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# Crystallographic Microstructure of Nacre 

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We measured the crystallographic aspects of the microstructure of mollusk nacre for the species Mytilus edulis with high-resolution electron backscatter diffraction (EBSD). For the common Pmen setting of aragonite ( $a=4.97 \AA, b$ $=7.97 \AA, \mathrm{c}=5.75 \AA$, i.e. [001] perpendicular to the $\left[\mathrm{CO}_{3}\right]^{2-}$ groups) the average c -axis orientation is perpendicular to the aragonite platelets with a near-Gaussian distribution in the order of ca. $25^{\circ}$ FWHM in a scanned area of 20 x $40 \mu \mathrm{~m}^{2}$. In the a-b- plane many different discrete orientations are present, which may merge to a continuous cylindrical distribution with increasing scan area. On the grain scale we find that within the aragonite platelets of typically $900 \times 4600 \mathrm{~nm}$ size the crystallographic orientation has a spread of $2.5^{\circ} \mathrm{FWHM}$ (compared to the experimental accuracy of $+/-0.3^{\circ}$ ). We attribute this spread to a mesocrystal architecture within the platelets. If "crystal grains" in the nacre are defined to be regions enclosed by grain boundary misorientations larger than $3.5^{\circ}$, the "crystals" composing the Mytilus edulis nacre occupy the space of several neighbouring aragonite platelets. We observe composite crystal "towers" or stacks of 20 platelets of similar orientation along [001] and 1-2 platelets along directions in the a-b-plane. Thus the platelets boundaries are defined by organic matrix and they do not necessarily imply a crystal grain boundary in the sense of a change of crystallographic orientation of the adjacent crystals. Between neighbouring towers the most frequent large-angle misorientation is the common 110 aragonite twin orientation system (which can leads to pseudohexagonal triplets).

