**Figure S1.** Observed (crosses), calculated (full line) and difference (bottom) RT TOF NPD normalized patterns for La$_{9.33}$(Si$_{0.5}$Ge$_{0.5}$O$_4$)$_6$O$_2$
**Figure S2.** Observed (crosses), calculated (full line) and difference (bottom) RT TOF NPD normalized patterns for La₆Sr₂(GeO₄)₆O₂.
Figure S3. Observed (crosses), calculated (full line) and difference (bottom) RT LXRPD patterns for La$_{9.33}$(SiO$_4$)$_6$O$_2$. 
Figure S4. Observed (crosses), calculated (full line) and difference (bottom) RT LXRPD patterns for La$_{23}$(Si$_{0.5}$Ge$_{0.5}$O$_4$)$_6$O$_2$. 
**Figure S5.** Observed (crosses), calculated (full line) and difference (bottom) RT LXRPD patterns for La$_8$Sr$_2$(SiO$_4$)$_6$O$_2$. 
Figure S6. Observed (crosses), calculated (full line) and difference (bottom) RT LXRPD patterns for $\text{La}_8\text{Sr}_2(\text{GeO}_4)_6\text{O}_2$