Stonework of ancient Inca

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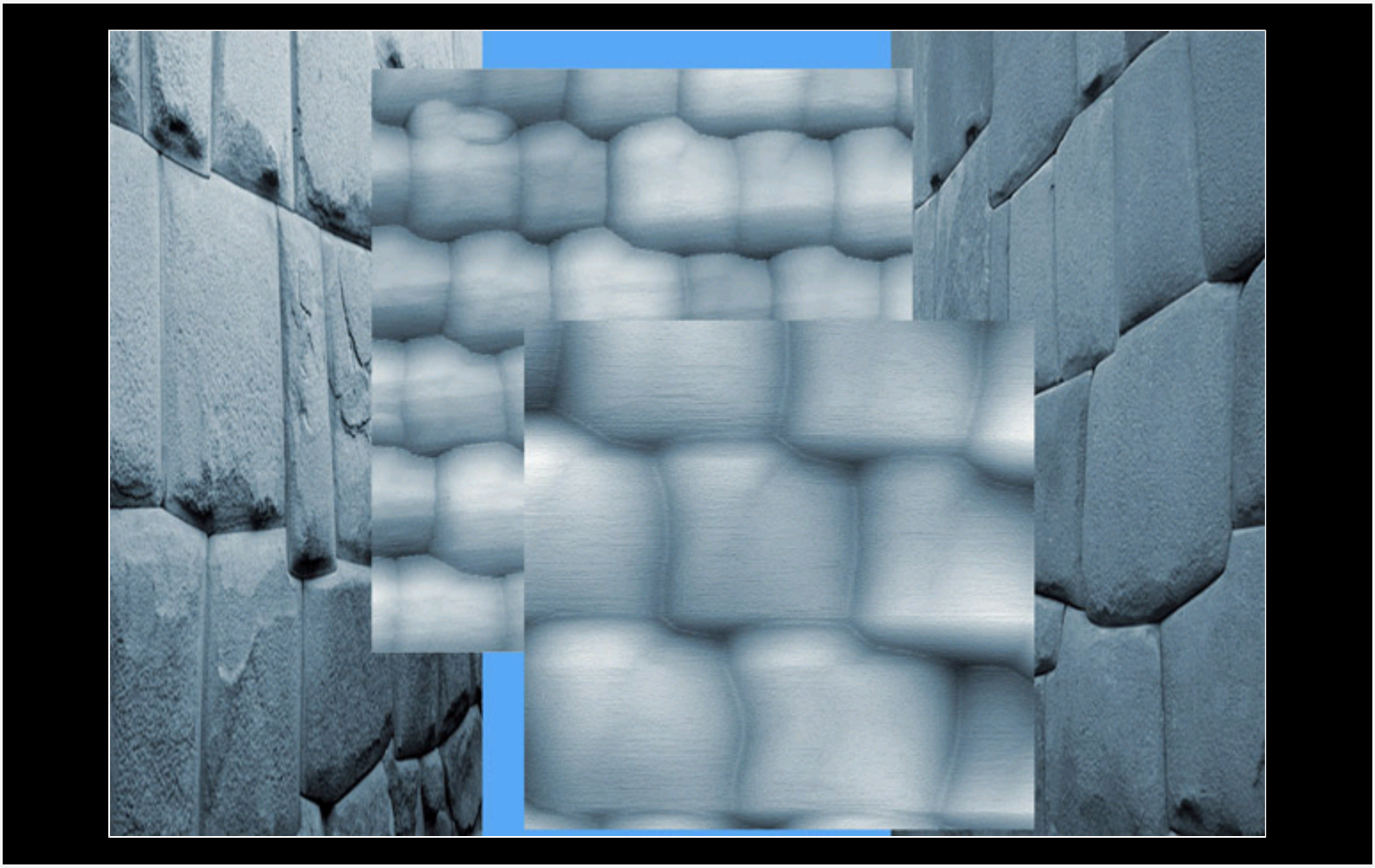

The survived wall fragments of splendid temples erected by the ancient Inca were built of large stone blocks with no mortars applied (shown in the image on the left and on the right). The stones are so precisely fitted that a knife blade can not be jammed between them. No one will ever confuse the stonework of the ancient Inca with any other.

While settling the submicron-sized “stone blocks” (silica particles) from a colloidal solution, self-assembly of an ordered structure known as synthetic opal occurs on the polished silicon substrate. In the central part of the picture in the background is shown a 1.4×1.4 micrometers fragment of such a surface. The particles of the obtained structure hold together without any bonds. The 270 nanometers sized particles are so closely “fitted” to each other that even the ultrasharp probe of an atomic-force microscope is unable to penetrate between them (see the surface area in the foreground measured with high magnification). Like with the stonework of the ancient Inca, the presence of specific notches interlocking the structure elements along with the large contact area ensures a high strength of the construction.

Usually, synthetic opals consist of identical spherical silica particles from 10 to 500 nanometers in size. The particles may form both ordered surface structures of a single monolayer thickness and ordered bulky structures – *sui generis* crystals composed of hundreds of layers. At present, synthetic opals are considered as promising candidates for creation of photonic crystals – 2D and 3D structures capable of effective light flux control.

The images of the synthetic opal were taken with the atomic-force microscope Solver™ P4 (NT-MDT Co., Russia) in air in tapping mode. Silicon cantilever (Institute of Physical Problems named after F. V. Lukin, Russia) with force constant 100 N/m and resonance frequency 487 kHz was used, curvature radius of the probe made 10 nm.

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