in the badlands of Paderno. It was discovered between 1602 and 1604 and represents the first observation of the phenomenon of phosphorescence. University Museum System Alma Mater Studiorum University of Bologna <http://www.sma.unibo.it>



Museum G. Capellini: fossil of a Diplodocus

11. Geological Garden Museum *Sandra Forni* – Viale della Fiera, 8

A few steps from the centre you can take a walk through geology thanks to the route of the Geological Garden Museum *Sandra Forni*: 14 rocks tell the geological history of the Emilia Romagna region, a history that is revealed in the landscape of the hills of Bologna. The wild landscape of the badlands characterizes the upwelling areas of clay, shaped by the surface run-off. The majesty of the cliffs of Contrafforte Pliocenico (Pliocene Spur) expresses the resistance to erosion of the sandstones of the ancient shores of the Padan Sea; the karstic shapes (sinkholes,

ponors and caves) show the presence of soluble rocks, such as gypsum. <http://ambiente.regione.emilia-romagna.it/geologia>



Badlands

In collaboration with Geological, Seismic and Soil Survey of Emilia-Romagna



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The geology of Bologna

“La creta, la selenite e l’arenaria / Di qui nasce il colore di Bologna / Nei tramonti brucia torri e aria [...]”

“Clay, selenite and sandstone / The colour of Bologna comes from that / Towers and the air burn in the sunset [...]”

Roberto Roversi



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1. Salaborsa

Piazza Nettuno, 3

A crystal floor shows the archaeological excavations, which in 1989–90 revealed the existence of a building that was probably the seat of administrative offices of the Roman colony *Bononia* (II–I century B.C.). According to geological studies the subsoil of Bologna is characterized by the presence of gravel, sand, silt and clay that were deposited by the Apennine rivers. Clay and silt are in the old town centre, whereas gravel and sand are mainly to be found in the outskirts of the town, due to deposits from the Reno river and the Savena stream. This distribution of sediments in the subsoil shows that the Reno river and the Savena stream have often come close to the old town centre but have never gone through it. It was in this area, which was better protected from floods, that the Roman colony of Bononia was founded.



Archaeological excavations in Salaborsa

2. Around Piazza Maggiore

Clay, sandstone and selenite are local rocks, that is why they are so common in the buildings and monuments of the old town centre. Sandstone is a kind of cemented sand whose grains mainly consist of quartz. In Bologna there are at least two different types of sandstone: a yellowish type, not very cemented and not very resistant (with clear signs of degradation) and another type, also known as *pietra serena*, that is harder and in a grey-blue colour. Clay, in the form of bricks and terracotta, is the main material of the city palaces and monuments, its colour ranges from red to yellow. Bologna had very few stones, so terracotta has been widely employed since the Etruscan age, for this reason Bologna is called the red city. In the façade of Palazzo Comunale sandstone is the protagonist of the portal and clay is the material shaped by



Sandstone tiles of Palazzo Podestà

Nicolò dall'Arca to form the beautiful Virgin with child that now decorates the façade. The façade of Palazzo del Podestà, with the bossage work consisting of three thousand floral tiles, by the famous architect Fioravante Fioravanti, called Aristotele, is completely made of sandstone. Palazzo Re Enzo instead is all made of bricks.

3. Palazzo d'Accursio

Piazza Maggiore, 6

In the courtyard of the palace you will see the *stone living room*, donated to the city by the sculptor Pinuccio Sciola in 2006, an unusual resting place sculpted in trachyte, a volcanic rock that was widely used in Bologna during the Roman era to pave streets. On the first floor of Palazzo d'Accursio, in Sala d'Ercole, you can see the fresco *Madonna of the Earthquake*, painted by Francesco Francia as an ex voto for the earthquake of 1505 which hit Bologna and its surrounding area. The seismicity of Emilia Romagna is linked to the evolution of the Apennines: a "young" mountain range that started to take shape about 55 – 60 million years ago and is still slowly but progressively rising.

4. Archaeological Civic Museum – Via dell'Archiginnasio, 2

The Museum documents the local history of Bologna, from prehistory to the Roman era, its main attractions are the collection of sandstone funerary steles in the section of the Etruscan Felsina and the Roman section, which mainly includes commonly used objects, symbols of the everyday life in Bononia. <http://www.comune.bologna.it/museoarcheologico/>

5. Two Towers

Piazza di Porta Ravegnana

Here we are, at the feet of the monument that is the symbol of Bologna: the two towers. The Asinelli Tower, the taller one (97.20 m) and the Garisenda Tower, the smaller one (47 m) that is clearly leaning. The basis of the Garisenda Tower is covered with selenite, with the characteristic *dovetailed* twinned crystals with a milky shine that resembles the reflection of the moon (*selene* in Greek). Selenite is a rock consisting of gypsum, originating from evaporated sea water. In the Messinian (about 6 million years ago) the Strait of Gibraltar closed, isolating the Mediterranean from the Atlantic Ocean. In these conditions selenite sedimented in the low seabed of the sea basins along the edges of the Apennines. The wide diffusion of selenite in Bologna is due to the proximity of gypsum extraction areas and to its humidity insulation properties. Selenite is the material that was used for the first circle of walls of the city (IV–VI century) and for most of the foundations of the buildings. The characteristic leaning position of the towers is due to the subsoil. The soil under the towers is made up of silt and clay with different consolidation levels. Over time the static load of the towers has caused a non-homogeneous sinking of the soil and of the foundations, which in the past 100 years has increased by 0.3–0.4–mm/year.



Selenite twinned crystals

6. Piazza Santo Stefano

The Santo Stefano abbey is an old complex of buildings from different periods, that were restored many times. Here local stone materials (sandstone, terracotta and selenite) were used together with scrap materials coming from the demolition of old monuments. The façade of the church of the Saints Vitale and Agricola (rebuilt at the end of the 19th century) has many fragments of green porphyry and Egyptian red porphyry, inserted

in terracotta. Inside the church, among other attractions, there are two marble sarcophagi that support a Greek marble slab, coming from a Roman monument. In the Basilica of the Holy Sepulchre, seven African marble columns surround the sepulchre of Saint Petronius. African marbles, like Apuan and Greek marbles, came to Bologna only during the Roman imperial period, then they were no longer used. They started to be used again from 1850 onwards, with the introduction of railroad transport.



The façade of the church of the Saints Vitale and Agricola

7. Strada Maggiore

The portico of Casa Isolani, after the high wooden structures that are placed on selenite blocks, leads to Strada Maggiore. At the crossroads with Via Guerrazzi you can see on one side the famous sandstone Atlas figures of the façade of Palazzo dei Bargellini (1658) and on the other side the Renaissance portico of the Church of Santa Maria dei Servi, made of Istrian limestone