A chemical threshold controls nanocrystallization and degassing behaviour in basalt magmas

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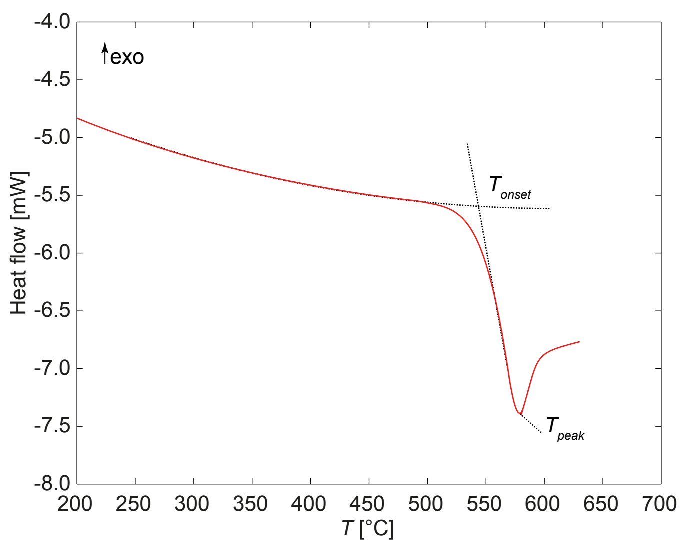
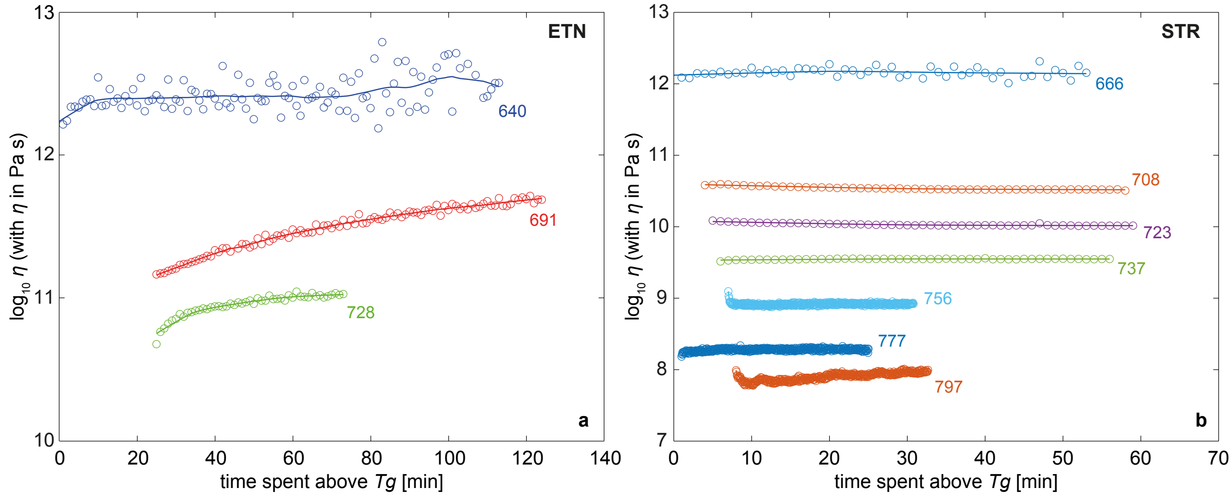
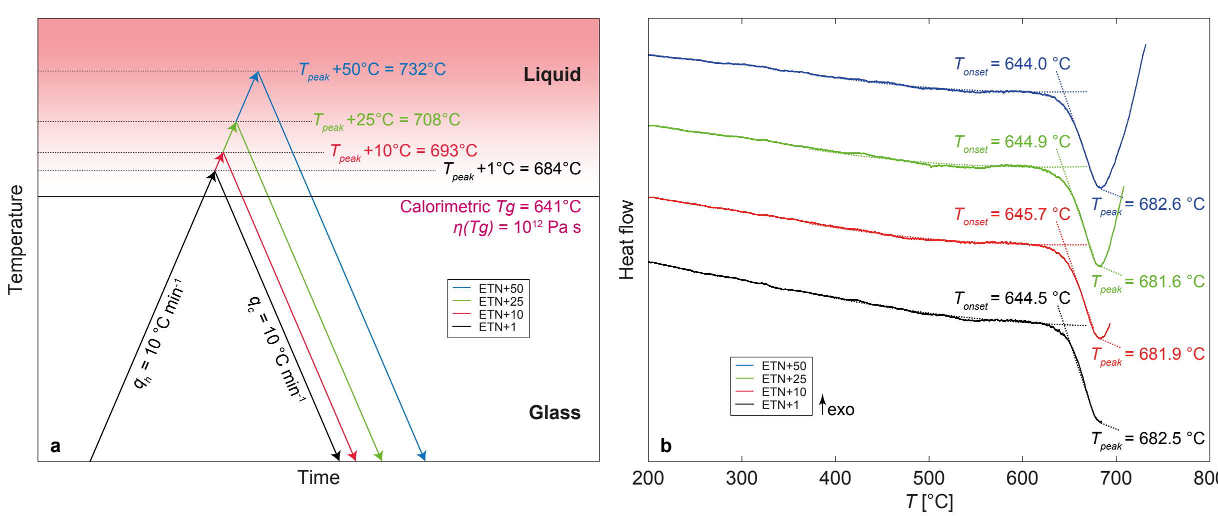


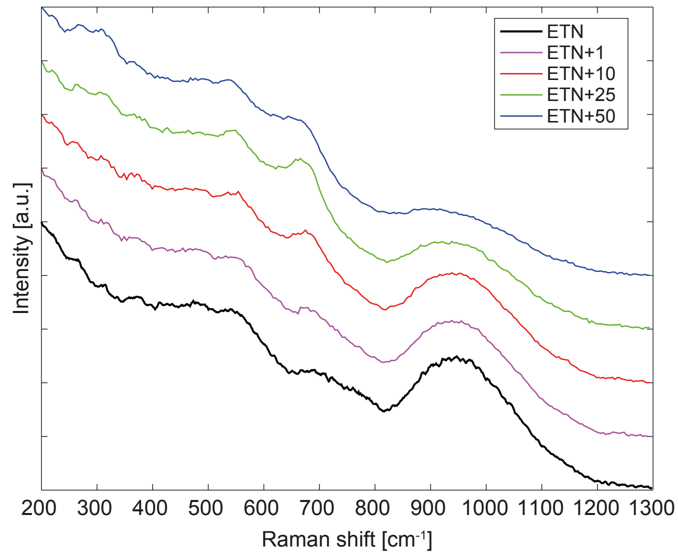
Supplementary Figure 1. Measured heat flow as a function of temperature for DGG-1[1] standard glass at a heating rate of 10 K min^{-1}, following a cooling rate of 10 K min^{-1} through the glass transition region. The characteristic glass transition temperatures used in this study (T_{onset} and T_{peak}) are shown in the figure.



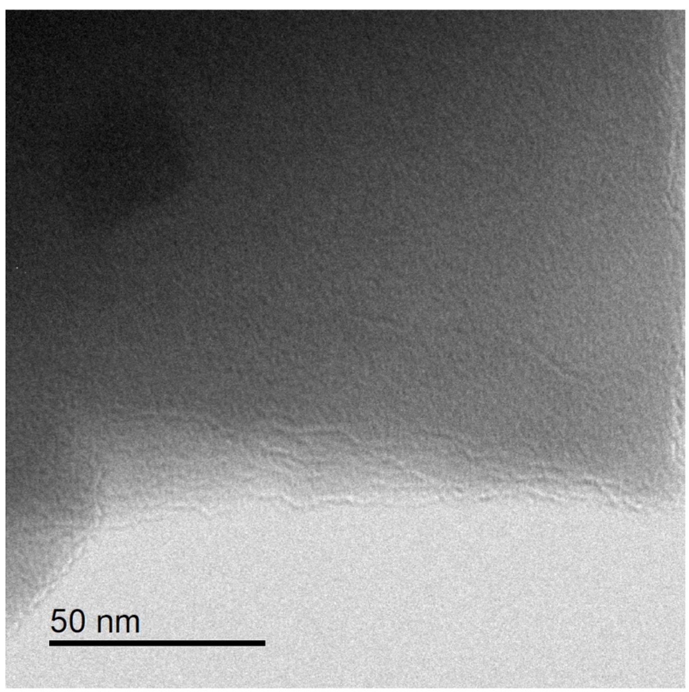
Supplementary Figure 2. Viscosity measured over time by micropenetration viscometry (MP) for (a) ETN and (b) STR. Labels represent the temperature of the viscosity measurement. Lines represent smoothing of experimental data.



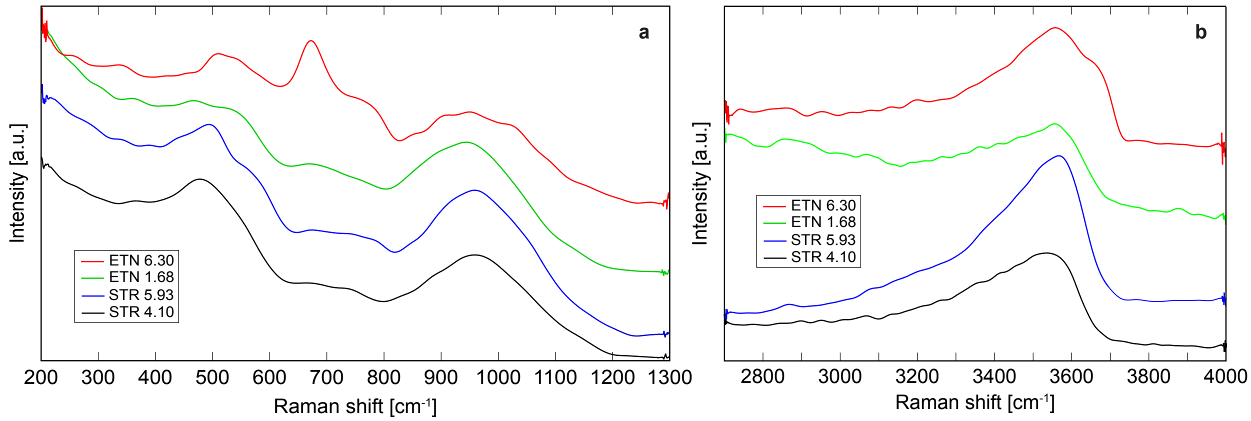
Supplementary Figure 3. Illustration of the controlled heat treatments (a) performed on ETN using a DSC to study its low-temperature phase separation and crystallization behaviour (b). Recovered samples were analysed by Raman spectroscopy and transmission electron microscopy.



Supplementary Figure 4. Normalized Raman spectra of ETN samples before (thick curve) and after controlled heat treatments as illustrated in Supplementary Fig. 3.



Supplementary Figure 5. High resolution TEM micrograph obtained from Mt. Etna starting glass (ETN), confirming the absence of nanoscale heterogeneities within instrumental resolution.



Supplementary Figure 6. Normalized Raman spectra of ETN and STR hydrous samples after high-temperature and -pressure experiments. Samples show (a) different nanolites contribution at ~300 and ~660 cm^{-1}, and (b) different water content at ~3650 cm^{-1}.

Oxide	[a]ETN (wt %)	[a]STR (wt %)
SiO_2	48.92 (0.21)	51.06 (0.39)
TiO_2	1.67 (0.05)	0.91 (0.10)
Al_2O_3	16.75 (0.18)	17.52 (0.28)
$FeO_{tot.}$	10.05 (0.17)	7.58 (0.25)
MnO	0.20 (0.04)	0.17 (0.07)
MgO	5.77 (0.09)	6.02 (0.20)
CaO	10.44 (0.16)	11.29 (0.29)
Na_2O	3.74 (0.07)	2.70 (0.19)
K_2O	1.92 (0.06)	2.12 (0.12)
P_2O_5	0.55 (0.10)	0.64 (0.27)

[a]Numbers in parenthesis indicate the error (±1σ).

Supplementary Table 1. Chemical composition (wt.%) of the investigated glasses.

Sample	Measurement	Temperature (°C)	η (Pa s)
ETN	MP	635	12.17*
		640	*12.50*
ETN	MP	689	11.19*
		691	*11.69*
ETN	MP	726	10.68*
		728	*11.03*
ETN	CC	1400	0.62
ETN	CC	1375	0.71
ETN	CC	1350	0.85
ETN	CC	1325	0.97
ETN	CC	1300	1.10
ETN	CC	1275	1.21
ETN	CC	1250	1.34
ETN	CC	1225	1.47
STR	MP	666	12.18
STR	MP	708	10.52
STR	MP	723	10.02
STR	MP	737	9.55
STR	MP	756	8.92
STR	MP	777	8.28
STR	MP	795	7.82*
		797	*7.97*
STR	CC	1227	1.92
STR	CC	1266	1.68
STR	CC	1295	1.51
STR	CC	1312	1.41
STR	CC	1343	1.25
STR	CC	1361	1.17
STR	CC	1405	0.96
STR	CC	1432	0.84

Supplementary Table 2. Measured viscosity for ETN and STR using micropenetration (MP) and concentric cylinder (CC) viscometry, respectively. When viscosity increased with time due to nanocrystallization, the lowest measured viscosity is reported with the symbol *, whereas the highest measured viscosity at the end of the measurement is reported in italics.

Supplementary references

1. Meerlender, G. Viskositäts-Temperaturverhalten des Standardglases I der DGG. *Glas. Ber.* **47**, 1–3 (1974).