



Kirmenjāk – the stone on which Venice was built

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“The most characteristic building stone (in Venice) is the brilliant white marble shipped cheaply into Venice from Istrian quarries. It is easy to carve but remarkably resistant to weathering, which is severe in the humid, saline—and now acidic—air of Venice.”

This quotation from the *Encyclopedia Britannica* stresses the importance and qualities of the Istrian stone (in Italy known as *Pietra d’Istria*) – which in fact is not a marble, but a dense micritic or pelmicritic stylolitized limestone from Istria (Croatia) of Upper Jurassic –Tithonian age.

According to the results obtained by the testings of physical and mechanical properties of the *Pietra d’Istria* (nowadays called «*Kirmenjāk*» after the small village in central Istria where the main quarries are located) we can say the stone has extremely low water absorption $\sim 0.2\%$ mas., high compressive strength ~ 163 MPa, and very low coefficient of abrasion resistance ~ 12.6 cm³/50 cm² as well as nice ebony colour that with time obtains white patina. Those features make it the ideal material for the «base zone» of Venetian buildings – the zone between the foundation (wooden piles) and brickwork walls. As Venice was built in the Lagoon, founded on the muddy soil with inadequate mechanical strength for constructing houses, let alone magnificent Venetian palaces and churches, the mechanical characteristics of the soil were improved by sinking a dense network of wooden piles. Wood is appropriate for the underwater foundation, but if exposed to the daily high tide flooding and low tide drying, it deteriorates very easily.

Therefore, for the base zone the *Pietra d’Istria* was used, and it was never plastered or protected in any way. After the tradition, for those who cheated by using another kind

of stone, visually similar, but not with such excellent properties required in these specific conditions, the penalty was very severe. Thus, Venetian master-builders and their investors knew very well the properties of *Kirmenjak* and made good use of it. Our assumption is that they made advantage of horizontal stylolite discontinuities (partially filled with clay) as the multi-layer humidity insulation, which minimize already very low water absorption. Therefore, it is interesting to investigate how *Kirmenjak* blocks were laid into the base zone of Venetian buildings taking into account prevalent stylolite orientation.

Kirmenjak is the base stone of Venice — its buildings have colourful marble, porphyre, granite and other luxurious stone facings, but the *Serenissima* nevertheless lies on the white *Pietra d'Istria*. The importance of this base stone was shown in the great flood in the second half of the 20th century, when the *acqua alta* rose above the *Kirmenjak* base and damaged the brickwork superstructure (walls) and the expensive stone facing of the world famous Venetian facades.