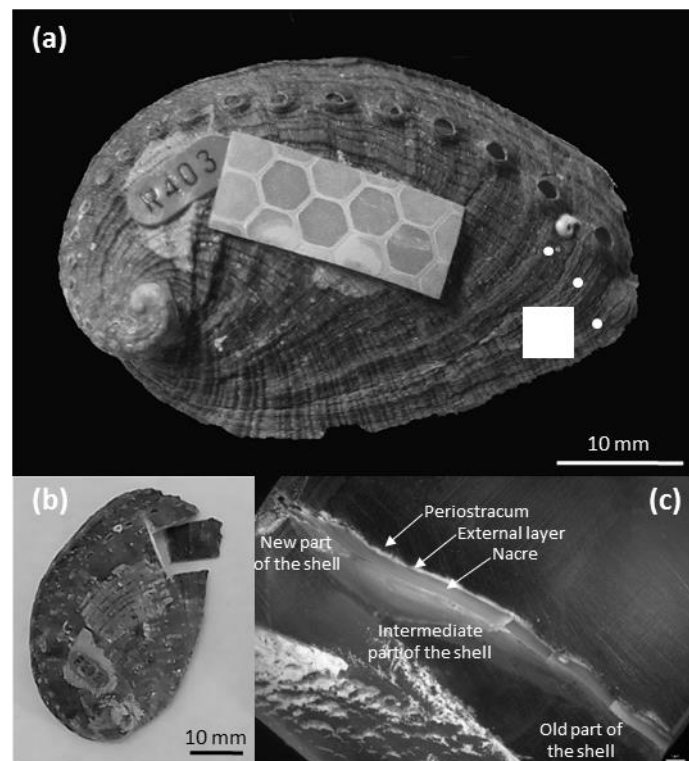


1 **Supplementary Figure S1.** (a) 3 points used to measure the shell thickness. A square of 4 mm
2 side (white box) was used to average the grey levels. (b) The shell fragment, cut in the newly
3 formed area, was used either for SEM surface analysis (internal or external faces), for SEM
4 cross-section analysis, or for nanoindentation (polished cross-section). (c) Shell cross-section
5 embedded in epoxy resin used for SEM and nanoindentation (after polishing) analysis (three
6 layers: periostracum, external layer and nacre; three zones: new, intermediate and old parts of
7 the shell).



8 **Supplementary Table S2.** Weibull analysis calculation of 95% confidence intervals for
9 nanoelasticity. \hat{m} and \hat{s} are estimates for m (Weibull modulus) and E_0
10 (characteristic Young's modulus of 63% of the population), respectively. 95% CI_{E_0} lower and
11 upper: lower and upper limits of 95% confidence interval on E_0 value.

| Layer | pH | Zone | n | m | c | E_0 (GPa) | \hat{m} | \hat{s} | 95% CI_M lower | 95% CI_M upper |
|-------|-----|------|-----|--------|---------|--------------|-----------|-----------|---------------------|---------------------|
| E | 8.0 | O | 367 | 8.424 | -38.283 | 94.14 | 8.424 | 94.14 | 92.92 | 95.39 |
| | | I | 347 | 5.853 | -26.670 | 95.26 | 5.853 | 95.26 | 93.43 | 97.13 |
| | | N | 369 | 6.194 | -28.165 | 94.34 | 6.194 | 94.34 | 92.68 | 96.04 |
| | 7.7 | O | 337 | 5.233 | -23.903 | 96.35 | 5.233 | 96.35 | 94.24 | 98.49 |
| | | I | 355 | 5.663 | -25.233 | 86.09 | 5.663 | 86.09 | 84.39 | 87.81 |
| | | N | 347 | 6.708 | -30.162 | 89.68 | 6.708 | 89.68 | 88.17 | 91.21 |
| N | 8.0 | O | 343 | 11.934 | -53.255 | 86.69 | 11.934 | 86.69 | 85.86 | 87.52 |
| | | I | 355 | 11.840 | -52.382 | 83.44 | 11.840 | 83.44 | 82.65 | 84.24 |
| | | N | 313 | 7.558 | -33.591 | 85.13 | 7.558 | 85.13 | 83.79 | 86.49 |
| | 7.7 | O | 336 | 5.576 | -24.601 | 82.43 | 5.576 | 82.43 | 80.73 | 84.15 |
| | | I | 367 | 7.428 | -32.538 | 79.89 | 7.428 | 79.89 | 78.71 | 81.09 |
| | | N | 364 | 6.925 | -30.161 | 77.89 | 6.925 | 77.89 | 76.65 | 79.15 |

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14 **Supplementary Table S3.** Weibull analysis calculation of 95% confidence intervals for
 15 nanohardness. \hat{m} and \hat{s} are estimates for m (Weibull modulus) and H_0
 16 (characteristic nanohardness 63% of the population), respectively. 95% CI_{H_0} lower and upper:
 17 lower and upper limits of 95% confidence interval on H_0 value.

18

| Layer | pH | Zone | n | m | c | H_0 (GPa) | mhat | shat | 95% CI_{H_0} lower | 95% CI_{H_0} upper |
|-------|-----|------|-----|-------|--------|-------------|-------|------|-------------------------|-------------------------|
| E | 8.0 | O | 367 | 5.206 | -9.044 | 5.68 | 5.206 | 5.68 | 5.56 | 5.80 |
| | | I | 367 | 3.836 | -6.600 | 5.59 | 3.836 | 5.59 | 5.43 | 5.75 |
| | | N | 369 | 3.623 | -6.160 | 5.47 | 3.623 | 5.47 | 5.31 | 5.64 |
| | 7.7 | O | 337 | 2.830 | -4.628 | 5.13 | 2.830 | 5.13 | 4.93 | 5.35 |
| | | I | 355 | 3.105 | -4.902 | 4.85 | 3.105 | 4.85 | 4.68 | 5.03 |
| | | N | 355 | 3.338 | -5.635 | 5.41 | 3.338 | 5.41 | 5.23 | 5.60 |
| N | 8.0 | O | 369 | 5.976 | -8.819 | 4.37 | 5.976 | 4.37 | 4.29 | 4.46 |
| | | I | 369 | 5.570 | -7.855 | 4.10 | 5.570 | 4.10 | 4.02 | 4.18 |
| | | N | 367 | 3.991 | -5.646 | 4.12 | 3.991 | 4.12 | 4.00 | 4.23 |
| | 7.7 | O | 355 | 3.001 | -4.064 | 3.87 | 3.001 | 3.87 | 3.73 | 4.02 |
| | | I | 355 | 4.874 | -6.688 | 3.94 | 4.874 | 3.94 | 3.86 | 4.03 |
| | | N | 367 | 3.477 | -4.614 | 3.77 | 3.477 | 3.77 | 3.65 | 3.89 |