



Figure 1. The two most complete thoracic vertebrae from El Sidrón. On the left, cranial (top) and lateral left (bottom) views of SD-1619 are presented. In this vertebra, identified as T6-T7, the dorsal orientation of the transverse processes, together with the sagittal orientation of the facets for the rib tubercle can be observed (see text for discussion of these features). On the right, cranial (top) and lateral right (bottom) views of SD-1641 are presented. In this vertebra, identified as T3-T4, there is lack of fusion of the epiphyses of the transverse processes, but a sagittal orientation of the immature surfaces on the tip of the transverse processes can be observed (especially on the right side).

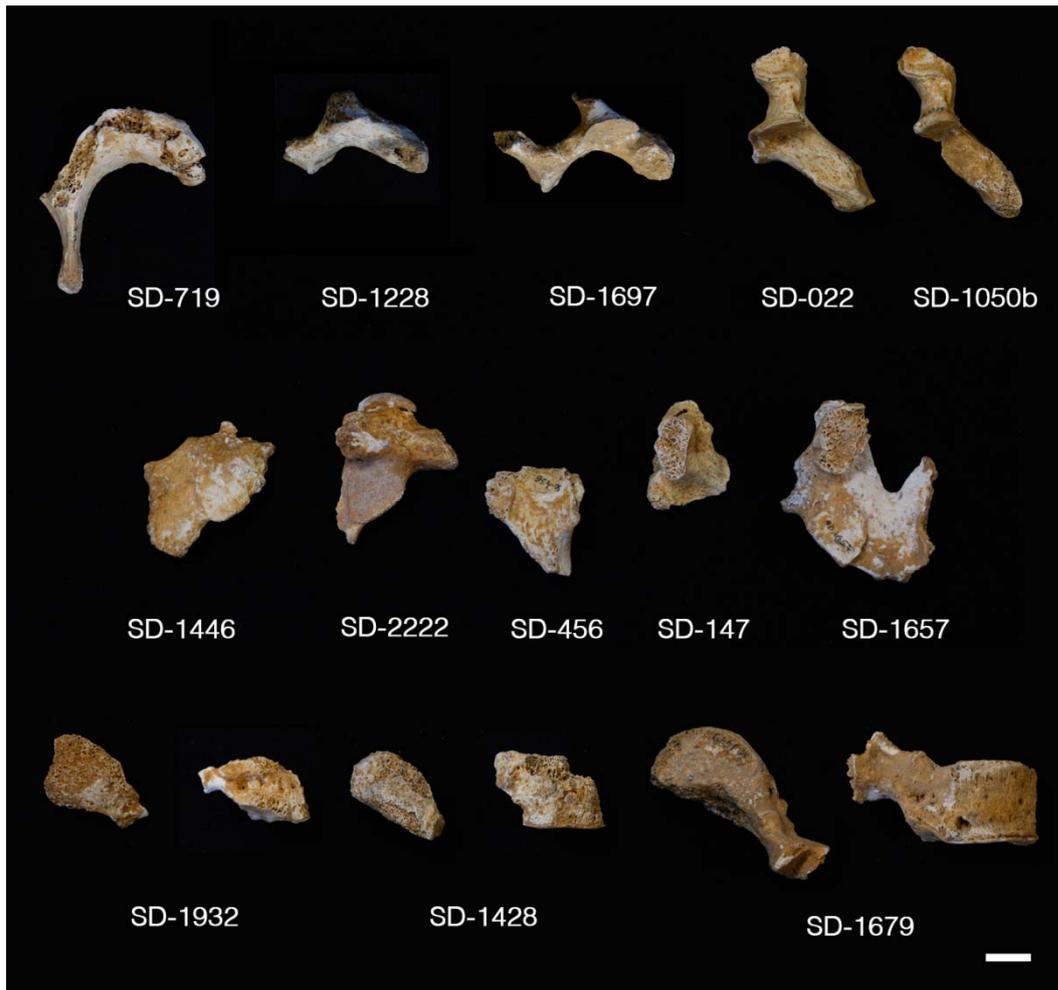


Figure 2. Vertebral fragments from El Sidrón; see Tables 1 and 2 for vertebral number identification. Top: Fragments with transverse process. The five fragments correspond to the right side and are presented in cranial view, ordered from T1 (SD-719) on the left, to T5-T7 (SD-1050b) on the right. The dorsal orientation of the transverse processes and the sagittal orientation of the transverse costal facets can be observed. Middle: Fragments including lamina. The five fragments are presented in ventral view, ordered from T1 (SD-1446) on the left, to T8-T9 (SD-1657) on the right. Bottom: Fragments of vertebral body. The three fragments are presented in two views, cranial and lateral right, ordered from T1 (SD-1932) on the left, to T2-T4 (SD-1679) on the right.

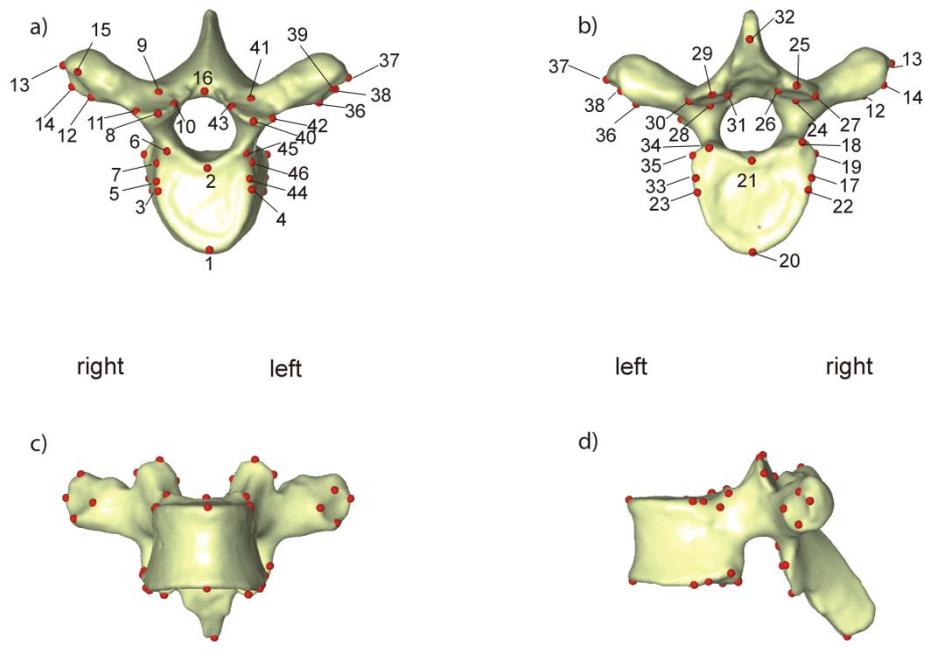


Figure 3. Thoracic vertebra and 3D landmarks. a) Cranial view, b) caudal view, c) frontal view, d) left lateral view.

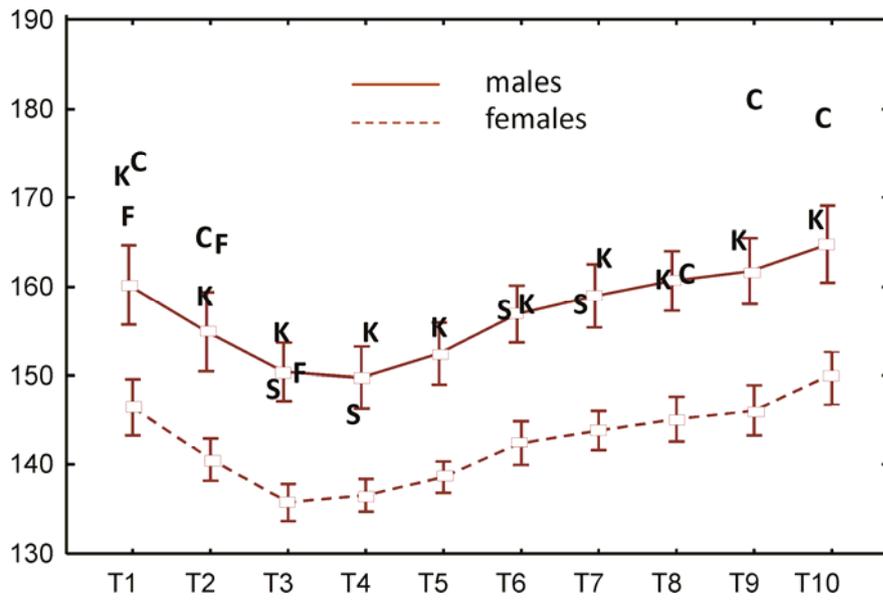


Figure 4. Centroid size comparisons. Means and 95% confidence intervals of modern human males (solid lines) and females (dashed lines) and Neandertals. K: Kebara 2; C: La-Chapelle-aux-Saints 1; F: La Ferrassie 1; S: El Sidrón (SD-1641 in comparison of T3, T4), SD-1619, in comparison of T6, T7).

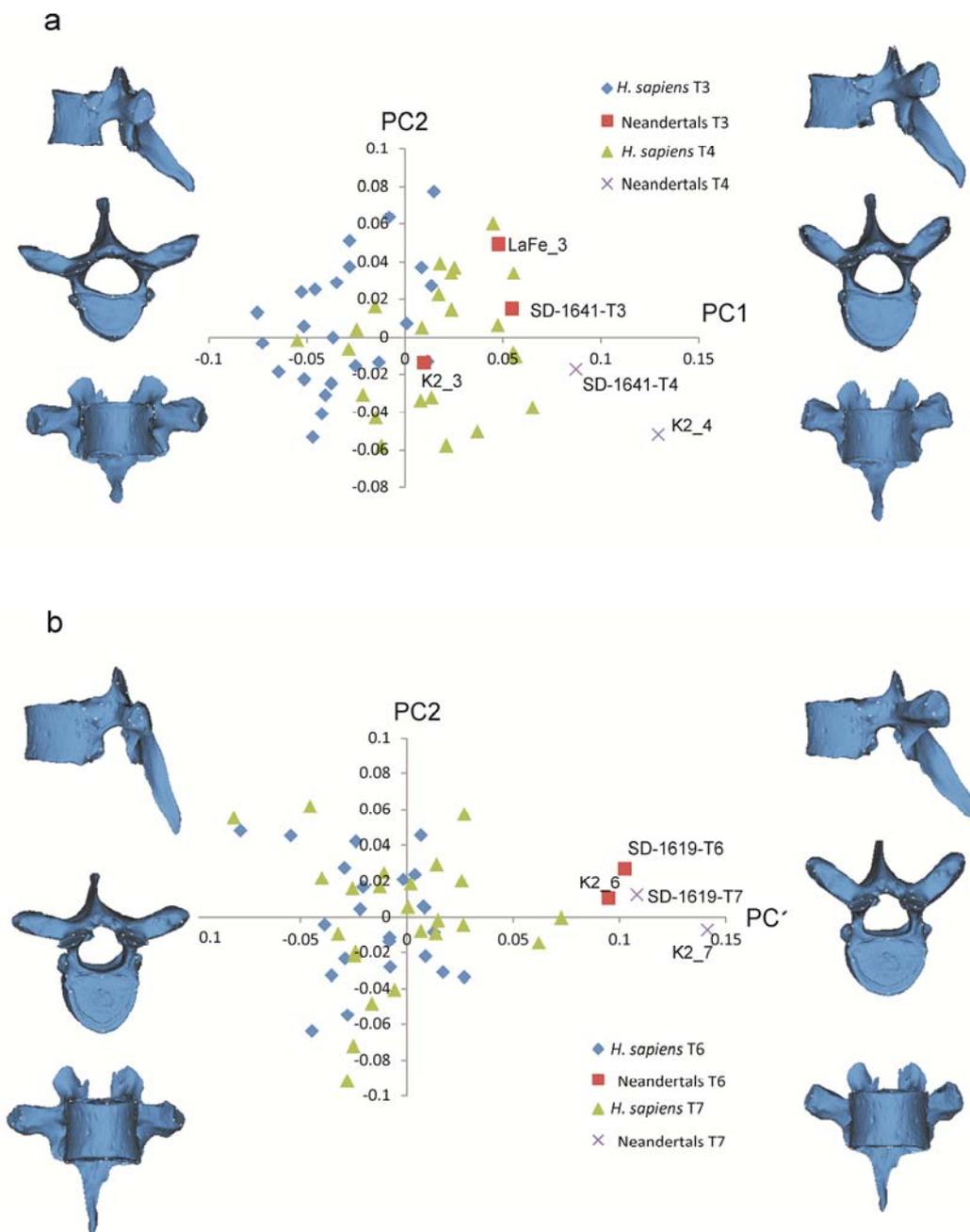


Figure 5. Principal components analyses of El Sidrón reconstructions. **a)** Comparisons of SD-1641-T3 and SD-1641-T4. Scatterplot of PC1 (19.9% total variance) and PC2 (12.7% total variance) illustrates shape distributions of T3 and T4 along PC1 and relations to other Neandertal vertebrae and *H. sapiens*. LaFe_3 (T3 of La Ferrassie 1; K2_3: T3 of Kebara 2; K2_4: T4 of Kebara 2). Note that the Neandertal vertebrae belonging to level T3 fall within the human T4 range and the Neandertal T4 vertebrae fall outside the human T4 range. 3D models show associated shapes. **b)** Comparisons of El Sidrón SD-1619-T6 and SD-1619-T7. Scatterplot of PC1 (21.7% total variance) and

PC2 (12.5% total variance) illustrates shape distributions of T6 and T7 along PC1 and relations to other Neandertals and *H. sapiens*. K2_6: T6 of Kebara 2; K2_7: T7 of Kebara 2). There is no statistical signal of shape variation related to serial position in these PCs. The Neandertals fall outside the modern human ranges of T6 and T7 which overlap to a great extent. 3D models show shapes associated to PC1. The scale factor of 3D warps in both PCA visualizations is the magnitude of the shape change as a Procrustes distance corresponding to Procrustes distances of -0.1 and +0.1 along PC1.

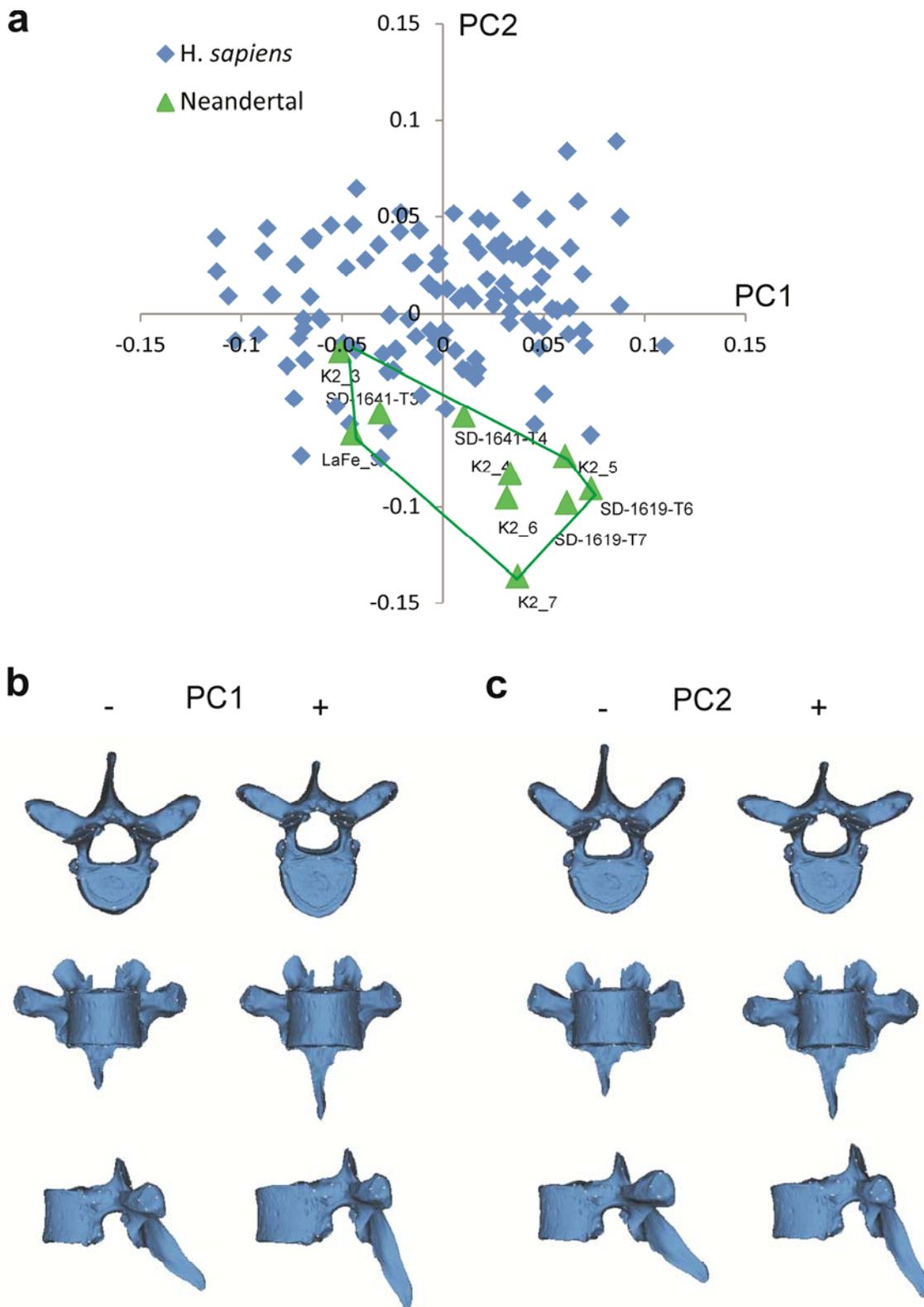


Figure 6. Principal components analysis of the thoracic spine between levels T3-T7. Scatterplot (Fig. 6a) of PC1 (24.1% total variance) and PC2 (14.7% total variance) illustrates diverging trajectories of serial shape change in modern humans and Neandertals. PC1 carries a strong serial signal (indicated by regression analysis, see

also Supplementary Figure S1). PC2 shows interspecific trends that increase towards positive PC1 scores. Shape changes associated to PC1 (Fig. 6b) and PC2 (Fig. 6c) are depicted below. Serial shape changes along PC1 include increase in vertebral body length, an increasingly caudally orientated the spinous processes and transverse processes that become slightly shorter, slightly more dorsally oriented and cranially oriented transverse costal facets. Interspecific shape changes along PC2 include transverse processes that are markedly more dorsally and cranially oriented, with more cranially facing and slightly larger transverse costal facets, slightly less caudally oriented spinous processes and relatively shorter vertebral bodies with very slightly decreased central body height towards negative PC2 scores, a range that is occupied by Neandertals.

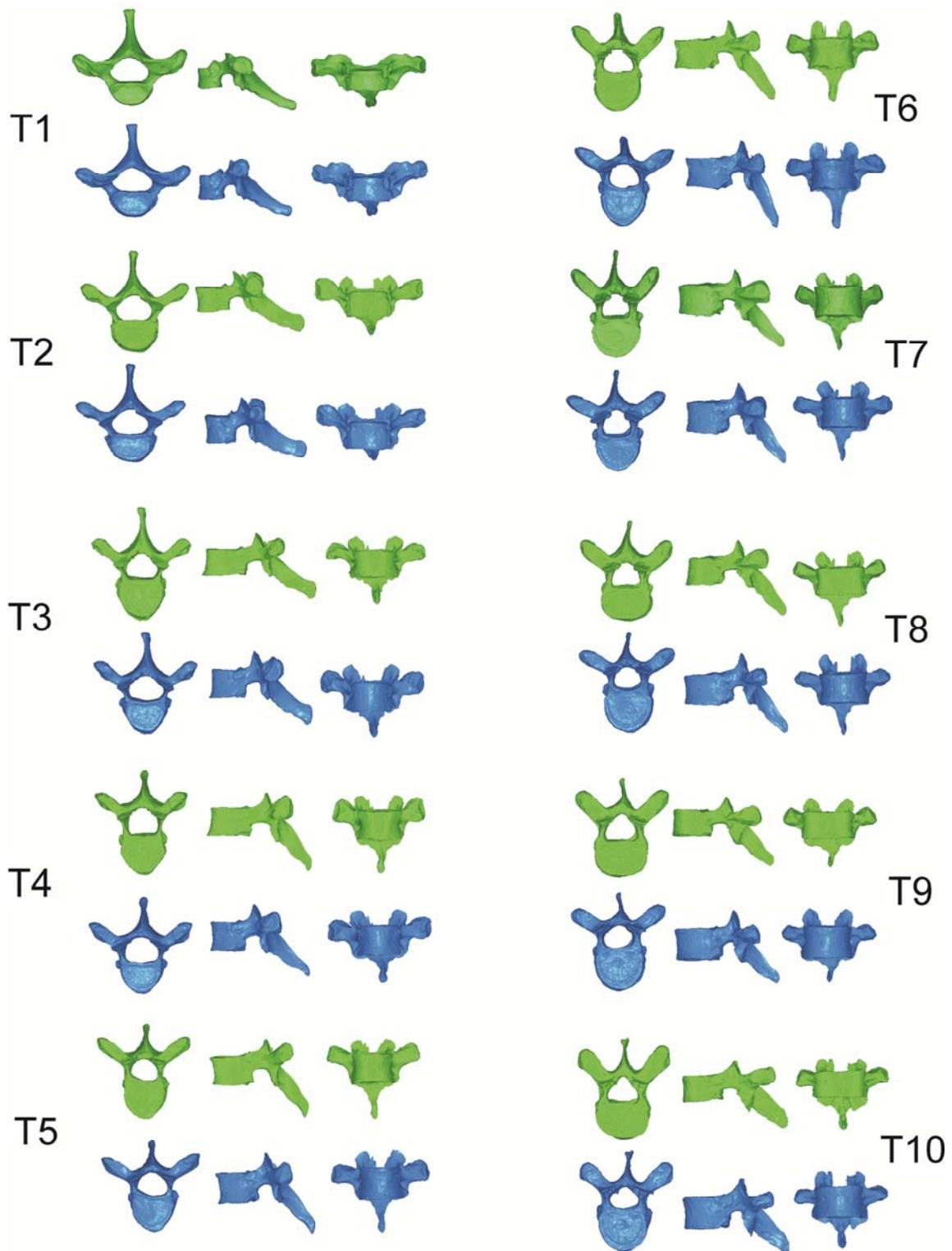


Figure 7. Mean shape differences at each vertebral level between the modern human males and the Neandertal samples in standardized anatomical views. Note that the Neandertals sample varies among the different levels. At T5 Neandertals sample is from one individual only (Kebara 2), while between levels T1 and T3 mean shapes are

composed of three individuals, and between T6 and T10 of two (see also Materials and Methods).