We have investigated pressure induced structural changes of the rare-earth gallides \( \text{REGa}_2 \) (RE = Tb, Er, Ho) by means of x-ray powder diffraction using diamond anvil cell techniques. At ambient pressure \( \text{ErGa}_2 \) and \( \text{HoGa}_2 \) crystallize in the \( \text{AlB}_2 \)-type structure (\( \text{P6}_3\text{mmm} \)) consisting of six-membered Gallium layers forming hexagonal prisms centered by the RE atoms. A common feature of all \( \text{AlB}_2 \)-type compounds \( \text{REGa}_2 \) is an \( c/a \) ratio close to the ideal value of 1.07 for touching spheres. \( \text{ErGa}_2 \) undergoes a discontinuous transition to the \( \text{KHg}_2 \)-type structure (\( \text{Imma} \)) near 6 GPa. The interlayer Ga-Ga distance 2.788(5) Å (7.6 GPa) is close to the Ga-Ga distance in \( \text{TmGa}_2 \) which crystallizes in this structure type at ambient pressure. In the \( \text{KHg}_2 \)-type the Ga atoms form six-membered rings in chair conformation. The layers are connected by Ga-Ga bonds along the crystallographic c-axis thus forming a three dimensional covalent gallium network of distorted tetrahedra with the RE atoms occupying the voids. \( \text{ErGa}_2 \) and \( \text{TmGa}_2 \) transform into the \( \text{KHg}_2 \)-type structure at 24 and 22 GPa respectively. The \( \text{UHg}_2 \)-type is a branch of the \( \text{AlB}_2 \)-type having a \( c/a \) ratio of 0.59 and 0.87. The pressure induced change of hybridization in these compounds results in a transition of a three-dimensional covalent network (\( \text{KHg}_2 \)) to a layered gallium partial structure. The breaking of the interlayer Ga-Ga bonds was observed in other perovskite compounds displaying the same space group (\( \text{Pbnm} \)) and \( \text{P6}_3\text{mmm} \) at continuous and spallation high pressure conditions. The pressure induced electronic transition plays an important role in stabilizing such low-symmetry structures. As examples we will review the changes in the crystal structures of \( \text{Cs} \) and \( \text{Ba} \) under high pressure. Other unique crystal structures will also be presented including the singularity in the hcp structure recently found for \( \text{Zn} \) and \( \text{Cd} \).