Table S1. Chemical compositions (wt.% and mol. ratio) of $MgSiO_3$ and $CaSiO_3$ glasses

Wt. %	SiO_2	MgO	CaO	Total
$MgSiO_3$	62.20(±0.28)	38.36(±0.19)		100.56(±0.30)
$CaSiO_3$	50.88(±0.21)		47.39(±0.24)	98.27(±0.43)

Mol. ratio	Si	Mg	Ca	O
$MgSiO_3$	1.027(±0.005)	0.945(±0.005)		3.000(±0.010)
$CaSiO_3$	1.001(±0.005)		0.999(±0.005)	3.000(±0.015)

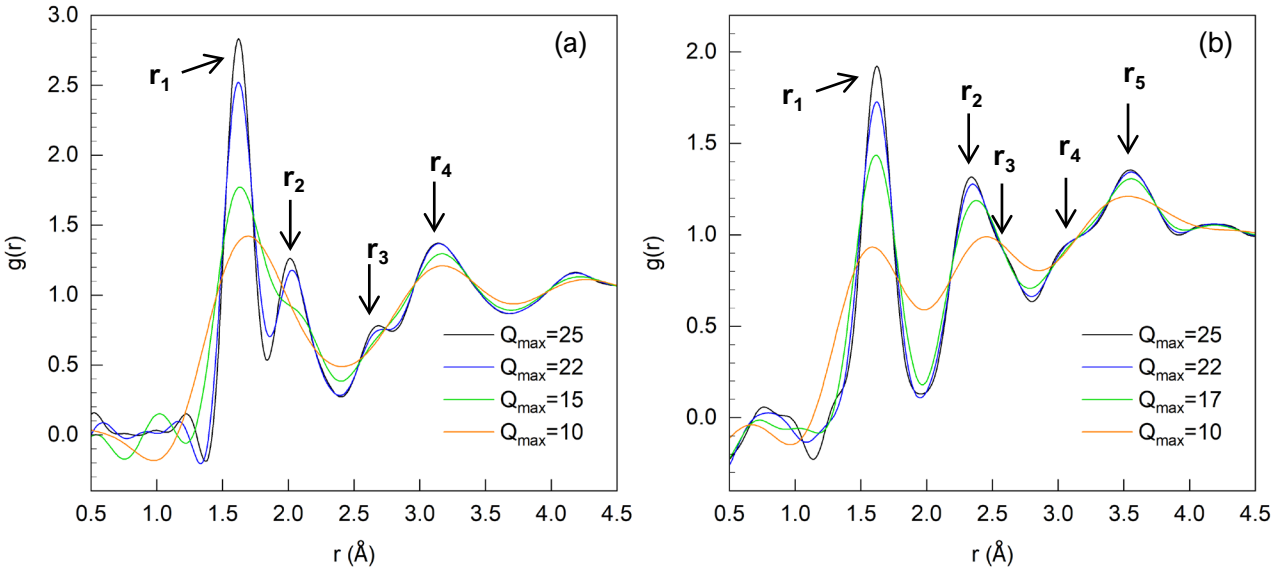

Figure S1. Comparison of $g(r)$s of $MgSiO_3$ (**a**) and $CaSiO_3$ (**b**) glasses at ambient pressure with different Q range.

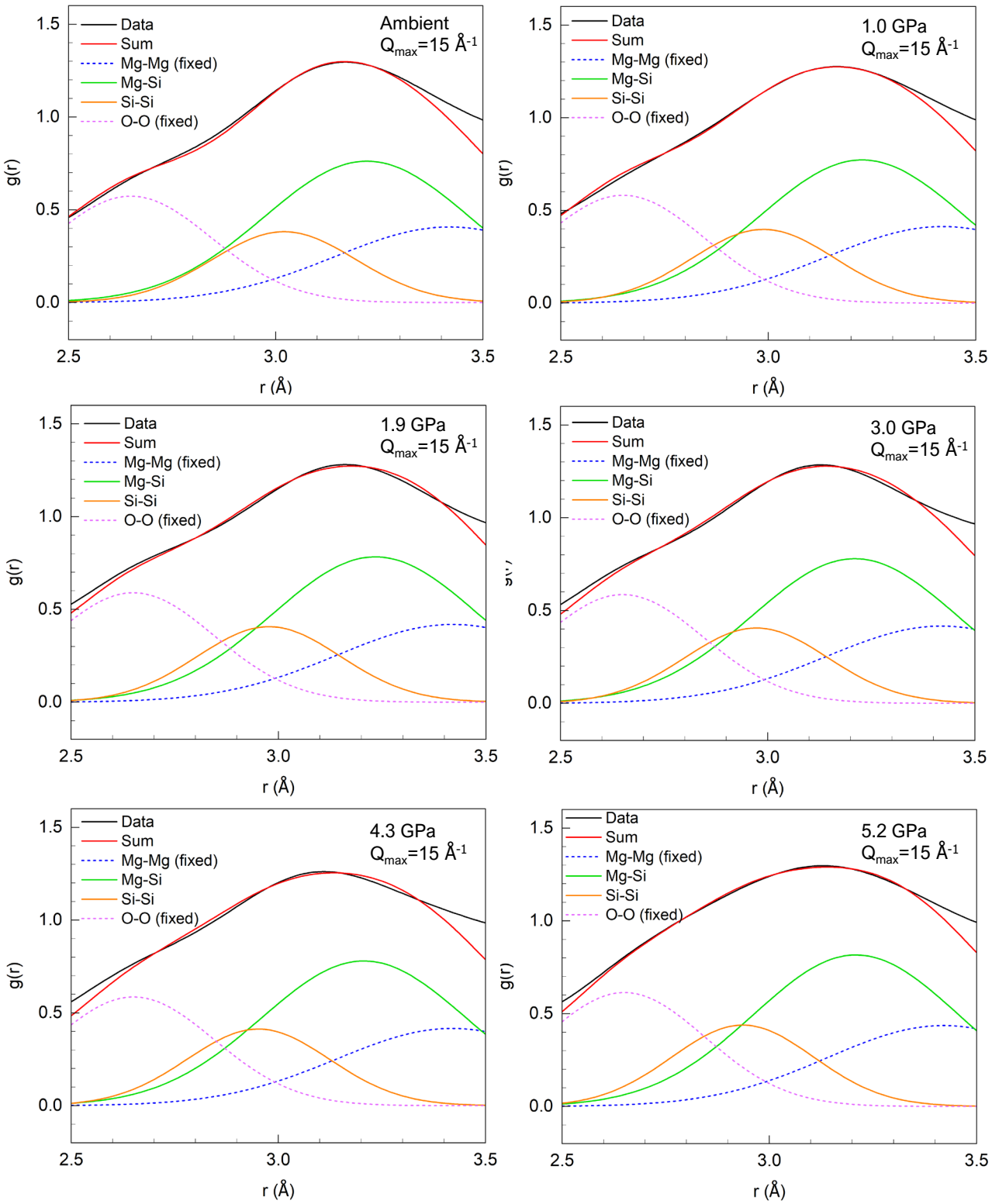

Figure S2. Results of peak-fitting for r_4 peak of $MgSiO_3$ glass from ambient to 5.2 GPa.

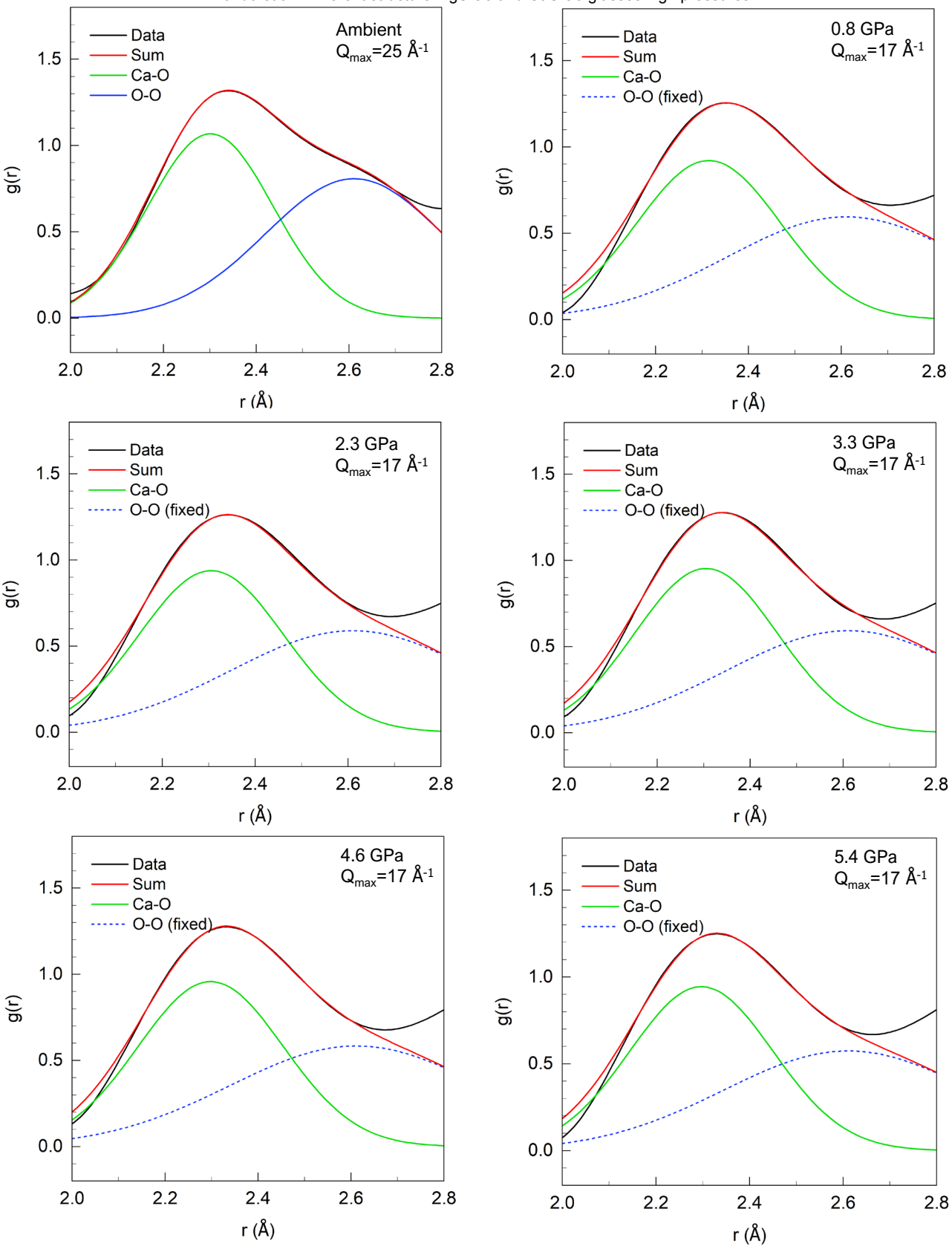

Figure S3. Results of peak-fitting for r_2 and r_3 peaks of $CaSiO_3$ glass from ambient to 5.4 GPa.