

'Piedra Mar del Plata': An Argentine orthoquartzite worthy of being considered as a 'Global Heritage Stone Resource'

F. CRAVERO^{1*}, M. B. PONCE², M. R. GOZALVEZ³ & S. A. MARFIL⁴

¹*INGEIS (Institute of Isotope Geology and Geochronology) CONICET-UBA.*

Pabellón INGEIS, Ciudad Universitaria,

C1428EGA Ciudad Autónoma de Buenos Aires, Argentina

²*Institute of Mining Technology, Argentine Geological and Mining Survey (SEGEMAR).*

Av. General Paz 5455. B1650KNA San Martín, Buenos Aires, Argentina

³*Institute of Geology and Mineral Resources. Argentine Geological and Mining Survey (SEGEMAR). Av. General Paz 5455. B1650KNA San Martín, Buenos Aires, Argentina*

⁴*Department of Geology, Universidad Nacional del Sur. B8000ICN Bahía Blanca, Argentina*

*Corresponding author (e-mail: fcravero@ingeis.uba.ar)

Abstract: Although Argentina is a large country, only a few local stones meet the requirements to be used for construction purposes. *Piedra Mar del Plata* is a quartzite that has been used for more than 50 years, mainly as a building stone. During the 1930s and 1950s, its use in the construction of houses in the city of Mar del Plata (a famous beach resort) created a distinctive architectural style. Because of its durability and availability, the use of this stone rapidly spread to other parts of the country. Sculptures and monuments have also been made out of this stone. Mar del Plata architectural style is now part of the heritage of Argentina and represents the rise of the middle class, when local citizens could afford to build their own houses in a style different from the mansions, which were constructed by rich families with imported stone.

The oldest constructions in Argentina date back to the 1600s when the Jesuits built their reductions, churches and so on. These constructions were made of bricks and cobble stones, and only a few were built with local stones. After massive European immigration in the late 1800s, rich families constructed their mansions with imported stones. The main monuments and buildings followed the same trend. Only after the rise of a middle class, in the early-middle 1900s, did local stones start to be used for domestic purposes.

Argentina is a large country of more than 2 780 400 km². The type of stone used for construction varies in different parts of the country. But there is only one, Mar del Plata stone, that was used in the construction of houses during the 1930s and 1950s in the famous city of Mar del Plata that created an architectural style named after this rock. *Piedra Mar del Plata* (Mar del Plata stone) was used not only in houses but also in statues and monuments that were placed in other cities like Buenos Aires, the capital of Argentina.

- **Formal Name for this proposed 'Global Heritage Stone Resource'.** *Piedra Mar Del Plata* (Mar del Plata Stone).

- **Origin of Name.** This stone was named after the city of Mar del Plata (General Pueyrredón County) where it was first used and most of the quarries were developed.
- **Stratigraphic (or Geological) Name.** Balcarce Formation.
- **Area of Occurrence.** The Balcarce Formation forms part of the Tandilia System located in the southeastern area of the Province of Buenos Aires. The most significant outcrops are between the cities of Mar del Plata and Balcarce (Fig. 1a).
- **Principal Location of Quarry or Quarries.** In the Mar del Plata area, mining dates back to the late 1800s and early 1900s (Del Río & De Marco 2012). By 1965 (Alvarez 2012) 21 quarries had been active since 1950, when chalet construction in Mar del Plata was at its highest. By 2011, only eight quarries were still working.

The main quarries are located in the Batán area, about 10 km from Mar del Plata city (Fig. 1b). One of the most important and oldest quarries is Yaravi (Fig. 1b, c) where a 20 m thick sequence is composed of groups of 1–2 m beds arranged in depositional forms. Internally the beds show planar and

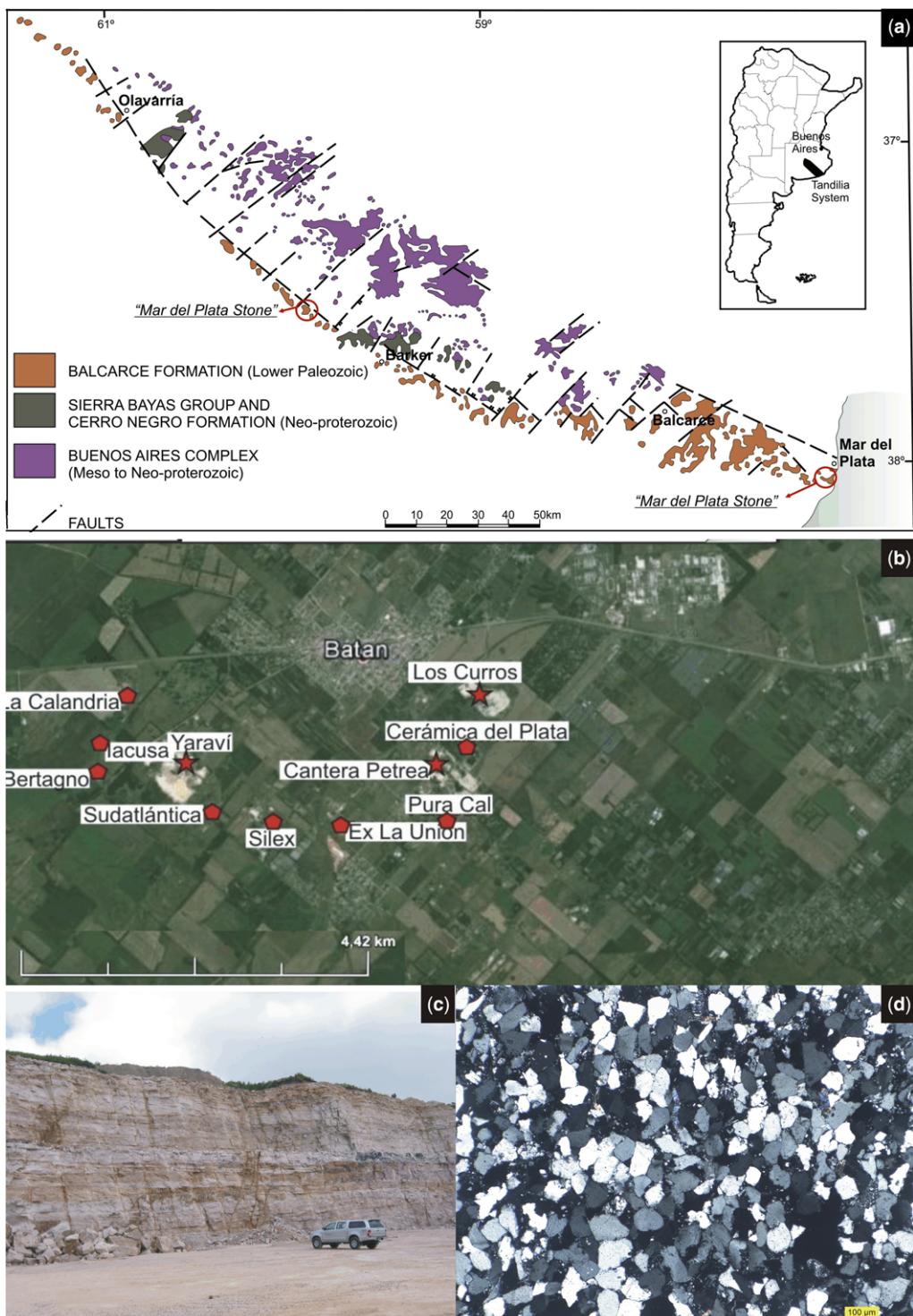


Fig. 1. (a) Geological map of Tandilia System (after Iñíguez *et al.* 1989). (b) Location of active (red polygon) and abandoned (red star) quarries. (c) Yaraví quarry. (d) Quartzite texture in thin section.

tangential cross stratification, heterolithic units in which alternating groups of mudstones and fine rippled sandstones are associated with cross bedded sandstones, and fine conglomerates with normal gradation (Poiré *et al.* 2003). The whole sequence provides a 50–70 m thick front for exploitation.

- **Geological Age and Geological Setting.** The Río de la Plata craton is one of the continental blocks located at the core of western Gondwana. The southernmost outcrops of this cratonic region are exposed in the Tandilia System (Fig. 1a). The Tandilia basement is partially covered, towards the west and southeast, by three sedimentary units: the Neo-Proterozoic Sierras Bayas Group, and the Eopalaeozoic Cerro Negro and Balcarce Formations. Mar del Plata stone comes from the Balcarce Formation of Cambro-Ordovician age (Poiré *et al.* 2003). This subhorizontal unit outcrops between the city of Balcarce and the Atlantic coast along the eastern border of the Tandilia System (Poiré & Spallati 2005) (Fig. 1). The Balcarce Formation is made up of thick quartz arenite beds with kaolinitic claystones and thin fine-grained conglomerates. It was formed in near-shore and inner-shelf environments of a tide-dominated and storm-influenced open platform. It shows many features suggesting tidal sedimentation (Poiré *et al.* 2003). The Balcarce Formation average thickness is 75–90 m, reaching c. 450 m in the Punta Mogotes borehole near Mar del Plata (Cingolani 2011).
- **Petrographic Name.** In the literature, it is often described as orthoquartzite, because more than 95% of the clasts are composed of quartz. When a sedimentological description is made, the term used is quartz arenite.
- **Primary Colour(s) and Aesthetics of Stone.** The stone is yellowish white to light grey, or even reddish when stained by iron oxides.
- **Natural Variability.** Natural variations are related to variations in colour: technical properties are constant.
- **Composition.** Chemical composition was determined with a SHIMADZU, LAB CENTER XRF 1701, Sequential X-ray fluorescence spectrometer on fused samples with lithium borate. The average chemical composition of major elements (%) is about: SiO₂, 91.20; Al₂O₃: 5.52; Fe₂O₃: 0.21; TiO₂: 0.03; ZrO₂: 0.02; P₂O₅: 0.01; MnO: <0.01; CaO, 0.03; MgO, 0.06; Na₂O, <0.01; K₂O, 0.35; SO₃, 0.01; LOI, 1.90. In thin sections (Fig. 1d) the rock shows a clastic texture composed 98% of clasts and 2% of matrix plus cement. Clasts are composed of about 0.1 mm subangular quartz (98%) with few lithoclasts. Clays and sericite are found in the matrix. The cement is siliceous.
- **Technical Properties.** (Data obtained on samples from Yaraví quarry) Density (kg/m³), 2540 (IRAM 10602); Porosity (%), 3.68 (IRAM 10602); Flexural Strength Dry (MPa), 18.63 (ASTM C 880); Salt Crystallization (Δ%), 0 ± 0.01 (UNE-EN 12370); Water absorption coefficient by capillarity, 0.003 (UNE-EN 1925); Compressive strength (IRAM 1510), 1025–1275 kg/cm² (Añón Suarez *et al.* 1969).
- **Suitability.** *Piedra Mar del Plata* has been utilized mainly as a building stone, paving slabs, for facades and as aggregates. There are a few, but no less important, examples where it was used for sculpture (for example, two sea lion effigies guarding an esplanade in Mar del Plata, made by José Fioravanti in 1941, that are an unmistakable symbol of the city).
- **Vulnerability and Maintenance of Supply.** There are still active quarries, although the abandoned ones are not exhausted. There are also known outcrops that could be exploited in case of a supply shortage. The rock is composed almost entirely of quartz: it is very hard and massive. Quartz is the highest resistant mineral to chemical weathering, only at very high pH is it possible to dissolve SiO₂, conditions that are not present in the surface environments. On the other hand, the quartzite is massive, so mechanical weathering such as salt crystallization and frost wedging is not likely to be possible. All these characteristics have been proven in the original locale, Mar del Plata, a seaside town.
- **Historic Use and Geographic Area of Utilization.** Mar del Plata is a well-known beach resort on the Atlantic coast, which at the beginning of the twentieth century became the choice for rich families that live in the capital city, Buenos Aires, for their summer holidays. As a result, huge mansions were constructed following European styles. During the decades between 1935 and 1950, upward social mobility was much more dynamic in Mar del Plata than in Buenos Aires itself, paving the road for a strong middle class based on tourist services, the building industry and prosperous commerce. It was during this time that a new urban style was born in the city, not by following guidelines designed by technocrats, but in a ‘democratic’ process. That was the environment in which the Mar del Plata style emerged.

The ‘Mar del Plata style’ or ‘marplatense’ comes from the picturesque, especially that related to the ranch-style house in California. The new style adapted the main characteristics of the great mansions of the Belle Époque into a domestic scale.



Fig. 2. (a) Sea Lion, (Fioravanti, 1941), one of the two sculptures situated in the esplanade. Hotel Provincial is in the back. (b) Torre Tanque, water storage tower finished in 1943 and still functioning. It offers awesome views over Mar del Plata and further out to sea. (c) Mar del Plata-style chalet, Isla family (Marazzato, 1941). Mar del Plata architectural heritage.

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The *chalet marplatense* was a translation of the main characteristics of eclecticism to the domestic space; quartzite stone facades, mission or French tiles, gable roofs, dormers, chimneys, prominent eaves and front porches.

Although the main area of utilization has been in Mar del Plata and its surroundings, the Mar del Plata style extended more widely. It is very common to find houses built in that style in other places, mainly in the Province of Buenos Aires (the most populated area of Argentina with 30% of the total population) and in the capital of Argentina (Buenos Aires). Monuments carved from this rock are also distributed not only in Mar del Plata but also in Buenos Aires.

- **Buildings where Mar del Plata stone was used as blocks to build the masonries.** The list is very extensive, so the most representative buildings are mentioned. *Churches*: Santa Cecilia Chapel (1873), Stella Maris Church (1908/12), San Gemma Chapel, Tandil (1947, by Arch. Alejandro Bustillo). *Public buildings*: General Pueyrredon City Hall (1938), Provincial Hotel (1938) and the Gran Casino (1941), Post Office (1958), Argentinian National Bank (Arch. A. Bustillo, Buenos Aires, 1944–1955). *Iconic buildings in Mar del Plata*: Monk's Tower (1904), Opera Theatre (1945), Tower Tank (1943) (Fig. 2b). ‘Mar del Plata chalets’ (Mar del Plata-style chalets), houses built with this stone, are distributed all around the country, one of the most important is Dr. Isla House (1941) (Fig. 2c, Mar del Plata), declared as a Mar del Plata-style heritage chalet.
- **Summer villas.** The stone was used in parts of the buildings either as cladding or in the interior for decorative purposes: Château Frontenac (1905), Villa Devoto (1918), Villa Ortiz Basualdo (1918), Villa Normandy (1918/9), Château Frontenac (1905), Villa Devoto (1918), Villa Ortiz Basualdo (1918), Villa Normandy (1918/9), Marazzato (1941).
- **Sculptures and monuments.** These include: Sea lions (Fig. 2a) (1941) sculptured by José Fioravanti, Mar del Plata; Alfonsina Storni (1942) sculptured by Luis Perlotti, Mar del Plata; Ameghinós face (1938) sculptured by Rafael Radogna, Roque Sáenz Peña; Diagonal Norte (1923) and Florida (1926) sculptured by José Fioravanti, Buenos Aires; San Martín (1956) sculptured by Luis Perlotti, Mar del Plata.

Conclusion

Piedra Mar del Plata qualifies as a heritage stone. It has been used for about 100 years: its customary use reflects the social changes of an important period

of time in Argentina, and moreover, an architectural style was developed after the use of this stone in middle-class houses. Although local, its importance in Argentinian heritage makes this stone suitable to be nominated as a Global Heritage Stone Resource.

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