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Geo-diversity and geo-materials in the region of Rabat-Sala-Kenitra: Characterization and Rationalization of Utilization

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Abstract— The Rabat-Sala-Kenitra (RSK) is distinguished by a rich geology is varied. Outcrops are found in both the Paleozoic basement, especially along the major wadis in the area and a fairly extensive coverage postpaléozoïque and locally very thick. It offers a wide variety of petrographic facies some of which the construction of geomaterials value (GMC), very solicited by the construction sector and public works (BTP). Among the most important GMC furniture and beds of RSK: the Sands,the Calcarenite, the Limestones, Granites.

Furthermore, we recall that in the Region of RSZZ exist geomaterials outcrops of great scientific and educational value that must be protected and prohibited from exploitation as well to preserve geological heritage

Index Terms—Geo-diversity, Geo-materials, Kenitra, Morocco, RSK, Rabat, Sala,

1 Introduction

Rabat imperial city and capital of Morocco (see fig. 1) was appointed in 2012 by UNESCO World Heritage thanks to the value, location and heritage significance of many historic sites it contains.

The wealth of this city by historical monuments demonstrates the availability and richness in geo-materials.

This work aims to characterize the access, availability and location of Rbatis geo-materials.

Fig. 1. Rabat location

2 Geographical aspect

The supply of geo-materials has never been a problem for the city of Rabat.

In fact this is record to the geological diversity of the region of Rabat-Salé-Zemmour-zaer.

This diversity allows access to both consistent materials and other furniture while ensuring self-sufficiency in the field of construction.

The Rabat Sala Kenitra (RSK) is part of the north western end of the Moroccan Meseta (Michard, 1979 Piqué, 1979; Michard et al, 2008; Figure. 1).

Two structural units are distinct: the deRabat-Tiflet area north and central western Morocco south (fig. 2 Piqué, 1994; Tahiri, 1994).

The Rabat-Tilfet area consists of two units: (i) north of the block Sehoul or metamorphic unit (Piqué, 1979; El Hassani, 1990) to Cambrian to Ordovician material formed of metamorphic rocks (Fig. 1,2) and granites; (Ii) south axis or Bouregreg Rabat-Tiflet or sedimentary unit (Piqué, 1979; El Hassani, 1990) formed rock metamorphic little or no dating from the Ordovician to Late Visean.

The Rabat-Tiflet area forms the border (or ride north bordière) Basin Devonian Dinantian Sidi Bettache (BSB), north western end of West Central Morocco; axis Rabat-Tiflet part of the northern fringe of BSB (Piqué, 1979; El Hassani, 1990; Tahiri, 1991, 1994).

The central Morocco, especially its western part, is formed by the BSB and its bordering wrinkles: wrinkle west of Cherrat limiting east coastal pier, north block of Sehoul, east and SE wrinkle of Aguettouane and wrinkle-Zaers Oulmès (fig. 3 Piqué, 1979; El Hassani, 1990; Chakiri 1991; Tahiri, 1991). In these units, the series is complete Paleozoic Middle Cambrian (Acadian) to Permian (Autunian).

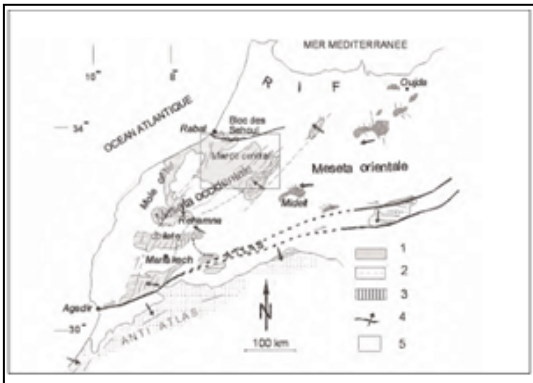

Fig. 2. structural scheme of the Variscan belt of northern Morocco. 1: Domain orogenic; 2: Margins in the chain; 3: Rabat -Tiflet area; 4: Main plicatives directions and divergences; 5:

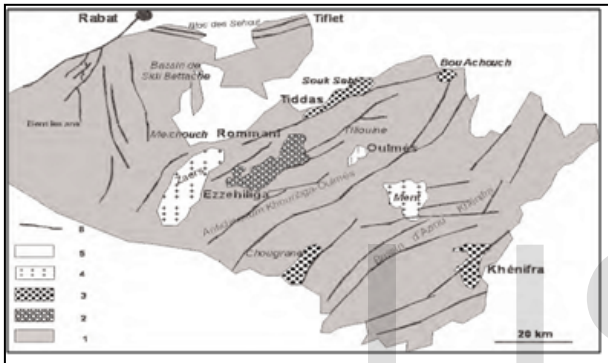

Fig. 3. Schéma structurel simplifié du Maroc la situation de with central des principales a toponymes. 1: Principaux affleurements des terrains paléozoïques anté-Westphalien; 2: Les dépôts westphaliens; 3: Principaux Bassins permiens; 4: Granits varisques; 5: Couverture post-pa1léozoïque; 6: accidents Principaux varisques.

3 Lithology

-The Paleozoic Hercynian base comprises from bottom to top:
- Micaceous pelites, quartzites, pelites of alternations and micaceous sandstone (Ordovician p.p.);
- Conglomerates, pelites, alternations of pelites and dolomitic limestones (Silurian-Lower Devonian p.p. / Loch- kovien);
- Dolomitic limestones and shales (Devonian p.p.);
  - Fossil sandy schiste (Carboniferous p.p., Tournaisien) and conglomerates, pelites to gréso-pelites to goniatites and bivalves, greenish sandstone purposes (p.p. Carboniferous, Westphalian).

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-Neogene includes upwards:
  - Calcarenite (5 m) surmounted by yellow and blue marl (Miocene p.p.) that constitute the post-Paleozoic unconformably cover;
  - The Pliocene succession consists from bottom to top:

a. of sandstone lumachelles to conglomeratic beds in small discrepancy on the Miocene marls (Pliocene p.p., marine);
b. 10 m poorly consolidated sands and gravels, metrics benches calcarenite; intercalated thin conglomeratic levels (recent Pliocene fuvio submarine);
c. a dune system generally NE-SW direction (wind sandstone) parallel to the shoreline (Pliocene continental dune)
- Quaternary:
The Quaternary of the Rabat region is similar to that of the whole of the Moroccan Atlantic coast (Bouhaouli 1974 Texier et al 1994) (see fig. 4). It is represented by coastal marine deposits, mainly calcarénitiques, deposited during the Quaternary transgressions diferent at altitudes and distances from the coast increasingly important for older (90 to 100 m and 10 from the coast to the Messaoudien and 2 m and along the current coastline, for Mellahien).

The stratigraphic column of Fig.4 shows a section which outcrops on cliffs along the left bank of Bouregreg river near its mouth (Lambert coordinates: x: 368, 8; y: 381, 2).

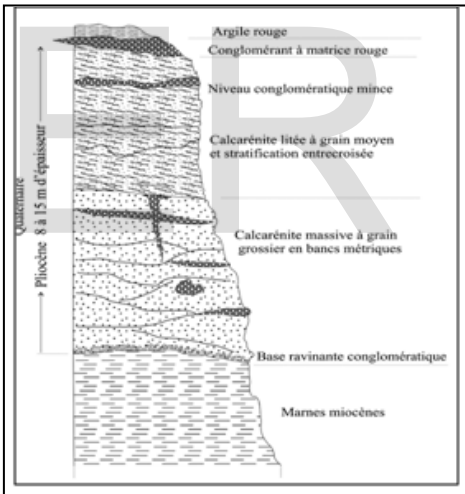

Fig. 4. Log coastal Quaternary deposits of the Moroccan coastal plateau.

4 Tectonic

The Paleozoic basement very distorted by the Caledonian and Hercynian phase consists of a set Northern (block Sehoul) that overlaps a southern southward together. The first set, older, of Cambrian-Ordovician, is wrinkled and schistose by the Caledonian orogeny. (see fig. 6)
It consists of sandstones and shales; the second set, age from Ordovician to Carboniferous (Westphalian), distorted by folds (anticlines and synclines) during the Hercynian phases is essentially sedimentary.
Tectonically, two families of Hercynian faults affect these groups:
• Vertical faults N 120 ° E

• Faults strike slip later N 10 and N 70 ° E.

5 Geo-materials

All flap historic monuments are built from existing geo-matérials on a radius of 20 km radius around the city of Rabat. These materials can be subdivided into two groups: the cohesive materials and geo-materials furniture. (see tab.1)

variety	Trade name	Reserve estimate
Grey	Pearl Grey	18 Mt
Veined gray	Ykem river	28Mt
Pink gray	Fisherman flower	18Mt
Pink grainy	Red granite	300Mt
Homogeneous Black	Black atlantis	18Mt
Purplish black	Moorish purple	18Mt
Veined black	Antique black	21Mt

Tab. 1.Reserve estimate of solid limestone-Rabat(2010)

5.1 Cohesive materials

It's all solid materials whose exploitation requires first of the big block of extractions and operations routing to places crushing or flaking.

- The solid limestone: PALEOZOIC base comprises many limestone layers of different thicknesses différentes. Its ages are used for their ornamental values and their physico-mechanical properties.(see tab.2)

Parameter	Ykem river	Akrech river	Carrare marble
Density (g / cm3)	2,74	2,73	2,75
Porosity(%)	2,67	2,35	4,48
Water absorption(%)	0,18	0,17	0,19
Resistance to compression in Admin (MPa)	100	108	97

Tab. 2. average values of the physico-mechanical parameters of solid limestone-Rabat(2010)

- Calcarenite: It is about one of the most exploited rocks in Rabat under the name of "sandstone Rabat" or "salty stone", they easier to extract compared to the solid limestone with a very low resistance to weathering.(see Tb. 3.)

5.2 Furniture materials

These are minerals to disjoint grains such as:

	SiO2	Al2O 3	Fe2O3	MgO	CaO	Na2O3	K2O	PF	CaCO3
Salé	15,05	1,71	4,35	0,28	42,67	0,43	0,48	335,0	75,95
Sidi Bouknadel	6,50	0,76	0,87	1,28	48,66	0,34	0,21	39,10	86,61

Tab. 3. Chemical analysis of Rabat's Calcarenites (2010)

-Red clays: Played for which adobe construction, pottery, brickworks ...

-Blue and yellow marl Miocene

-Sands correspond to all the furniture rocks whose size is between 2 mm and 63 µm,they come essentially from beaches located between Rabat and Kenitra. (see fig. 5)

Fig.5. Sands quarry

6 Conclusion

Rabat is well stocked for all geo-materials it needs for construction, Potrie the décord ... but surely the supplying and excessive operation will cause in the future that deficite 'avoid.

6 References

[1] André Michard, Saddiqi Omar Ahmed Chalouan Dominique Frizon de Lamotte 2008 "Contintnal Evolution: The geology of morocco"

[2] El Amrani E.I & El AzharinH. 2009 "Evaluation of the physical and chemical properties of building stone in Morocco from P-wave velocities and impact resistance '' pp 41-54

[3] El Hassani, A.; Huon, S.; Hoepffner, C. Whitechurch, H. & Piqué, A. (1991)." An average Ordovician age deformation in the Sehoul zone (northern Moroccan Meseta)". A look at the "Caledonian" segments in the NW of Africa. Comptes Rendus of the Academy of Sciences of Paris, 312: 1027-1032

[4] Tahiri, A.; Azor, A.; Lodeiro, F.G.; Martinez Poyatos, D.J.; El Hadi, H. (2005). The tectonic frame of the Variscan-Alleghanian orogen in Southern Europe and Northern Africa, Tectonophysics, 398: 181-198. doi:10.1016/j.tecto.2005.02.00

[5] Michard, A.; Yazidi, A.; Benziane, F.; Hollard, H. & Willefert, S. (1982). Foreland thrusts and olistostromes on the pre-Saharan margin of the Variscan orogen, Morocco. Geology, 10: 253-256.doi:10.1130/0091-7613(1982)10<253:FTAOOT>2.0.CO;2