REPUBLIC OF CYPRUS
MINISTRY OF AGRICULTURE
NATURAL RESOURCES AND ENVIRONMENT

GEOLOGICAL SURVEY DEPARTMENT
1415 NICOSIA

REPORT ON RAW MATERIALS
MINERAL PRODUCTION IN CYPRUS

Mining: There has been only one mine operating in 2006 and that is the Skouriotissa Copper Mines where by the application of the leaching - SX - EW method is succeeded the production of high purity copper cathodes (99.999%). The cumulative exports of copper cathodes is today about 35.000 tones. The mine, which has interrupted temporarily its operations during 2004, has started again, since the copper price was inclined during 2006.

Quarrying: In 2006, there has been extensive quarrying of rocks and industrial minerals in Cyprus. There are about 185 quarries producing of various materials. They produce for local use backfill material, crushed aggregates (from calcarenite, limestone and diabase) building stone, limestone, clay, gypsum etc. and for export building stone, gypsum, bentonite, umber and ochre etc. There is also local production and exports of quick and hydrated lime, portland and other types of cement, gypsum plasters etc.

Information concerning the production of various industrial minerals for the last five (5) years is shown in the table below.

Table of the mining and quarrying of metallic and industrial minerals for the period 2002-2006 (In metric tones)

Raw Material	2002	2003	2004	2005	2006
Metallic Copper	3.630	2.525	1.344	0	880
Crushed Aggregates	10.500.00	10.700.000	11.600.000	12.064.112	12.198.513
Backfill material	2.000.000	1.000.000	1.200.000	1.000.000	700.000
Massive Chalk for Cement	1.950.000	2.220.000	2.290.000	2.450.000	2.210.000
Marl for Cement	480.000	550.000	565.000	600.000	540.000
Clay for bricks and roof tiles	350.000	350.000	425.000	443.000	400.000
Building Stone	30.000	25.000	22.000	26.000	39.000

Armorstone	50.000	78.000	83.000	25.000	52.500
Bentonite	146.000	165.000	170.000	185.000	164.000
Umber and Ochre	6.000	6.000	5.200	5.100	5.800
Recrystalized limestone for mosaic tiles	2.000	2.000	1.000	1.500	1.100
Limestone for Lime	12.190	13.370	13.990	16.589	14.913
Gypsum	295.000	300.000	255.000	215.500	270.000

Table of Exports for the period 2002-2006 (In metric tones)					
Raw Material/ Product	2002	2003	2004	2005	2006
Copper	3.695	2.552	1.344	0	880
Umber and Ochre	5.464	5.471	5.205	5.086	5.757
Bentonite	128.416	144.859	155.717	172.366	150.620
Gypsum	181.923	191.186	143.700	94.140	152.067
Building Stone	4.267	2.229	2.835	1.767	1.525
Crushed Aggregates	37.038	103.675	0	0	60.950
Cement	257.222	362.054	138.381	207.894	173.213
Clinker	212.459	56.034	66.865	37.891	97.846

Report on Crushed Aggregates

The most important rock types used for the production of aggregates for concrete and road making are Diabase, Reef Limestone/Limestone and Calcarenite.

Historically the production of aggregates for concrete and road making in Cyprus can be divided into three periods. The first period includes the years before July 1974. The aggregates that were used during that period were crushed limestone from the Pentadactylos mountain range (considered as the southern-most portion of the Tauro-Diranide Alpine Zone), river deposits and beach deposits.

The second period includes the years between 1974 and 1984. The abrupt loss of the crushed limestone sources from the Pentadactylos mountain range due to their occupation by the Turkish army in 1974 resulted the extensive use of aggregates mainly from river and beach deposits. During this period aggregates from crushed reef limestone and crushed diabase were introduced.

The third period includes the years after 1984 when the majority of quarries of natural aggregates ceased to operate except those producing natural sand. The main sources of aggregates have been quarries producing crushed aggregates from reef-limestone

and diabase. In the early 90´s the production of fine sand from crushed calcarenite was introduced which progressively replaced the production of natural sand. The progressive replacement of natural sand by the crushed calcarenite is shown by the production figures indicated below.

Rock Type / Year		**2002**	**2003**	**2004**	**2005**	**2006**
Crushed aggregates	Diabase, %	57.8	57.4	57.9	57.3	58.0
	Reef Limestone / Limestone, %	29.2	29.1	27.5	27.7	27.9
	Calcarenite, %	11.5	13.1	14.4	13.4	13.2
	Natural Sands/Gravels, %	1.4	0.4	0.2	1.6	0.9

Production of crushed aggregates percentages of major rock types for the last 5 years.

Diabase comprises almost the entire Sheeted Dyke Complex of the Troodos Ophiolite (Upper Cretaceous) and has a basaltic to doleritic composition. It was formed by the solidification of the magma in the channels, through which it intruded from the magma chambers at the bottom of the oceanic crust, feeding at the same time the submarine extrusion of lava on the seafloor. The Diabase occurs in the form of dykes that are parallel and contiguous with their thickness to vary from 0.30 to more than 3 m. After their emplacement, the sheeted dykes undergone hydrothermal alteration resulting the local modification of the original composition of the diabase. The facies that have been recognized so far are the quartz-diabase, epidote-diabase, amphibole-diabase and albite-diabase. The primary minerals found in diabase are plagioclase, pyroxene, olivine and amphibole whereas ilmenite, magnetite and sphene are found as accessory minerals. The secondary minerals that were formed due to the hydrothermal alteration include quartz, epidote, albite, actinolite, chlorite, calcite and zeolites. Pyrite and chalcopyrite may also be present in small amounts in the form of single crystals or veins. Therefore, the quality of the diabase used for the production of concrete aggregates depends on the degree of alteration that the sheeted dykes undergone.

Currently, there are eight active quarries zones of diabase with ten quarries to operate producing fine and coarse aggregates for concrete structures and road making. The diabase quarries are located two in Nicosia District, five in Limassol District and three in Larnaca District. The ten active quarries of diabase produce about 7.1 million metric tones of aggregates that correspond to approximately 58 % of the total production of aggregates in Cyprus.

The **reef limestone** and limestone that is used for the production of fine and coarse aggregates comes mainly from the reef limestone of the Koronia Member (Upper Miocene) and Terra Member (Lower Miocene) of the Pakhna Formation. In addition to this, limited quarrying for crushed aggregates comes from the layered limestone of the Agios Photios group of the Mamonia Complex. The production of aggregates from this type of rock is approximately 3.4 millions of metric tones and correspond to approximately 27.9 % of the total production of aggregates in Cyprus.

The Koronia Member represents the second phase of reef growth on Cyprus that is occurring in the upper part of the Pakhna Formation. This later phase of reef growth is comparable with similar fringing reefs of monospecific, poritid coral reefs that were

commonly developed around the Mediterranean basin in the Tortonian-early Messinian time. The morphology and distribution of the Koronia Member reef outcrops differ in each main area of exposure due to the fact that were controlled by local structural settings. The Koronia limestone is lithologically described as a recrystallized bioclastic, bioherm and biostrom reefs. This dolomitic or magnesium-rich reef limestone has a creamy to off-white color. The reef limestone, that is exploited as a source of raw material for aggregates, is generally hard, massive and relatively porous whereas locally it may be bedded, brecciated and contain conglomeratic and/or sandy facies.

Currently, there are two active quarries zones of the Koronia Member reef limestone with three quarries to operate in each quarry zone producing fine and coarse aggregates for concrete structures and road making. The quarries zones of the Koronia Member reef limestone are located at the Kato Moni – Mitsero area in Nicosia District and at the Xylophagou area in Larnaca District.

The Terra Member represents the first phase of reef growth on Cyprus that is occurring in the lower part of the Pakhna Formation. These reefs were formed in the late Aquitanian-early Burdigalian time on isolated stable basement highs in two major localities, the Cape Greco area in southeast and Androlykou area in west Cyprus. The size of the reefs is up to 500 m by 80 m and they grew as diverse patch reefs in relatively shallow, calm seas. In general, these reefs are circular to cresent-shaped in plan view with a shallow, domed profile. The reef structures are scattered about 1 km apart and resemble modern lagoonal patch reefs in size, shape and distribution. The structure of the reefs is made up of a primary framework of massive and branching corals (Porite Species) plus a secondary framework composed of encrusting organisms, including solidary corals, calcareous red algae, bryozoans, serpulids, foraminifera and mollusks. The Terra reefs were cemented by Mg-calcite and botryoidal aragonite during and shortly after growth. Uplift and extensional faulting caused fracturing of the, by then, brittle reefs and fissures were locally enlarged by karst-forming solutions. The fissures eventually were filled with fine-grained carbonate sediments, which were prone to dolomitization. The reef limestone, that is exploited as a source of raw material for aggregates, is generally hard, massive and relatively porous and it has a creamy to off-white color.

Currently, there is one active quarry zone of the Terra Member reef limestone with three quarries to operate producing fine and coarse aggregates for concrete structures and road making. The quarry zone of the Terra Member reef limestone is located at the Androlykou area in Pafos District.

The **calcarenite** used for the production of fine sand comes from the Nicosia – Athalassa Formation and it is of Pliocene age. The production of fine sand from this type of rock is approximately 1.61 millions of metric tones and corresponds to approximately 13.2 % of the total production of aggregates in Cyprus. This calcarenite is located on the plateau of Agios Sozomenos in Nicosia District. This plateau forms a flat top area of about 3 km^2, which is composed of lenses of beige to yellow calcarenite with lenses of loose sand forming all together sub-horizontal layers and crossed-bedded layers. The calcarenite consists of fragmental limestone, foraminiferal sands, calcitic grits and occasionally marls and clastic sediments. The grain size of the calcarenite varies from medium to coarse whereas the grain size of the sandy fraction varies from very fine to coarse. At the Agios Sozomenos plateau there are two quarries operating producing sand for concrete works.