We can pave a surface with identical patterns or shapes (squares, rectangles, hexagons), and we can fill large volumes with smaller volumes (bricks) which are identical (cubes, parallelepipeds, prisms, ...). The shape of the building blocks determines the symmetry of the lattice.

Try with these shapes...

All of these volumes or shapes have axial 2-, 4-, 5- and 6-fold symmetry (angles of 180°, 90°, 72°, or 60°). If we use the pentagonal (5-sided, angles of 72°) or decagonal (10-sided, angles of 36°) shapes with surfaces with 5- or 10-fold symmetry, we would find that it is not possible to pave the surface completely; there would be gaps. The same is true for volumes with 5- or 10-fold symmetry, such as the icosahedron or pentadodecahedron, ... for crystallographers, therefore, these sorts of symmetry could not possibly be found in crystals.

Build a crystal using the same type of brick.

«Quasi-crystals» cloud the picture

The discovery of «quasi-crystals» in aluminium and manganese alloys in 1984 undermined the certainties of crystallographers and physicists: a quasi-periodic order could exist - the regular stacking of two different types of brick. Build a ten-pointed star with these two different and distinctive shapes.

All of these volumes or shapes have axial 2-, 4-, 5- and 6-fold symmetry (angles of 180°, 90°, 72°, or 60°). If we use the pentagonal (5-sided, angles of 72°) or decagonal (10-sided, angles of 36°) shapes with surfaces with 5- or 10-fold symmetry, we would find that it is not possible to pave the surface completely; there would be gaps. The same is true for volumes with 5- or 10-fold symmetry, such as the icosahedron or pentadodecahedron, ... for crystallographers, therefore, these sorts of symmetry could not possibly be found in crystals.