Supplementary Information

for the manuscript "A revisit to phase transition behavior of K-feldspar at high-pressure and high-temperature: Implications on metastable K-feldspar in cold subduction" by He and Li

Supplementary

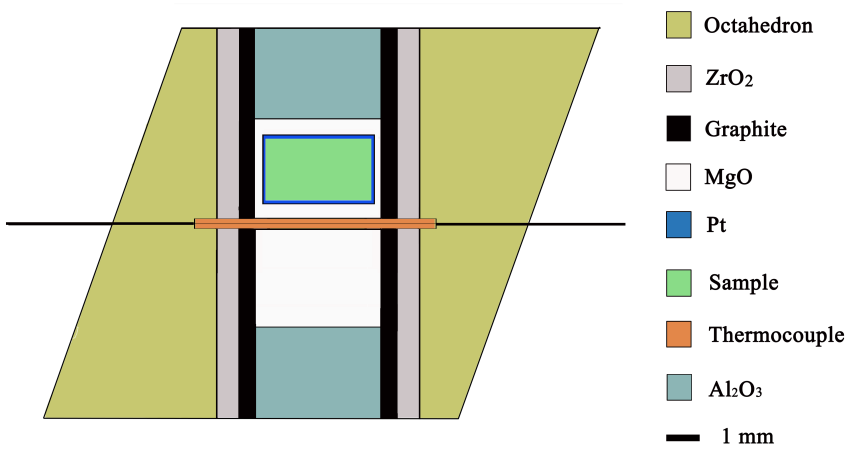


Figure S1. Schematic cross-section of cell assembly for quenching experiments.

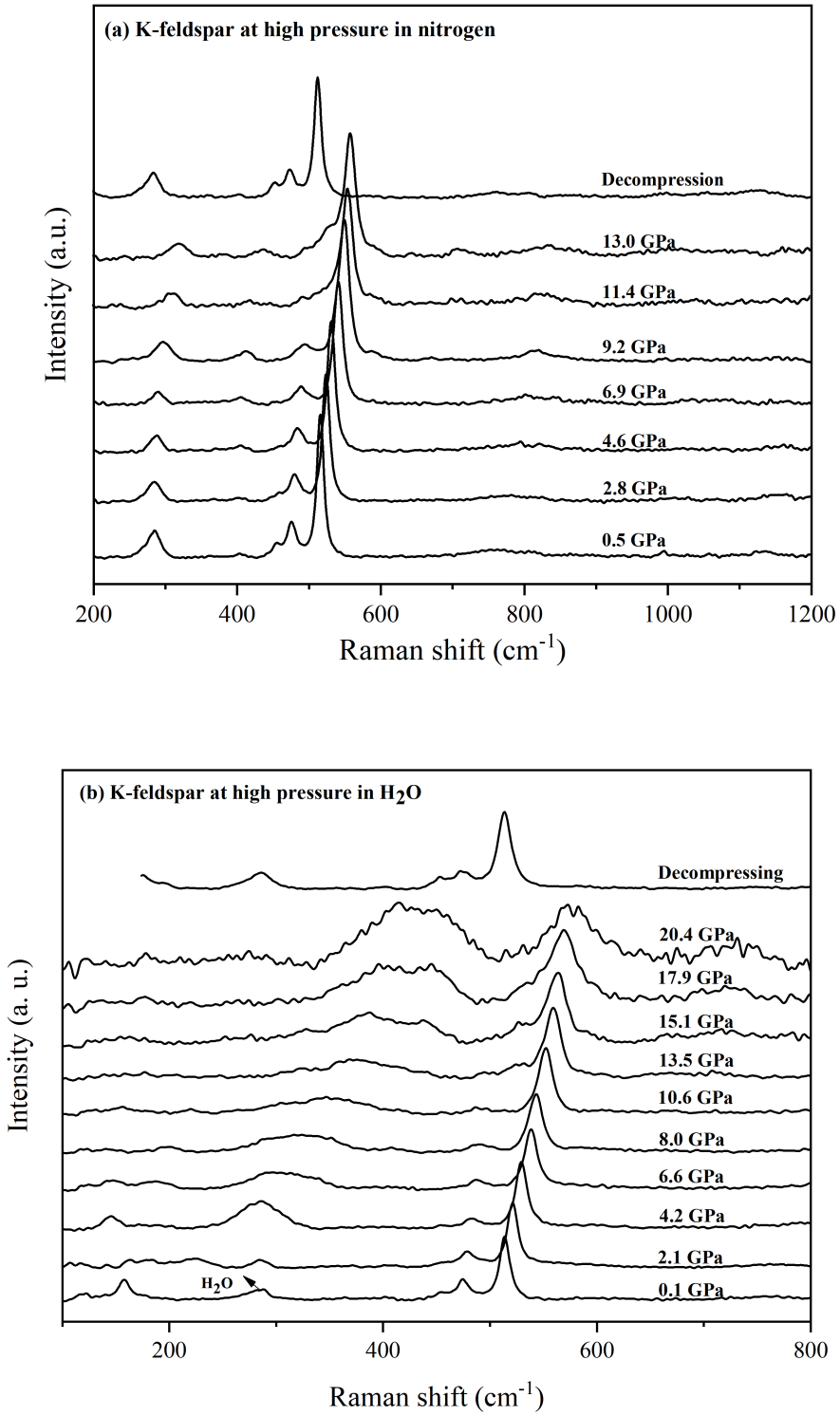


Figure S2. Representative Raman spectra of K-feldspar measured with increasing pressure in nitrogen **(a)** and H_2O **(b)**. The decompression spectra as shown in (a) is nearly same with the spectrum at ambient condition, which reveals the phase transition of K-feldspar into metastable

phase under high was reversible. The spectra only displayed in the frequency range of 200-1200 cm^{-1} because of the intense Raman bands at 100 and 200 cm^{-1} of the pressure medium nitrogen. Another decompression spectra as shown in (b) is also similar with the spectrum at ambient condition, which indicates the reversibility of the not fully amorphization.

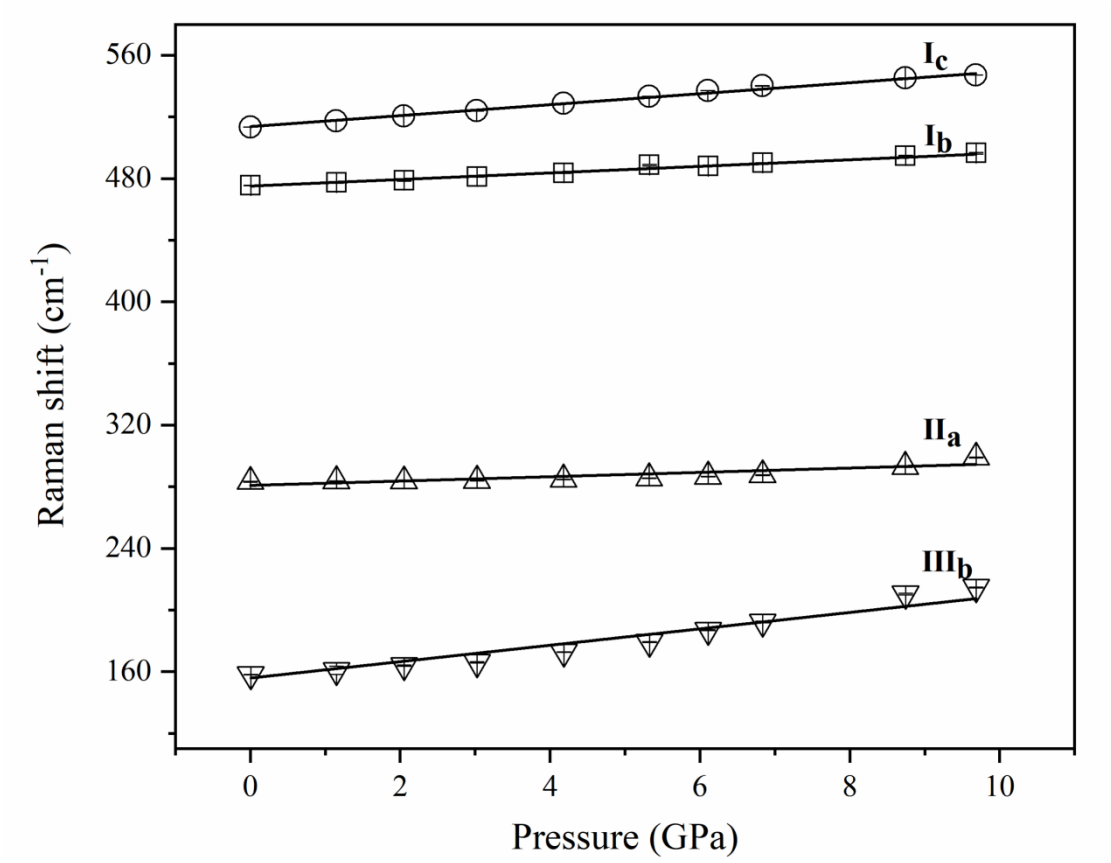
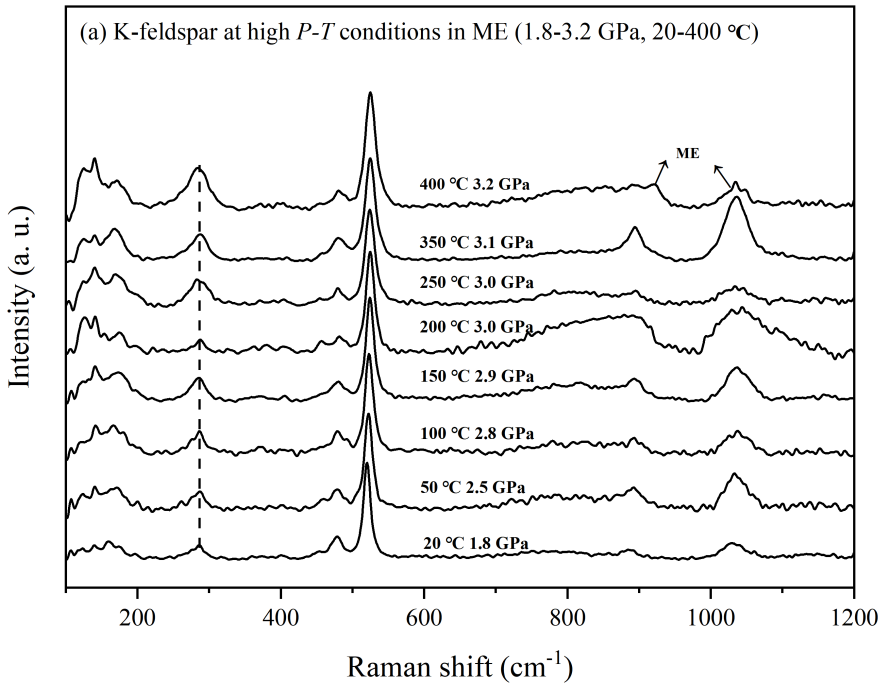
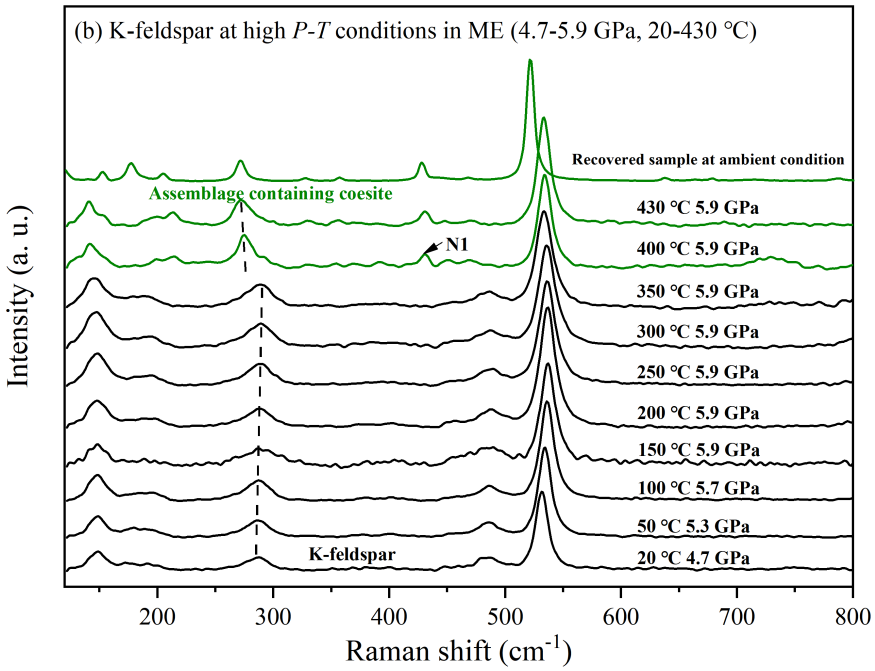
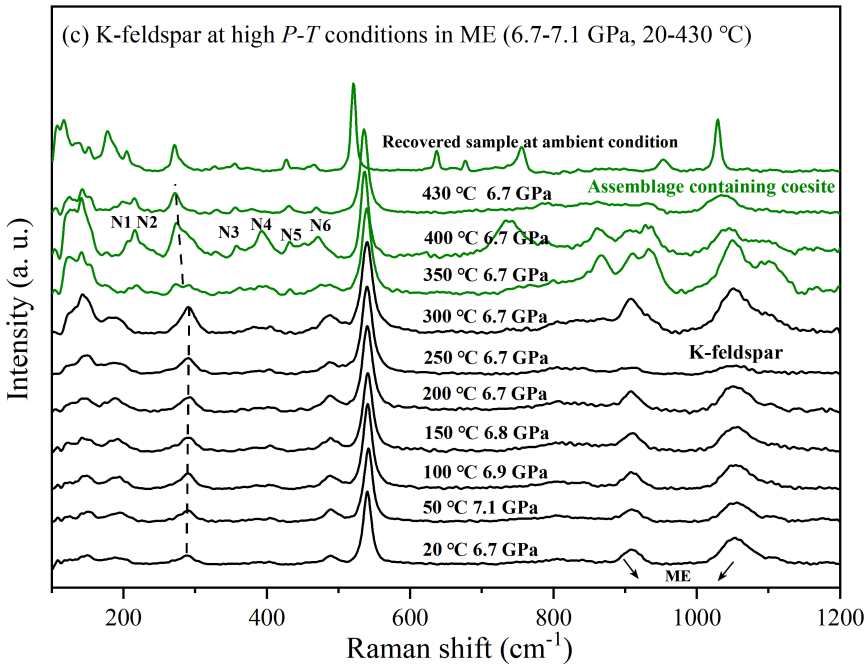
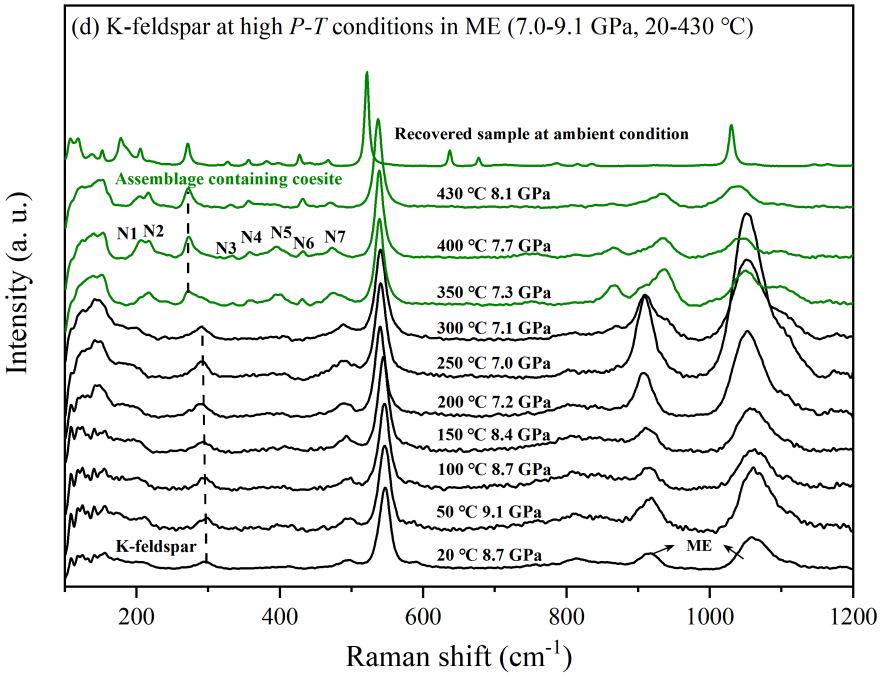


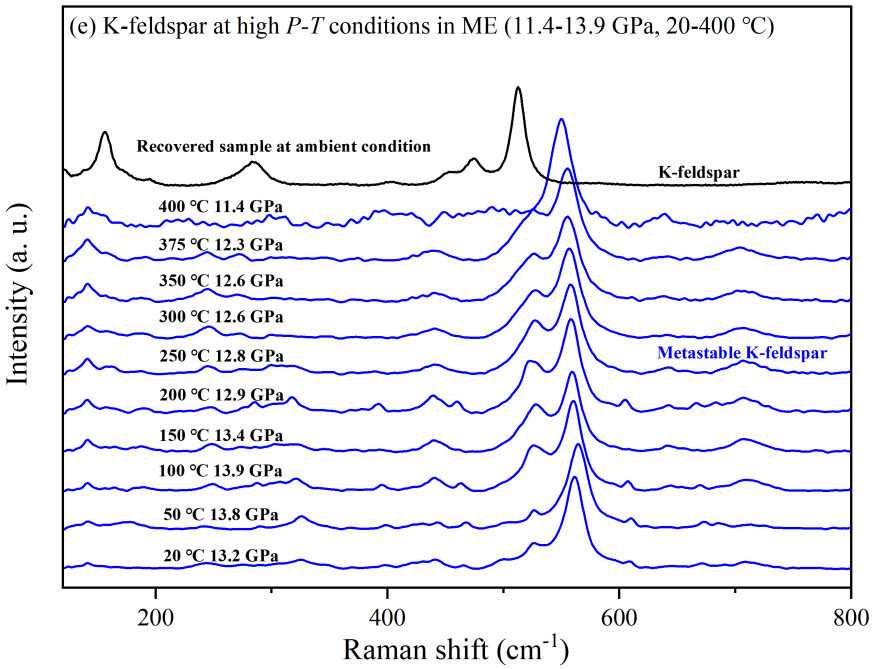
Figure S3. Pressure dependence of the Raman bands of K-feldspar at ambient temperature.

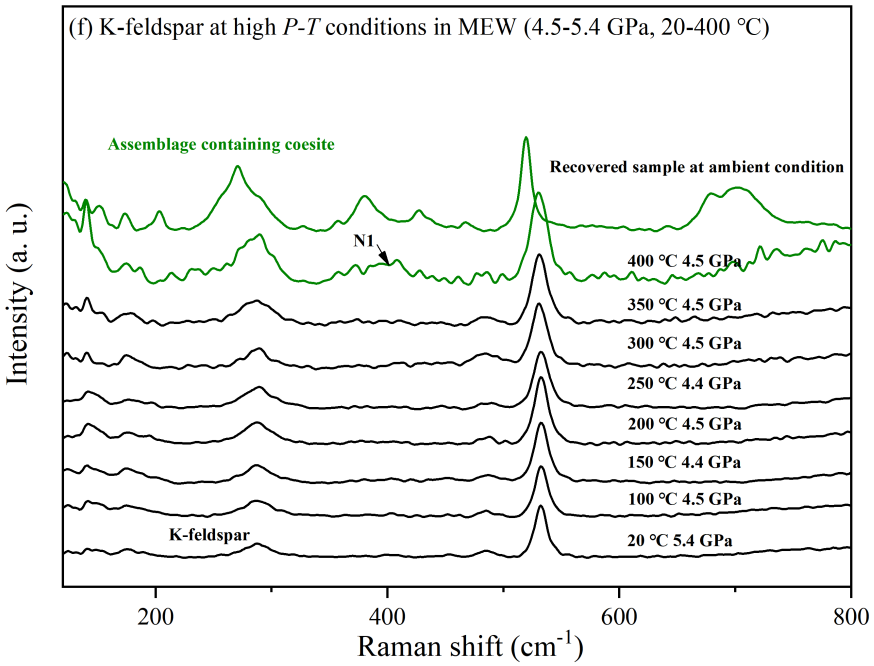

(a) K-feldspar at high *P-T* conditions in ME (1.8-3.2 GPa, 20-400 ℃)
ME
400 ℃ 3.2 GPa
350 ℃ 3.1 GPa
250 ℃ 3.0 GPa
200 ℃ 3.0 GPa
150 ℃ 2.9 GPa
100 ℃ 2.8 GPa
50 ℃ 2.5 GPa
20 ℃ 1.8 GPa
Intensity (a. u.)
200
400
600
800
1000
1200
Raman shift (cm-1)

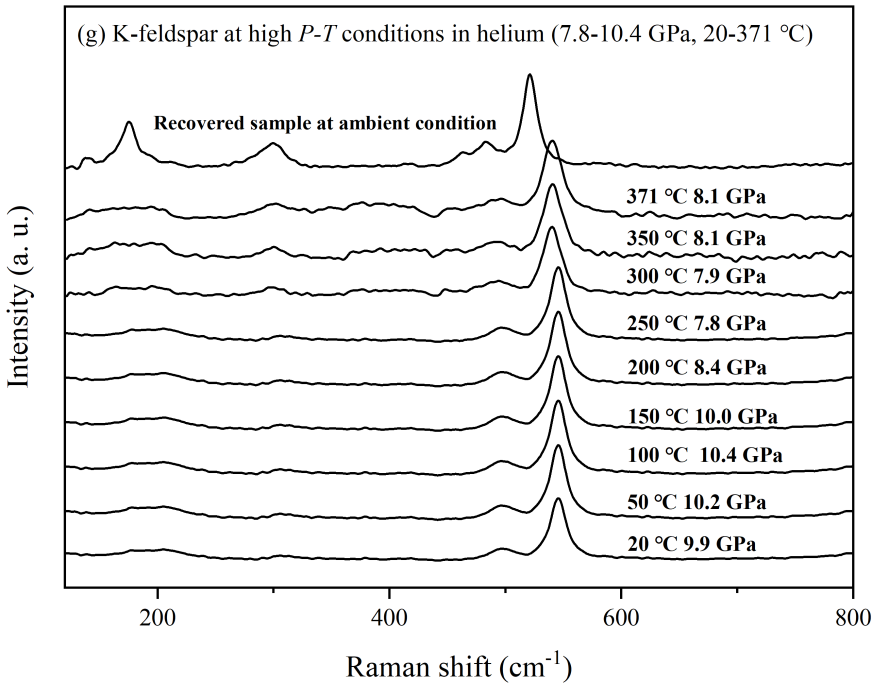

(b) K-feldspar at high *P-T* conditions in ME (4.7-5.9 GPa, 20-430 ℃)
Recovered sample at ambient condition
Assemblage containing coesite
430 ℃ 5.9 GPa
N1
400 ℃ 5.9 GPa
350 ℃ 5.9 GPa
300 ℃ 5.9 GPa
250 ℃ 5.9 GPa
200 ℃ 5.9 GPa
150 ℃ 5.9 GPa
100 ℃ 5.7 GPa
50 ℃ 5.3 GPa
K-feldspar
20 ℃ 4.7 GPa
Intensity (a. u.)
200
300
400
500
600
700
800
Raman shift (cm-1)

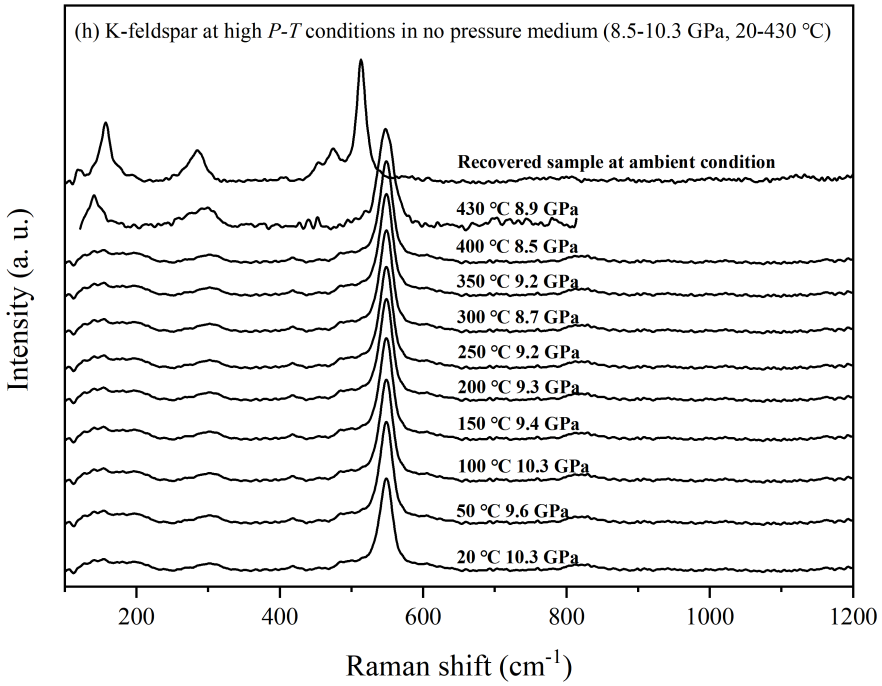

(c) K-feldspar at high *P-T* conditions in ME (6.7-7.1 GPa, 20-430 °C)
Recovered sample at ambient condition
430 °C 6.7 GPa
Assemblage containing coesite
400 °C 6.7 GPa
350 °C 6.7 GPa
300 °C 6.7 GPa
250 °C 6.7 GPa
200 °C 6.7 GPa
150 °C 6.8 GPa
100 °C 6.9 GPa
50 °C 7.1 GPa
20 °C 6.7 GPa
K-feldspar
ME
N1 N2
N3
N4
N5
N6
Intensity (a. u.)
200
400
600
800
1000
1200
Raman shift (cm-1)


(d) K-feldspar at high *P-T* conditions in ME (7.0-9.1 GPa, 20-430 °C)
Recovered sample at ambient condition
Assemblage containing coesite
430 °C 8.1 GPa
400 °C 7.7 GPa
350 °C 7.3 GPa
300 °C 7.1 GPa
250 °C 7.0 GPa
200 °C 7.2 GPa
150 °C 8.4 GPa
100 °C 8.7 GPa
50 °C 9.1 GPa
20 °C 8.7 GPa
K-feldspar
ME
N1 N2
N3
N4
N5
N6
N7
Intensity (a. u.)
200
400
600
800
1000
1200
Raman shift (cm-1)


(e) K-feldspar at high *P-T* conditions in ME (11.4-13.9 GPa, 20-400 °C)
Recovered sample at ambient condition
K-feldspar
400 °C 11.4 GPa
375 °C 12.3 GPa
350 °C 12.6 GPa
300 °C 12.6 GPa
250 °C 12.8 GPa
200 °C 12.9 GPa
150 °C 13.4 GPa
100 °C 13.9 GPa
50 °C 13.8 GPa
20 °C 13.2 GPa
Metastable K-feldspar
Intensity (a. u.)
200
400
600
800
Raman shift (cm-1)


(f) K-feldspar at high *P-T* conditions in MEW (4.5-5.4 GPa, 20-400 °C)
Assemblage containing coesite
Recovered sample at ambient condition
N1
400 °C 4.5 GPa
350 °C 4.5 GPa
300 °C 4.5 GPa
250 °C 4.4 GPa
200 °C 4.5 GPa
150 °C 4.4 GPa
100 °C 4.5 GPa
K-feldspar
20 °C 5.4 GPa
Intensity (a. u.)
200
400
600
800
Raman shift (cm-1)


(g) K-feldspar at high *P-T* conditions in helium (7.8-10.4 GPa, 20-371 °C)
Recovered sample at ambient condition
371 °C 8.1 GPa
350 °C 8.1 GPa
300 °C 7.9 GPa
250 °C 7.8 GPa
200 °C 8.4 GPa
150 °C 10.0 GPa
100 °C 10.4 GPa
50 °C 10.2 GPa
20 °C 9.9 GPa
Intensity (a. u.)
200
400
600
800
Raman shift (cm-1)


(h) K-feldspar at high *P-T* conditions in no pressure medium (8.5-10.3 GPa, 20-430 °C)
Recovered sample at ambient condition
430 °C 8.9 GPa
400 °C 8.5 GPa
350 °C 9.2 GPa
300 °C 8.7 GPa
250 °C 9.2 GPa
200 °C 9.3 GPa
150 °C 9.4 GPa
100 °C 10.3 GPa
50 °C 9.6 GPa
20 °C 10.3 GPa
Intensity (a. u.)
200
400
600
800
1000
1200
Raman shift (cm-1)

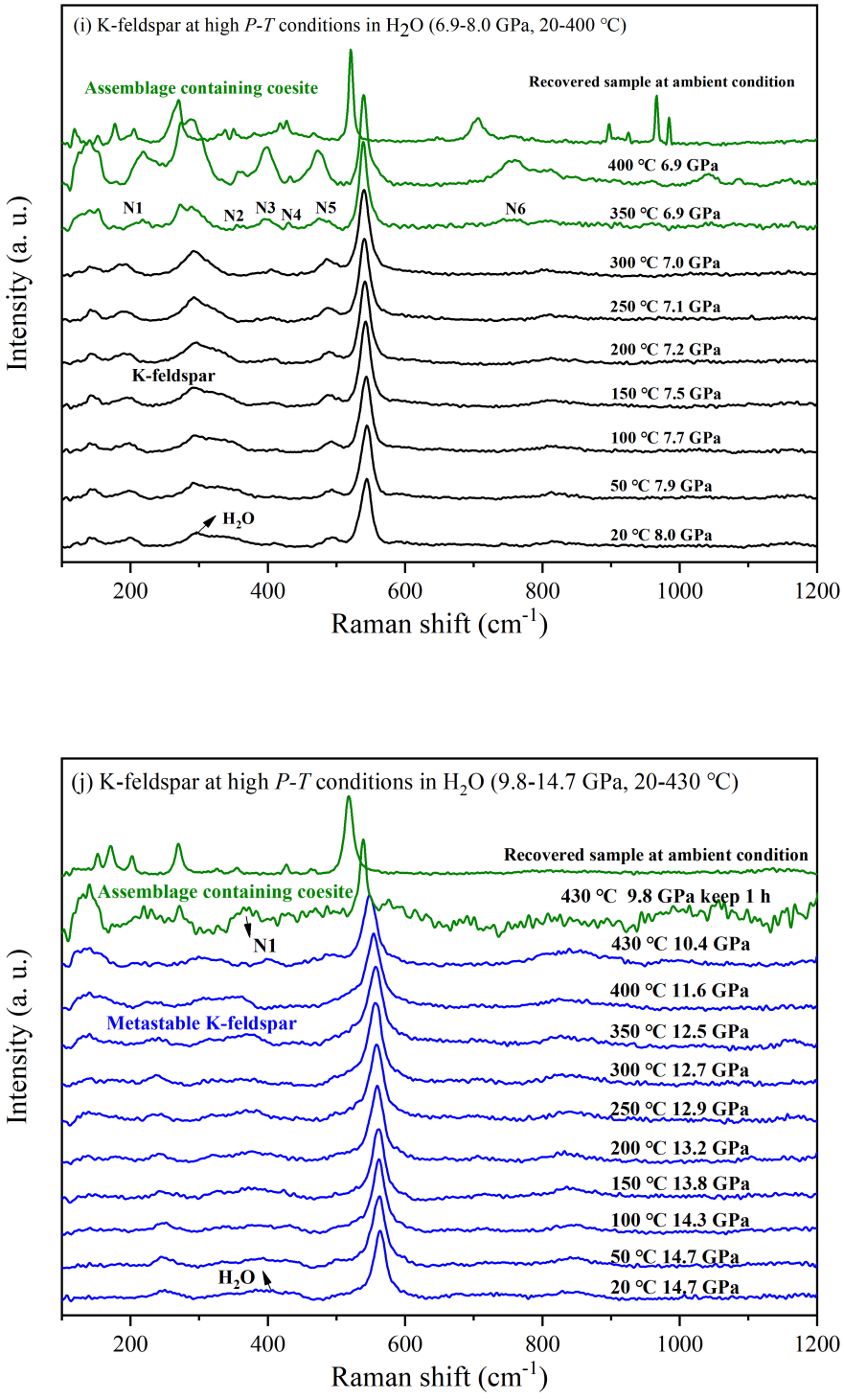


Figure S4. Raman spectra of the K-feldspar up to ~14.7 GPa, 430 °C within various PTMs. Raman spectra of K-feldspar at high *P-T* in 4:1 ME mixture, 16:3:1 MEW mixture, helium, no PTM, and H_2O, respectively **(a)-(e), (f), (g), (h), (i)-(j)**. N(1-7) are the new bands that may correspond to the assemblage containing coesite revealed in Raman spectra of the recovered

samples.

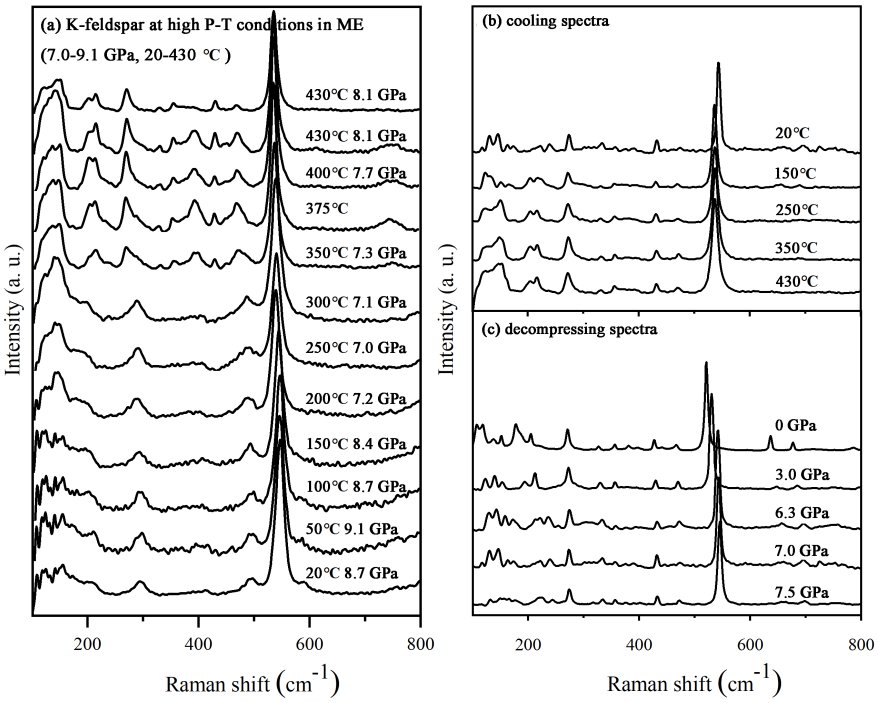
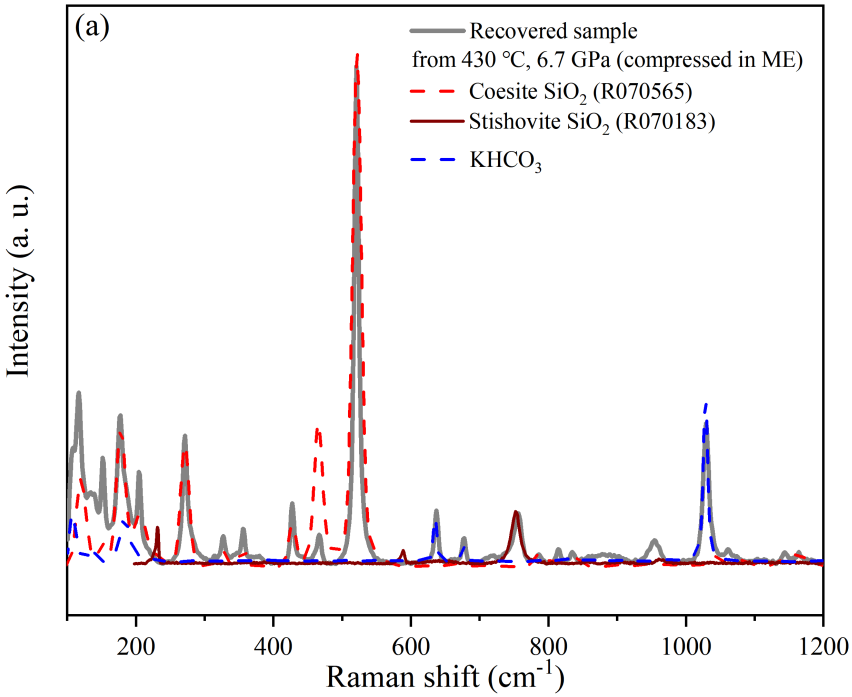
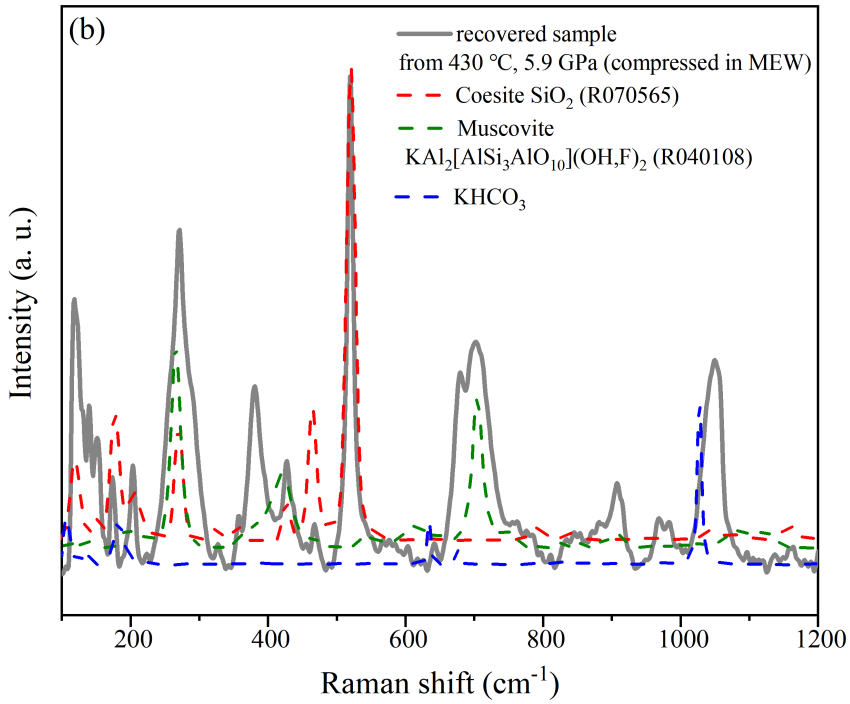


Figure S5. Raman spectra of K-feldspar during compressing **(a)**, cooling **(b)**, and decompressing **(c)** process.


(a)
Recovered sample
from 430 °C, 6.7 GPa (compressed in ME)
Coesite SiO2 (R070565)
Stishovite SiO2 (R070183)
KHCO3
Intensity (a. u.)
200
400
600
800
1000
1200
Raman shift (cm-1)


(b)
recovered sample
from 430 °C, 5.9 GPa (compressed in MEW)
Coesite SiO2 (R070565)
Muscovite
KAl2[AlSi3AlO10](OH,F)2 (R040108)
KHCO3
Intensity (a. u.)
200
400
600
800
1000
1200
Raman shift (cm-1)

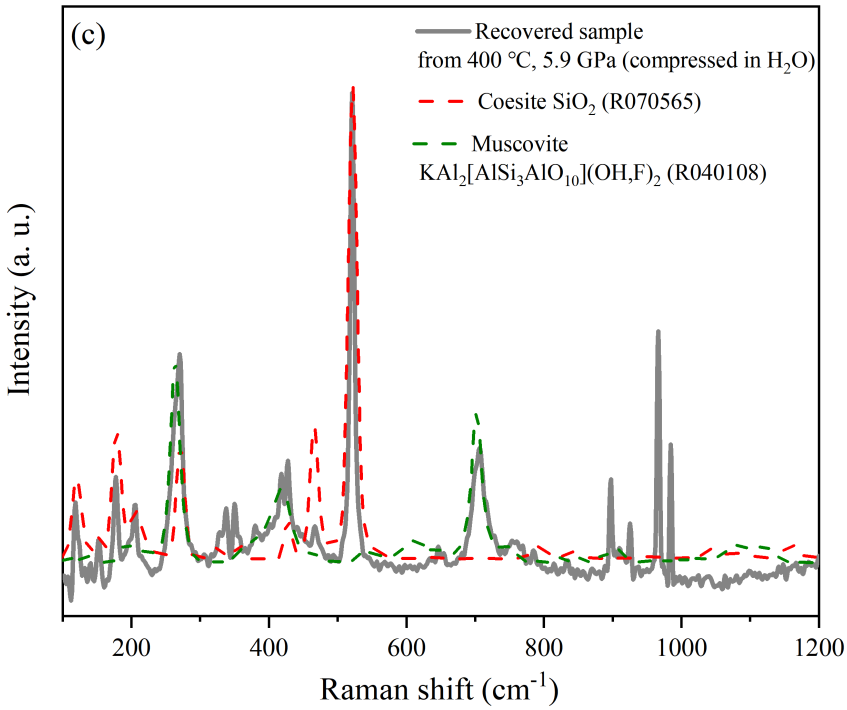


Figure S6. Determination of Raman spectra of recovered sample from 430 ℃, 6.7 GPa (compressed in ME) **(a),** 430 ℃, 5.9 GPa (compressed in MEW) **(b) and** 400 ℃, 5.9 GPa (compressed in H_2O) **(c)** by comparing with standard Raman spectrum of possible substances. The standard Raman spectra of $KHCO_3$ was obtained by measuring its high purity powder (99.99%, Alfa Aesar), and the others were download from RRUFF database (https ://rruff .info). The recovered sample from 430 ℃, 6.7 GPa (ME) contain coesite, stishovite, and $KHCO_3$. The recovered sample from 430 ℃, 5.9 GPa (MEW) contain coesite, muscovite, and $KHCO_3$. The recovered sample from 400 ℃, 5.9 GPa (H_2O) contain coesite and muscovite. The possible substances corresponding to the sharp peaks at 900-1100 cm^{-1} has not been determined yet, as shown in Figures (b-c).

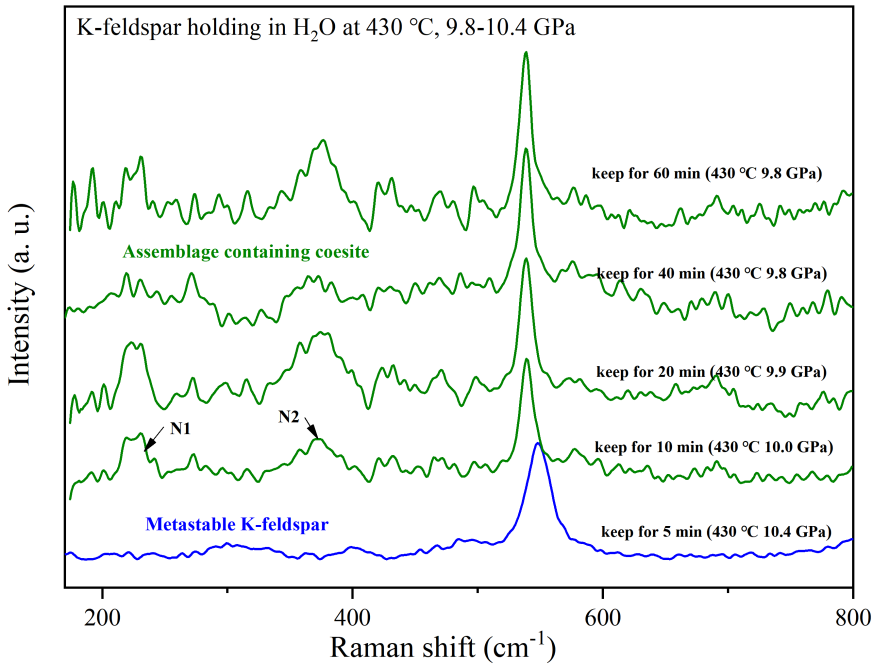


Figure S7. Raman spectra of K-feldspar holding at 430 ℃ in H_2O for 1h.