

**International Conference on Sustainable Aggregates Planning in South East Europe
-contributions to the EU minerals policy framework –
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Aggregates in Montenegro

- legislation, geological resources, production and planning -

Geological Survey of Montenegro
Naselje Kruševac bb, 81 000 Podgorica

Slobodan Radusinović
Darko Božović
Božica Jovanović
Ivana Radošević

In cooperation with :

Radosav Čović,
Ministry of Economy and
Dragan Asanović,
Environmental protection agency of
Montenegro



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Property on mineral resources

- Law on state property ("Official Gazette of Montenegro ", No 21/09) i
- The Mining Law ("Official Gazette of Montenegro ", No 65/08, 74/10)

The right to exploration and exploitation of mineral resources

- Law on concessions ("Official Gazette of Montenegro ", No 8/09)
The annual plan for granting concession

Detailed geological exploration

- Law on geological explorations (" Official Gazette of Montenegro ", No. 28/93, 27/94, 42/94, 26/07, "Official Gazette of Montenegro ", No 28/11)

Overview of legislation in Montenegro

Exploitation of mineral resources

- The Mining Law (“Official Gazette of Montenegro”, No 65/08, 74/10)
State plan of mineral resources exploitation

Waste management

- Law on waste management (“Official Gazette of Montenegro”, No 64/11), article 54.
The holder of construction waste is obliged to process construction waste into construction material

Investor is obliged that, with the management plan for construction waste, establish the measures to ensure recycling of at least 70% of construction waste mass, including the river deposits and other natural material from excavation.

The Rulebook for the treatment of the construction waste, manner and the procedure for processing of construction waste, conditions and manner for disposal of cement asbestos construction waste (Official Gazette of Montenegro No 50/12)

Resources for the production of primary and secondary aggregates

PRIMARY AGGREGATES : Crushed stone

Crushed stone, Technical – construction stone by the national classification of mineral resources

- 32 deposits of technical – construction stone
- 19 deposits in the coastal area, 6 in central, and 7 in the northern part of Montenegro
- 25 deposits in the process of exploitation
- 2 deposits simultaneously produces decorative stone

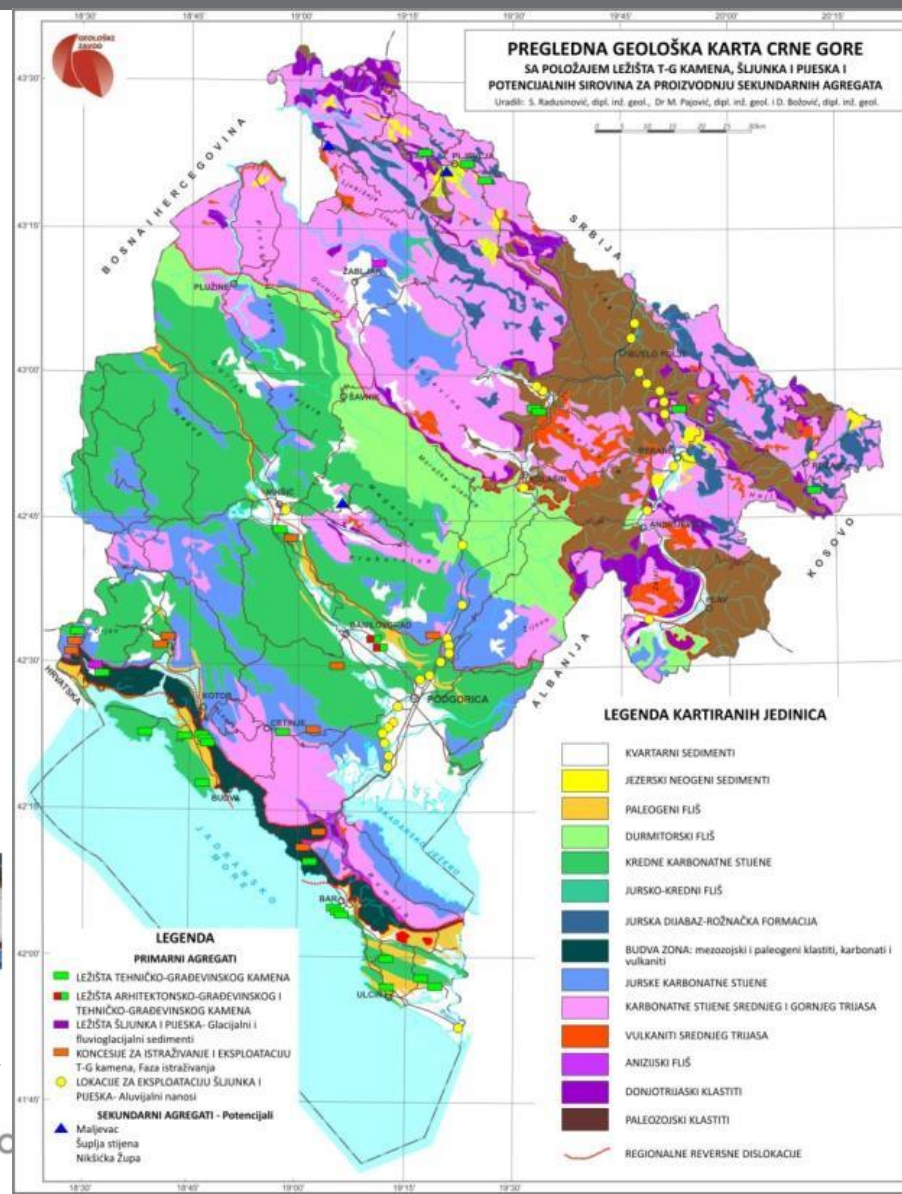
Deposits are of limestone and limestone-dolomite composition, except of one active deposit that is of volcanic origin.



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Resources for the production of primary and secondary aggregates

PRIMARY AGGREGATES : Gravel and sand

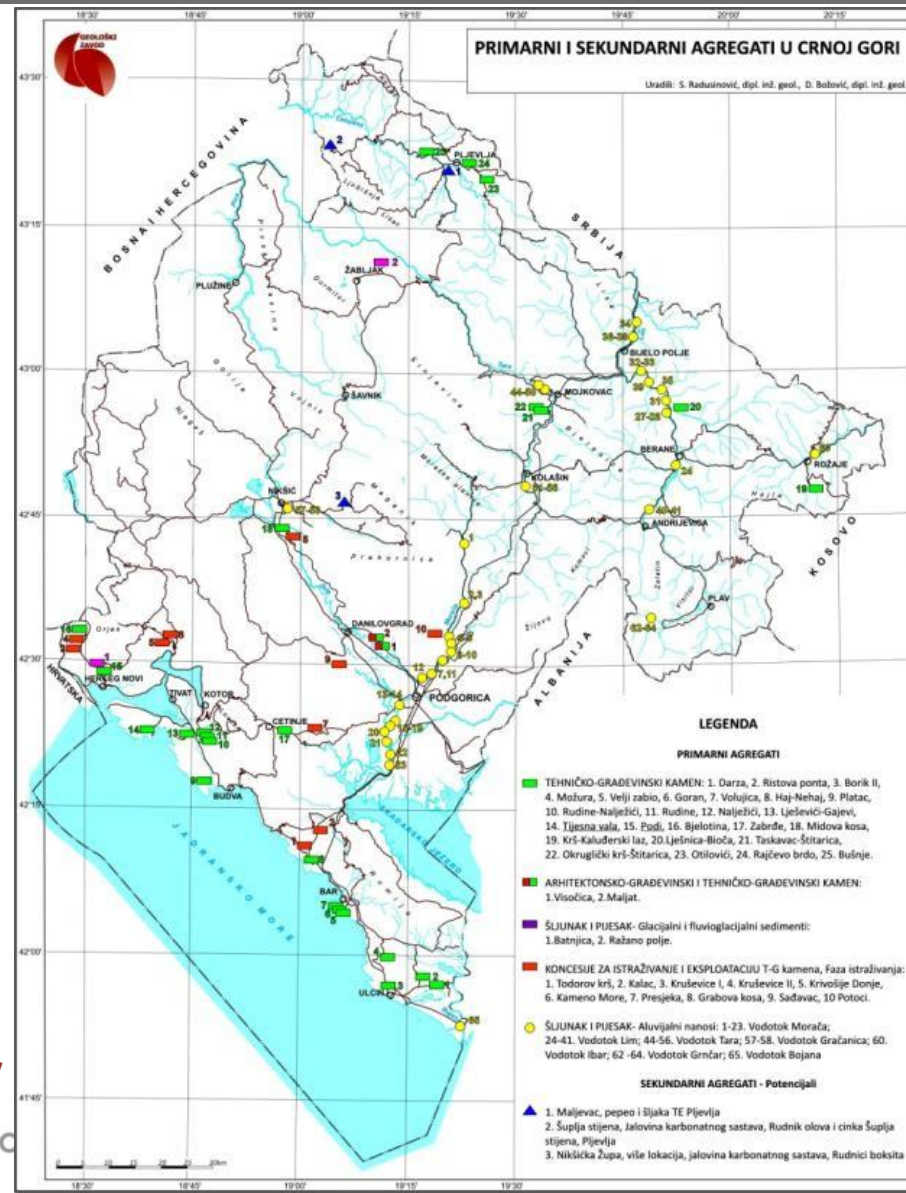
Gravel and sand of glacial and fluvioglacial origin

- In previous period, exploitation was performed at the several locations
- Quarries and interim pits are generally abandoned
- In almost all cases the sites are not re-cultivated

Gravel and sand of alluvial origin, river deposits

- Exploitation of alluvial gravel and sand from the riverbeds and inundation areas
- Rivers: Morača, Cijevna, Tara, Lim, Ibar, Gračanica and Grnčar
- More than 60 locations

River deposits from renewable and non-renewable deposits can be exploited at sites where mining contributes to preserving or improvement of the water regime, at the extent that does not affect the water regime and stability of the coast.



Resources for the production of primary and secondary aggregates

SECONDARY AGGREGATES

Potential materials:

- Ash and slag from Thermal power plant Pljevlja, Landfill Maljevac
- Mining waste of carbonate composition from Mine of lead and zinc Šuplja Stijena
- Mining waste of carbonate composition from active bauxite mines in the wider area of Nikšićka župa, Bauxite mines Nikšić
- Construction and waste from demolition of objects
- Excavated materials that occur in the process of construction of building structures (construction and civil engineering)



- Satellite images Google Earth

Resources for the production of primary and secondary aggregates

PRODUCTION OF PRIMARY AGGREGATES

**Table 1. Production of primary aggregates in Montenegro for the period
2007-2011**

Primary aggregates	Unit measure	2007	2008	2009	2010	2011	Ukupno
Crushed stone and sand and gravel of glacial and fluvioiglacial origin	m ³	424.464	604.809	351.080	214.235	207.849	1.802.437
Sand and gravel from river deposits ²	m ³	118.000	226.000	163.000	70.000	32.000	609.000
Total crushed stone and sand and gravel	m ³	542.464	830.809	514.080	284.235	239.849	2.411.437

Five year period production:

- about 1.8 millions m³ of crushed stone aggregate
- about 600 thousands m³ of sand and gravel from river deposits

Statistical office of Montenegro – MONSTAT collects, maintain record, and conducts statistical processing of data on aggregate production



Resources for the production of primary and secondary aggregates

SECONDARY AGGREGATES

- There is no facility for recycling and/or production of secondary aggregates in Montenegro
- In previous period, production was carried out from the overburden of carbonate composition from the bauxite open pits Liverovići I and II nearby Nikšić



It is estimated that significant amounts of excavated materials that occur in the construction of buildings, residential and commercial buildings in the construction and reconstruction of roads to be used raw or processed for the construction of embankments, tampons or as aggregates for concrete. This processing is done on-site by mobile installations and thus obtained material is used. We did not have data available on the amount of material that is processed and utilized for this purpose.

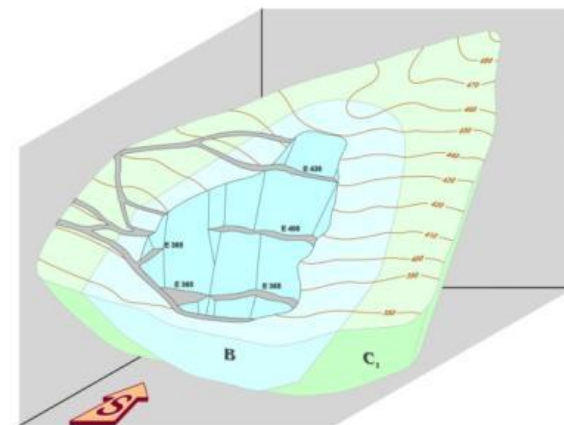
Potential, availability, quality of materials and opportunities for exploitation

PRIMARY AGGREGATES: Crushed stone

Crushed stone, Technical – construction stone according to national classification of mineral resources

- The total balance of proven geological reserves of t-c stone in Montenegro amount to about **110 millions m³**.
- Potential reserves of mineral raw materials, taking into account the geological structure are practically unlimited.
- Crushed stone of volcanic origin that is produced from only one deposit in Montenegro, whose proven reserves are about **2,5 millions m³**
- According to the testing properties, we can conclude that the technical – construction stone from the deposits in Montenegro, can be used for various purposes in the construction industry

Special possibility for valuation of carbonate raw materials is the production of carbonate fillers and their applications in different industries.



Potential, availability, quality of materials and opportunities for exploitation

PRIMARY AGGREGATES: Sand and gravel

Gravel and sand, glacial and fluvioglacial origin

- The total geological reserves in two deposits account for only about 200 thousand m³
- The potential is great, when we take into consideration that in territory of Montenegro, glacial and fluvioglacial formations are widely represented
- When it comes to quality, there are specific limitations related to the possibility of using

Gravel and sand from riverbeds

- Quantity of alluvial gravel and sand was evaluated through development of technical documentation for specific locations in the riverbeds and by the interested operators.
- These are amounts that are allowed to exploit in specific locations in order to regulate watercourses.
- Previously, permits were issued annually. Number of locations was over 60
- Since 2011, in accordance with the adopted legislation, the State through legal procedure performs concessions award for exploitation of river sediments, for a period of 5 years

Potential, availability, quality of materials and opportunities for exploitation

SECONDARY AGGREGATES

- Ashes from Thermal power plant Pljevlja. TPP Pljevlja annually produces about 350,000 t of ash, averagely. At landfills Maljevac in the last 30 years about **9 million tones** was disposed . It is not used for the production of aggregates.
- Active bauxite mines Nikšić. Mining waste of carbonate composition excavated on surface mining of bauxite in the Nikšićka župa. The total excavated quantity (limestone, dolomite limestone and glacial gravel and sand) on tailings deposited in the past 60 years at several locations are about **50 million tons**. One part of the material is used for the filling of the surface mines of exhausted deposits of bauxite. A significant part could be used for the production of aggregates. Earlier, there was attempt of aggregate production to a lesser extent from location that are nearby Nikšić. Now, there is no production.
- Active mine of lead and zinc Šuplja stijena, Pljevlja. Exploitation of overburden of carbonate composition was planned, a total of about **5 million m³**. Annual production is approximately 600,000 m³. Mining waste of carbonate composition is separately disposed and potentially can be used for aggregate production. It is not used for the production of aggregates.

Evaluation of the vault of the material reserves for the production of primary and secondary aggregates

- In accordance with applicable laws regarding the preparation of geological documentation, in the process of certification of reserves, geological and economic evaluation of deposits of technical-construction stone and deposit of gravel and sand of glacial and fluvioglacial origin, is carried out, as well as determination value of deposit
- The total value of the deposits of technical- construction stone deposits of sand and gravel of glacial and fluvioglacial origin, according to data from the certified Elaborate on classification, categorization and calculation of reserves is about **450 million €**
- Calculation of the value of deposits of sand and gravel of alluvial origin is not done
- Estimate of the value of materials for the production of secondary aggregates is not performed

Exploitation and processing of raw materials for the production of aggregates

- All deposits of technical-construction stone are excavated by open pits
- Basic system of exploitation consists of site preparation, drilling and blasting, loading and transportation of rock material to the crusher plant where the crushing and grading of raw materials is performed
- For loading, loaders of different capacities are used . Transportation is discontinuous – by truck.



- Crushing plant usually consist of the primary crusher and mills
- Most often they are located in the close to the mines
- Of the total number of open pits in operation (25), on 19 are used stationary while the 6 deposits are used stationary and/or mobile crushers

Exploitation and processing of raw materials for the production of aggregates

- Processing of mineral raw materials involves crushing, grinding and sieving of excavated rock material
- Plants with additional equipment are mainly used for the production of aggregates with fractions:
0-1, 0-4, 4-8, 8-16 and 16-32 mm
- More and more is present installation of dedusting system



- Exploitation of sand and gravel of glacial, fluvioglacial and of alluvial origin is carried out by construction machines - excavators and loaders of various capacities
- The material is used in their natural state, as sieved or crushed aggregate of various fractions. Treatment is usually carried out in the close vicinity of the exploitation site at the stationary and/or mobile systems.

Best available technologies

- Best available technologies of exploitation and processing
- Mining equipment and facilities for stone processing
- Environmental issues are being addressed through the obligation to develop an Environmental Impact Assessment Elaborate (EIA), which is the legal obligation of each concessionaire
- Monitoring of the process of production and processing of raw materials and informing the public and interested parties
- Control of the concessionaire by the geological, mining and environmental inspections



The contribution of the primary and secondary aggregates to the national economy

Statistical office of Montenegro - MONSTAT does not process separately data on the value of aggregate production.

Table 3: National GDP in Montenegro for the period 2007-2011.

	2011	2010	2009	2008	2007
Gross domestic product (GDP) in millions EUR (current prices)	3234	3104	2981	3086,1	2807,9
Gross domestic product per capita in EUR	5211	5006	4720	4908	4484
The real GDP growth (%) (GDP at constant prices for the year / GDP at current prices of the previous year) * 100-100	3,2	2,5	-5,7	6,9	10,7

Source: National GDP— MONSTAT, 2011

Roughly counting on basis of collected data, the total average annual production value of aggregates in Montenegro for the period 2007 -2011., seemed to be around 0.3% of GDP.

Trends in prices for primary aggregates

Selling prices of primary aggregates in Montenegro are given according to classification of MONSTAT

Uniformity is characteristic for the period 2008-2011

Table 4. Selling prices of aggregates in Montenegro for the period 2007-2011.

Name	Meas.unit	2007	2008	2009	2010	2011
Crude or crashed stone	m ³	12.19	14.04	13.96	13.95	14.05
Gravel	m ³	11.04	8.71	8.82	8.64	8.25
Stone granules	m ³	6.05	8.04	8.44	8.59	8.61
Broken stone	m ³	13.34	8.01	7.86	8.26	7.96

Source: Producer Price Index– MONSTAT, 2011

The prices represent the average price of aggregates within the selected sample for the research upon which is measured the dynamics of the index of the industrial products producers prices (*Explanation of MONSTAT*).

Demand for aggregates

Demand for aggregates can be assessed through the aggregate amount spent in construction.

Table 5: Quantity of spent building and operational material

Quantity of spent building and operational material	Meas. unit	2008	2009	2010	2011
Aggregates and profiled material of stone					
Profiled material of stone (curbstone, fence, stone cube, etc.)	m ³	640	3.607	1.135	2.489
Crushed technical stone and marble, all types	m ³	75.165	43.484	1.409	4.115
Broken stone and small size stone	m ³	58.055	75.209	7.621	8.628
Aggregates for concrete	m ³	341.630	264.833	200.848	54.187
Gravel	m ³	232.200	55.095	30.489	39.709
Sand	m ³	35.396	22.242	13.369	14.674
TOTAL	m³	743.086	464.470	254.871	123.802

Source: CONSTRUCTION, CONSUMPTION OF BUILDING ELECTRICITY AND FUEL- MONSTAT, 2011

Spent aggregates represent consumption of each aggregate based on which the dynamics of construction activity in Montenegro, is measured.

The data clearly shows a constant fall in aggregates spending in the period of 2008-2011.

Close to medium – term expectations of demand for aggregates

Forecasting demand for aggregates, we can now judge only through spent aggregate quantities in the construction industry in recent years (Source: Construction Statistics - MONSTAT)

For the assessment of demand we need data on:

- *the availability of natural aggregates,*
- *planned construction projects and the dynamics of their implementation,*
- *quality of aggregates,*
- *the spatial layout of the quarries in relation to major consumer centers and future needs of the construction of infrastructure and other facilities.*

Sources of information and literature

1. Ministry of economy (<http://www.mek.gov.me/>)
2. Directorate for water (<http://www.upravazavode.gov.me/>)
3. Statistical office of Montenegro– MONSTAT (<http://www.monstat.org/>)
4. Fund of professional documentation of the Geological Survey of Montenegro Podgorica
5. Resource map of Montenegro, Ministry of economy (www.mek.gov.me/biblioteka/dokument)
6. Ministry of transport (www.minsaob.gov.me/biblioteka/strategije)
7. Bauxite mine Nikšić
8. Coal mine Pljevlja
9. Gradir Montenegro Nikšić
10. Various materials of project SARMa

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