High Pressure Reveals Structural Determinants for Globin Hexacoordination: Neuroglobin and Myoglobin cases

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The influence of pressure on the equilibrium between five (5c) and six-coordination (6c) forms in neuroglobin (Ngb) and myoglobin (Mb) has been examined by means of molecular dynamics (MD) simulations at normal and high pressure. The results show that the main effect of high pressure is to reduce the protein mobility without altering the structure in a significant manner. Moreover, our data suggest that the equilibrium between 5c and 6c states in globins is largely controlled by the structure and dynamics of the C-D region. Finally, in agreement with the available experimental data, the free energy profiles obtained from steered MD for both proteins indicate that high pressure enhances hexacoordination. In Ngb the shift in equilibrium is mainly relate to an increase in the 6c→5c transition barrier, whereas in Mb such a shift is primarily due to a destabilization of the 5c state.