Abstract. Permutation products and their various “fat diagonal” subspaces are studied from the topological and geometric point of view. We describe in detail the stabilizer and orbit stratifications related to the permutation action, producing a sharp upper bound for its depth and then paying particular attention to the geometry of the diagonal stratum. We write down an expression for the fundamental group of any permutation product of a connected space $X$ having the homotopy type of a CW complex in terms of $\pi_1(X)$ and $H_1(X; \mathbb{Z})$. We then prove that the fundamental group of the configuration space of $n$-points on $X$, of which multiplicities do not exceed $n/2$, coincides with $H_1(X; \mathbb{Z})$. Further results consist in giving conditions for when fat diagonal subspaces of manifolds can be manifolds again. Various examples and homological calculations are included.