Radoboj : [booklet]

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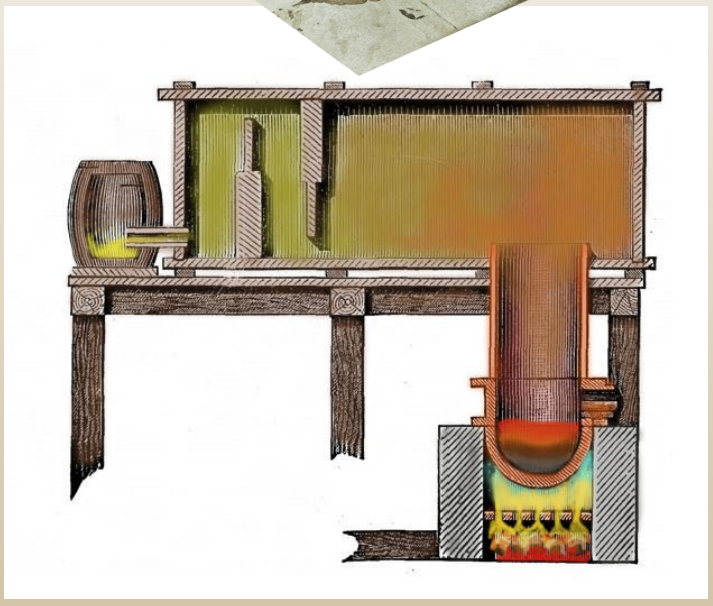
Radoboj



Radoboj

This booklet was created in the framework of the Project MineHeritage / Letak je pripremljen u sklopu projekta MineHeritage:

Historical Mining – Tracing and Learning from Ancient Materials and Mining Technology

Booklet/Letak: nº2, v. 13 – Radoboj

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This activity has received funding from the European Institute of Innovation and Technology (EIT), a body of the European Union, under the Horizon 2020, the EU Framework Programme for Research and Innovation

Sulphur

Sulphur was used in many ways throughout history. It was applied as a pigment for cave painting, combusted in Egyptian religious ceremonials, used for cotton bleaching or to produce explosives in China.
Many important metal ores (galena, sphalerite, pyrite, chalcopyrite, barite) are compounds of sulphur. Sulphur occurs as a native element as well. Just above its melting point, sulphur is a yellow, transparent liquid often found in volcanic regions. It is formed by aerial oxidation of hydrogen sulphide. Native sulphur can be found in deposits rich in organic matter as well. [1]

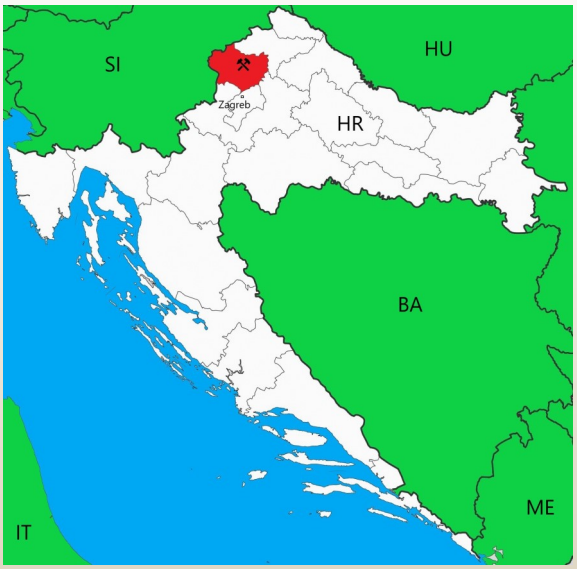
Sulphur/Sumpor—Collection of the Department of Mineralogy, Petrology and Mineral Resources RGNF, zbirka Zavoda za mineralogiju, petrologiju i mineralne sirovine RGNF

Sumpor

Sumpor je često korišten u povijesti. Upotrebljavan je kao boja za špiljske slike, spaljivan je u egipatskim obredima, korištio za izbjeljivanje pamuka kao i za pripremu eksploziva u Kini. Mnoge metalne rude (galenit, sfalerit, pirit, halkopirit, barit) spojevi su sumpora. Sumpor se može naći i u elementarnom stanju. Iznad točke taljenja sumpor je žuta, prozirna tekućina, i često se nalazi u područjima vulkanske aktivnosti. Nastaje oksidacijom sumporovodika. Nalazi se i u ležištima povezanim s taloženjem organske tvari. [1]

Radoboj deposit

Genesis of the deposit is still unresolved, but syngenetic marine deposition is assumed. The layers of dolomite, sandy-leafy clay (with coal) and "Litavac" limestone are tilted and sinking at 45 ° from the North to the South. Sulphur was found in a 17 meter thick layer of Sarmatian marl leaning on the top of the limestone. Marl was zoned and sulphur was located within two of three strata:

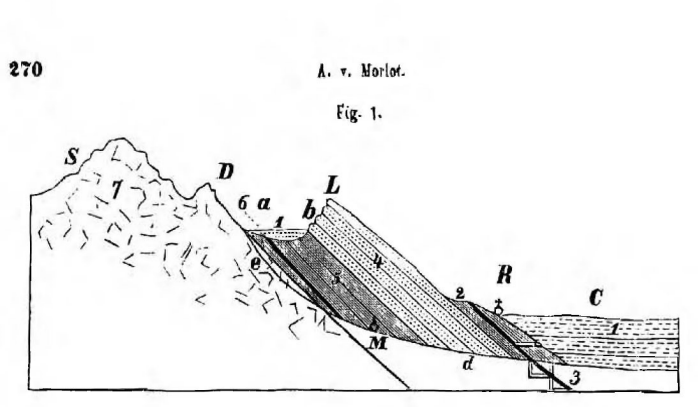


Radoboj location/Lokacija Radoboja

Ležište Radoboj

Pretpostavlja se da je ležište nastalo taloženjem u morskoj sredini. Slojevi dolomita, pjeskovito-listićave gline (s ugljenom) i „litavskog" vapnenca poniru pod kutom od 45° od sjevera prema jugu. Sumpor se nalazio u 17 metara debelim naslagama sarmatskog lapora koji se prije eksploatacije sastojao od tri sloja:

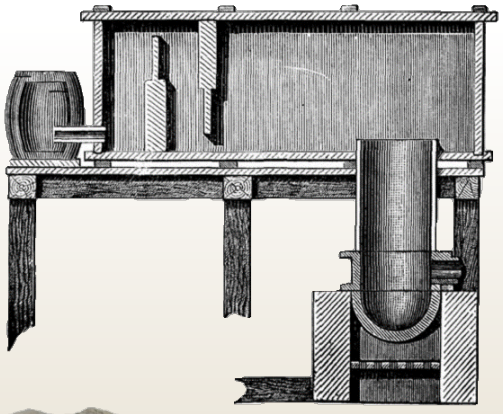
Upper strata— 10—40 cm thick containing sulphur in the form of bulbs located in dark shale. Bulbs were of various sizes ranging from the size of a nut to size of a head, 5—15 kg in weight.
Middle strata—formed of greyish silty shale did not contain sulphur but was abundant with fossils.
Lower strata—20—32 cm thick was saturated with sulphur but bulbs were not formed. Sulphur from this strata could be recovered only by distillation.
In both sulphur-bearing strata no admixtures of arsenic were detected which made sulphur high-



Geological profile of Radoboj deposit/Geološki profil ležišta u Radoboju [2]

Gornji — debljine 10 — 40 cm sa sumporom u obliku nepravilnih gomolja veličine oraha, jabuke, pa čak i 5 — 15 kg teški unutar tamnih šejlova.
Srednji —pepeljastosivi siltozni šejl bogat fosilnom faunom i florom bez sumpora.
Donji — debljine 20—32 cm saturiran sumporom bez pojave gomolja. Sumpor se mogao pridobivati samo destilacijom.
U slojevima sa sumporom nije bilo arsena što je sumpor činilo iznimno cijenjenim. [3]
Sumpor gornjeg sloja je bio veoma čist

ly valuable. [3] Sulphur from the upper layer was very pure (75,8—90%) while the material from the lower layer was heavily mixed with marl. The device was invented and constructed here. It was named the Radoboj machine. The raw material was heated and sulphur fumes were collected, cooled and processed to obtain rods or powder. [4]



Radoboj machine/ Radobojski stroj [4]

Sulphur bulb/ Gomolj sumpora, Senckenberg Naturhistorische Sammlungen Dresden (SNSD), Museum für Mineralogie und Geologie (MMG), Jana Wazeck,Min 336 SY

(75,8 —90 %) dok je materijal donjeg sloja bio uvelike pomiješan s laporom. Naprava je izumljena i izrađena u Radoboju te je nosila naziv Radobojski stroj. Sumporne pare nastale uslijed zagrijavanja sirovine su se hvatale, hladile i obrađivale u obliku sumpornog cvijeta ili lijevanih šipki. [4]

History of mining

It is told that in 1811, a farmer named Ambrose was digging a basement for his vineyard cottage there. As usual, even in the summer, he started a fire in the pit to burn some branches. To his own surprise, he noticed that not only the trees were burning, but the ground was burning as well. Although he was a simple peasant, he knew it was no miracle, but there must be some extraordinary cause for it. So he brought a chunk of the earth to a priest. Unfortunately, the discovery resulted in the confiscation of his land.[6]

A sulphur mine was opened in 1811 as the Imperial

Remains of the miners' settlement/Ostatci rudarskog naselja

Povijest rudarenja

Godine naime 1811. kopao si je seljak tamošnji u vinogradu podrum za kliet, ko što običajno kod naših seljakah, nesmije biti kod nijedne radnje bez ognja, makar i ljeto bilo, seljak po imenu Ambroš naloži dakle u jami na nekoliko stopah izkopanoj oganj: ali na svoje čudo spazi izza malo vremena, da su gorela ne samo drva nego i ista zemlja. Premda priprost seljak, to je ipak toliko mudar bio, i pomislio, da ovomu čudu, moraju biti izvanredni uzroci. Uzme si komad ove zemlje, te odnese župniku. Na žalost, kasnije je zbog toga izgubio svoju zemlju.[6]

mine and first miners were moved here from Idrija (Slovenia). Within two years whole settlement was built. Due to the war in 1816, the Substitution Mine court was moved here from Rude and the director Gayer became a Mining judge. It was a custom of the miners to support primary schools, but in 1833, miners decided to found their own one in Radoboj which was an exceptional venture. Most of the sulphur was mined within 40 to 50 years. The mine struggled due to the poor condition of the roads and underground water which was harder and harder to pump out. At the end, the mine was sold to Sonnenberg, Pulzer and Moses in 1865. The new owner continued by processing the tailings which contained about 40—50 % of sulphur. The mining of sulphur finally stopped in 1916.

Sulphur/Sumpor,
by analogicus from Pixabay

Sumporokop je 1811. otvorila Austro-Ugarska. Prvi rudari doseljeni su iz Idrije (Slovenija). U dvije godine sagrađeno je cijelo rudarsko naselje. Zbog ratnog stanja tu se 1816. seli i rudarski sud iz Ruda te voditelj Gayer postaje ujedno i rudarski sudac. Običaj rudara bilo je podupirati osnovne škole, no 1833. rudari su odlučili osnovati u Radoboju vlastitu školu što je bio izvanredan pothvat.
Većina sumpora je otkopana u 40 do 50 godina. Sumporokop je imao problema zbog loših cesta te podzemne vode koju je bilo sve teže crpiti. Na kraju je sumporokop prodan 1865. udruženju Sonnenberg, Pulzer i Moses. Rad se nastavlja preradom jalovišta u kojem je bilo 40—50% sumpora te se na kraju zaustavlja 1916. godine.

Legacy

Sulphur from Radoboj was displayed at major exhibitions. For example, it was shown in London in 1851 at The great industrial exhibition of all nations and it was rewarded with a silver medal at The first Dalmatian-Croatian-Slavonian exhibition in Zagreb in 1864.

The great industrial exhibition of all nations 1851/Velika izložba industrijske djelatnosti svih nacija 1851., Stuart Rankin at https://www.flickr.com/photos/24354425@N03/13531842193

A silver medal from 1864/
Srebrna medalja iz 1864.

Nasljeđe

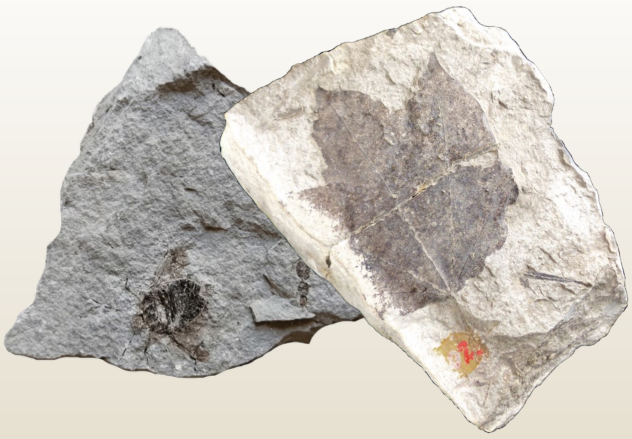
Sumpor iz Radoboja je izlagan na velikim izložbama. Izložen je 1851. u Londonu na Velikoj izložbi industrijske djelatnosti svih nacija te 1864. u Zagrebu na Prvoj dalmatinsko-hrvatsko-slavonskoj izložbi gdje je nagrađen srebrnom medaljom.
Čudnovata pojava sumpora privlačila je

The phenomenon of sulphur in marl intrigued scientists. King Frederick Augustus II. of Saxony, a known naturalist, visited Radoboj and collected a sample for his private collection. Radoboj attracted many scientists due to valuable fossils in such perfect conditions. For example, Morlot found 550 fossils of flora, 640 of insects and 100 of fish within 14 days and analysed a fossil of a flower which clearly showed five petals stamens and a pistil. [5] Fossils of terrestrial and marine fauna and flora

Frederick Augustus II. and his private collection sample of sulphur from Radoboj/Frederik August II. i sumpor iz Radoboja iz njegove privatne kolekcije —Senckenberg Naturhistorische Sammlungen Dresden (SNSD), Museum für Mineralogie und Geologie (MMG), Jana Wazeck,Min 20650 SY

znanstvenike. Kralj Frederik August II. Saski poklanjao je veliku pažnju prirodnim znanostima. Na jednom od svojih putovanja posjetio je i Radoboj iz kojeg je uzeo gomolj sumpora za svoju zbirku. Radoboj je privlačio brojne prirodoslovce i zbog izuzetno očuvanih fosila. Na primjer Morlot je prilikom 14 dnevnog boravka sakupio 550 fosila flore, 640 fosila insekata i 100 fosila riba. Fosilni cvijet koji je proučavao, sadržavao je svih pet latica, prašnike i tučak. [5]

were retrieved. The specimens point to a subtropical to tropical climate.[6] The oldest fossil of wine leaf in Europe was found here. Based on the huge amount of collected fossils, numerous scientific works were published on **fossilized flora** (Franz Unger and Constantin von Ettingshausen), **fossilized pollen** (Johann Heinrich Robert Göppert), **fossilized insects** (Oswald Heer) and **fossilized fish** (Johann Jakob Heckel).



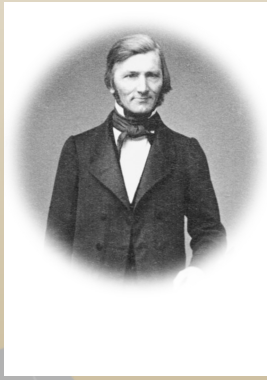
Tectocoris sp., Museum Radboa, Radoboj and *Vitis teutonica* A. BRAUN, Croatian Natural History Museum, Zagreb/ *Tectocoris sp.*, Muzej Radboa , Radoboj i *Vitis teutonica* A.BRAUN, Hrvatski prirodoslovni muzej, Zagreb

Pronađeni primjerci su fosili kopnene i morske faune i flore koji ukazuju na prevladavajuću suptropsku do tropsku klimu. [6] Pronađen je i najstariji fosil lista vinove loze u Europi.
Na temelju goleme količine prikupljenih fosila publicirani su mnogi znanstveni radovi o: **fosilnoj flori** (Franz Unger i Constantin von Ettingshausen), **fosilnoj peludi** (Johann Heinrich Robert Göppert), **fosilnim kukcima** (Oswald Heer) i **fosilnim ribama** (Johann Jakob Heckel).
Izložbeni primjerci se nalaze u europskim

Exhibits are scattered in European scientific institutions and museums. The richest collection is located in Graz [7]. Fossil specimens from Radoboj can be found in Zagreb, London, Liège, Ljubljana, Trieste and Wien.

Franz Unger

Flabellaria maxima UNGER, *Quercus palaeococcus* UNGER, *Cystoseirites communis* UNGER , Universalmuseum Joanneum, Geology & Palaeontology, Graz, Austria / Landesmuseum Joanneum Graz, Austrija



Oswald Heer

znanstvenim institucijama i muzejima. Najbogatija zbirka je smještena u Grazu [7]. Izlošci fosila iz Radoboja se nalaze i u Zagrebu, Londonu, Liègeu, Ljubljani, Trstu i Beču.

After the sulphur mine was closed, mining activities continued until 1943 by the extraction of black coal from clay layers. Finally, the shafts were flooded and filled with mullock. Although nowadays there is no evidence of it, mining caused significant changes in population, brought education and increased welfare. Mining is affirmed heritage of the area and to preserve it and educate the public about the significance of Radoboj, the Radboa Museum was opened.

The building of coal mine/ Zgrada ugljenokopa, Radoboj 1940, family album of Milivoj Jurinjak/obiteljski album Milivoja Jurinjaka

Nakon zatvaranja sumporokopa rudarenje se nastavilo sve do 1943. godine vađenjem ugljena iz slojeva gline. Na kraju su rudarska okna zatvorena, potopljena i nasuta jalovinom. Iako danas tragovi rudarenja nisu vidljivi, ono je donijelo značajne promjene u populaciji, obrazovanju i ukupnom napretku. To nasljeđe je prepoznato i za njegovo očuvanje i edukaciju o značaju Radoboja otvoren je Muzej Radboa.

Radboa Museum
Radoboj 34, 49232 Radoboj
phone: +385 49 350 118
cell phone: +385 91 725 7685
e-mail: info@radboa.com
web: www.radboa.com
Opening hours:
Tue—Sat: 9:00—17:00 (last entrance at 16:00)
During holidays—closed
(35 visitors max. per tour)

Muzej Radboa
Radoboj 34, 49232 Radoboj
tel.: 049 350 118
mob.: 091 725 7685
e-mail: info@radboa.com
web: www.radboa.com
Radno vrijeme:
Ut-pet: 9:00—17:00 (zadnji ulaz u 16:00)
Praznici—zatvoreno
(maksimalno 35 posjetitelja po grupi)

References

Literatura

[1] ENCYCLOPÆDIA BRITANNICA

[2] Morlot, A.: Ueber die geologischen Verhältnisse von Radoboj in Kroatien. Jahrb. Geol. Reichsanst., 1/2, 268-279, Wien, 1850.

[3] Koch, F.: Sumpor iz Radoboja, Glasnik Hrv. naravosl. društva, Zagreb, 1898-99.

[4] Kišpatić, M: Slike iz rudstva. Kulturno-prirodopisne crtice. - Poučna knj. Matice Hrvatske, Zagreb, 1878.

[5] Hirc, D.: U Zagorju, Hrvatski planinar, Br 12, 193—199, 1900.

[6] Vukotinović, Lj.: Geologički i paleontologički odnošaji u Radoboju. Rad Jugoslavenske akademije znanosti i umjetnosti, knj. 28, Zagreb 1874.

[7] Gross, M: Die phytopaläontologische Sammlung Franz UNGER am Landesmuseum Joanneum, Joannea Geol. Paläont. 1: 5–26, 1999.

The miners' flag, Radboa Museum, Radoboj/ Rudarska zastava, Muzej Radboa, Radoboj

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