



*Geophysical Research Letters*

Supporting Information for

**Humidity Dependence of AE Activity in Sheared Quartz Gouges and its Implication for the Micromechanics of Friction**

Yasuo Yabe<sup>1</sup>

<sup>1</sup>Research Center for Prediction of Earthquakes and Volcanic Eruptions, Graduate School of Science, Tohoku University

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**Additional Supporting Information (Files uploaded separately)**

**Introduction**

Table S1 gives test conditions. Figures S1-S8 shows plots of the rate- and state-friction (RSF) parameters estimated for individual sliding-rate steps and AE activity during individual steady sliding periods. Variations of the normal stress, the shear stress, friction coefficient, and sliding rate are also plotted. Figure S9 shows the gouge particle size distribution used in this study.

Tabel S1. Experimental conditions

Test name	Test condition	Temperature, °C	Relative humidity, %	Partial water vapor pressure, hPa	Gouge weight, g	Initial gouge thickness, mm	Added water, g	Sliding rate, µm/s	*Maximum sliding distance, mm
Qz20220105	Dry	14.4	7.2	1.18	1.004	1.82	0	3-10-30-100	144 (66)
Qz20220131	Dry	14.4	7.2	1.18	1.000	1.26	0	3-10-30-100	144 (66)
Qz20220210	Room	14.4	44.6	7.32	1.000	1.43	0	4.64-10-21.5-46.4	184 (81)
Qz20230206	Room	15.8	35.0	6.28	0.990	1.06	0	4.64-10-21.5-46.4	124 (30)
Qz20230119	Humid	15.2	100.0	17.27	0.990	1.04	0	4.64-10-21.5-46.4	172 (30)
Qz20230201	Humid	13.1	99.3	14.97	0.990	1.01	0	4.64-10-21.5-46.4	172 (30)
Qz20230202	Wet	15.7	98.8	1013	0.990	1.69	0.25	4.64-10-21.5-46.4	172 (30)
Qz20230222	Wet	14.5	97.3	1013	1.000	0.92	0.23	4.64-10-21.5-46.4	176 (30)

\*: Numeral in parentheses indicates the sliding distance up to which sliding-rate step was imposed every 1-mm sliding.

Qz20220105

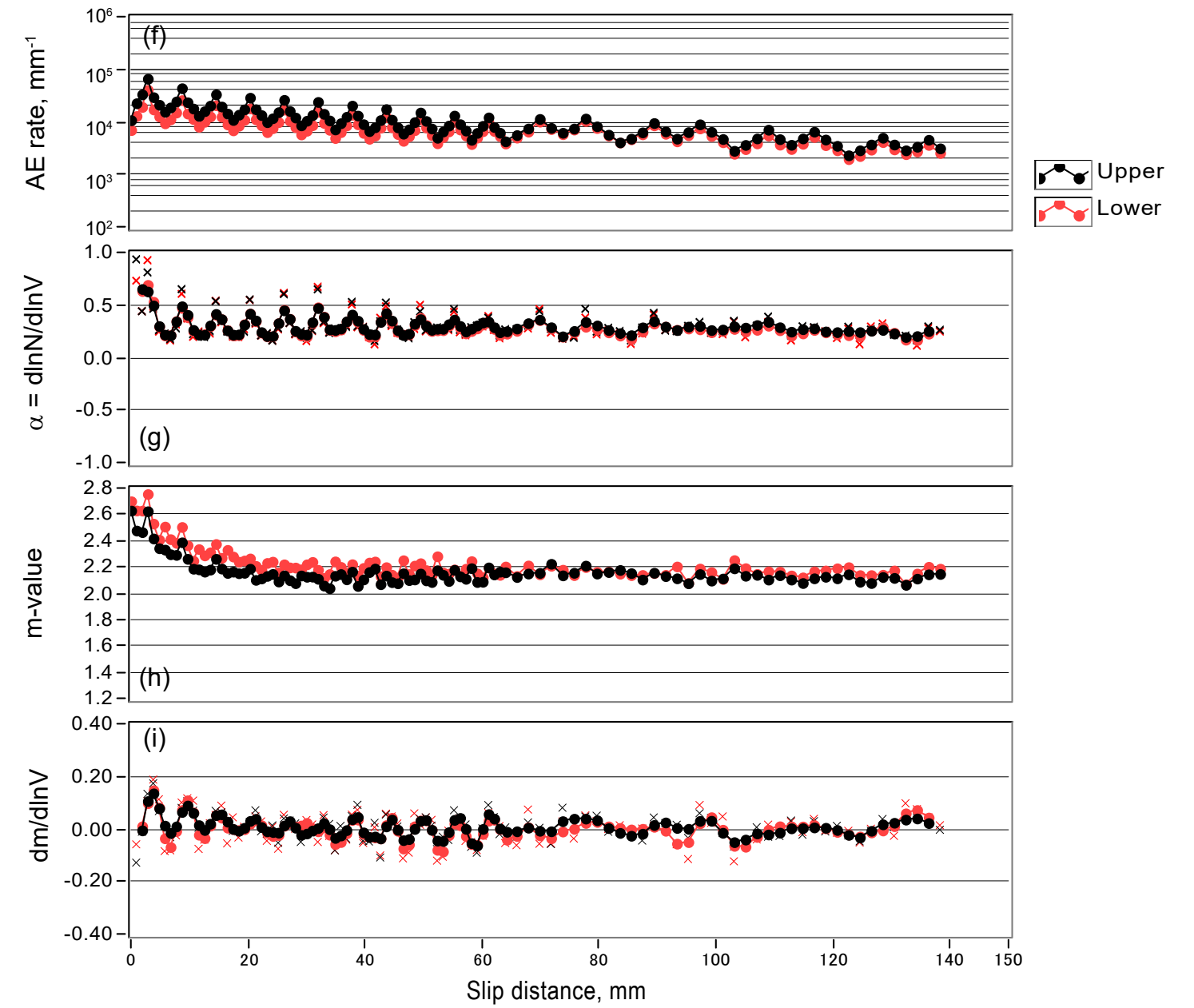
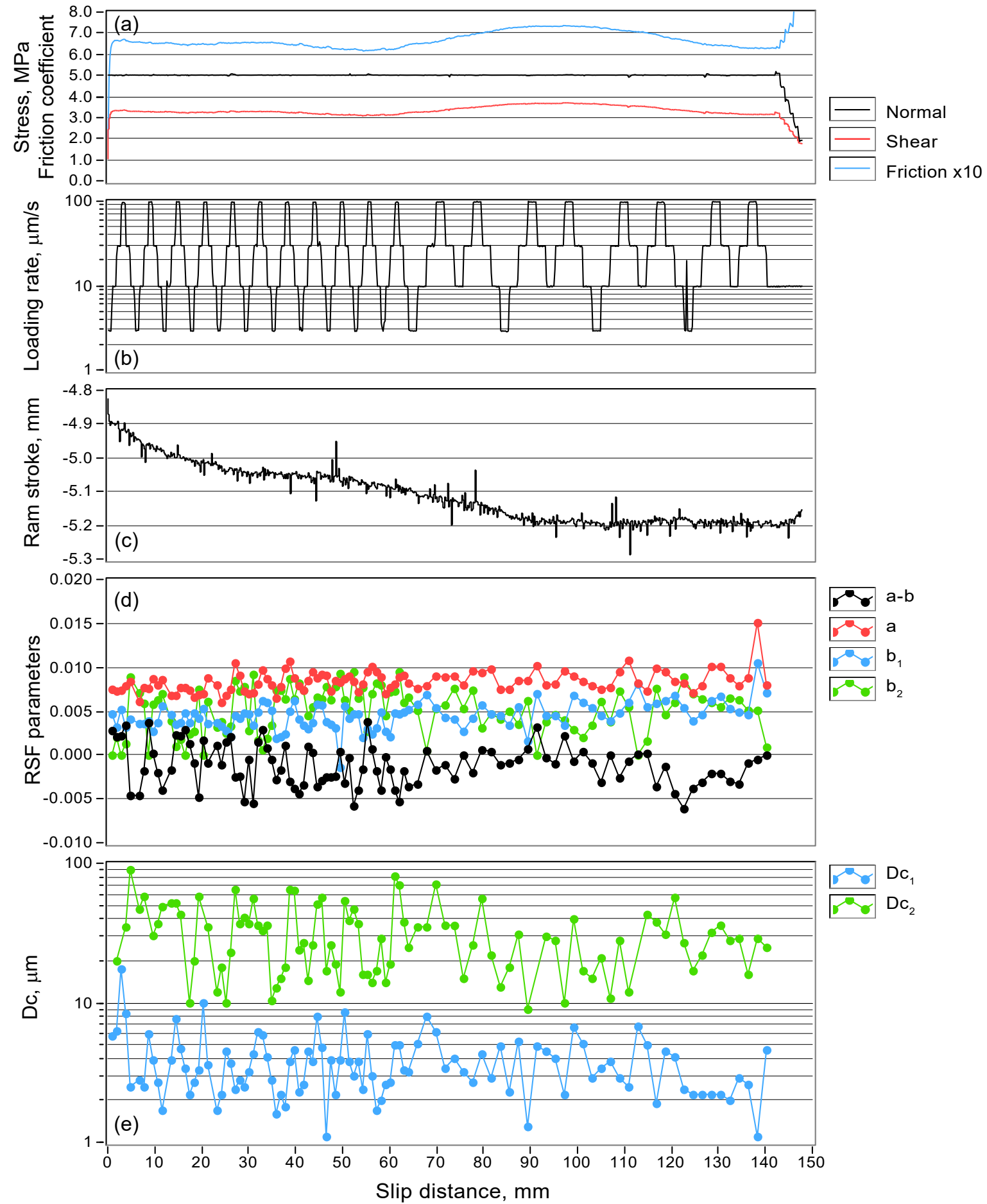


Figure S1. Experimental results of Qz20220105 with respect to sliding distance.

(a) Normal stress, shear stress, and friction coefficient.

(b) Loading rate.

(c) Ram stroke.

(d) Parameters of RSF law (the red, blue, green, and black circles represent  $a$ ,  $b_1$ ,  $b_2$ , and  $a-b$ , respectively).

(e) Critical sliding distances (the blue and green circles represent  $Dc_1$  and  $Dc_2$ , respectively).

(f) AE rate (the black and red circles represent AE activity observed by AE sensor in the upper and lower forcing blocks, respectively).

(g) Sliding-rate dependence of AE rate.

(h) The  $m$ -value

(i) Sliding-rate dependence of the  $m$ -value.

The crosses in (g) and (i) are raw data and the circles are 3-points running average.

Qz20220131

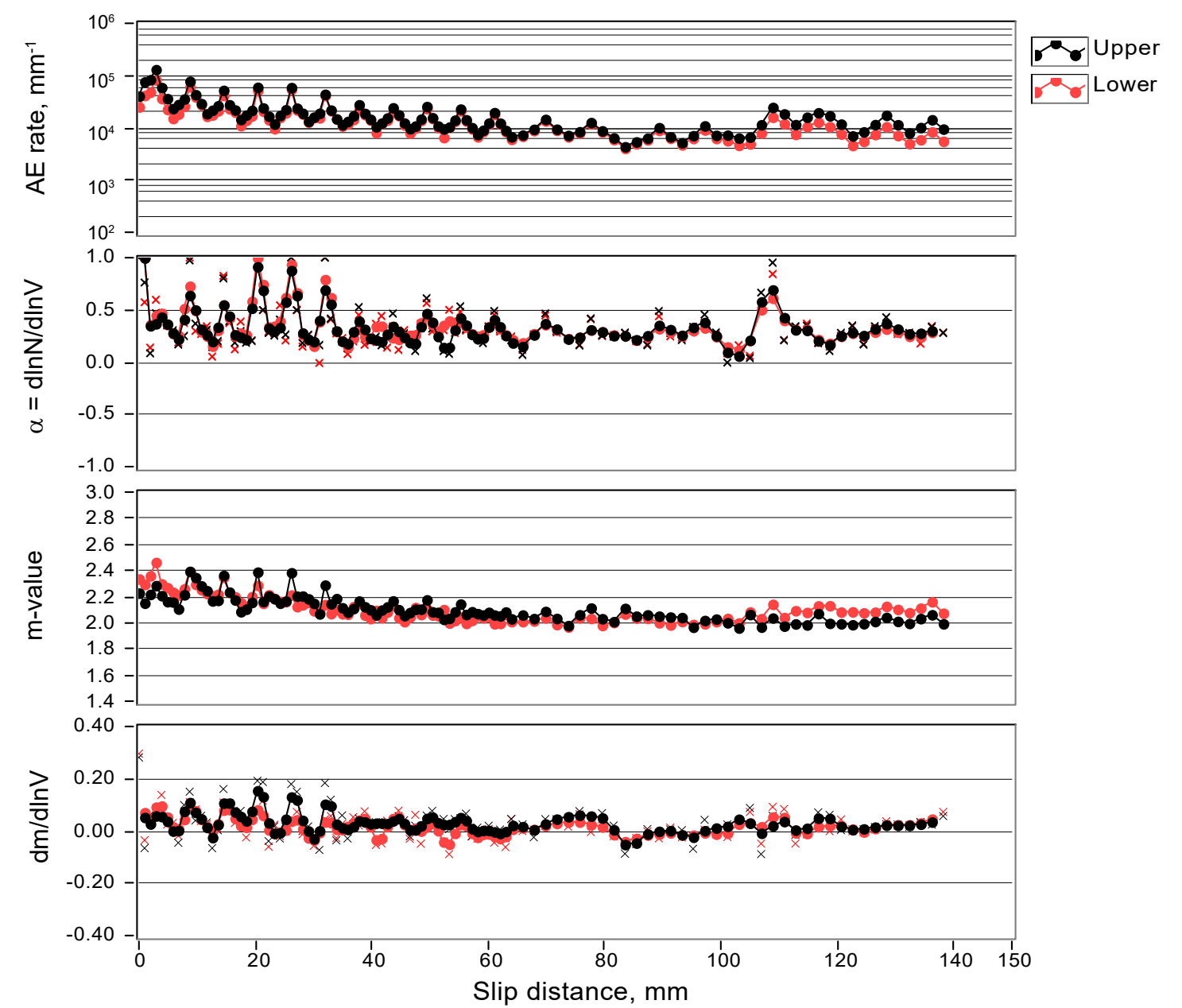
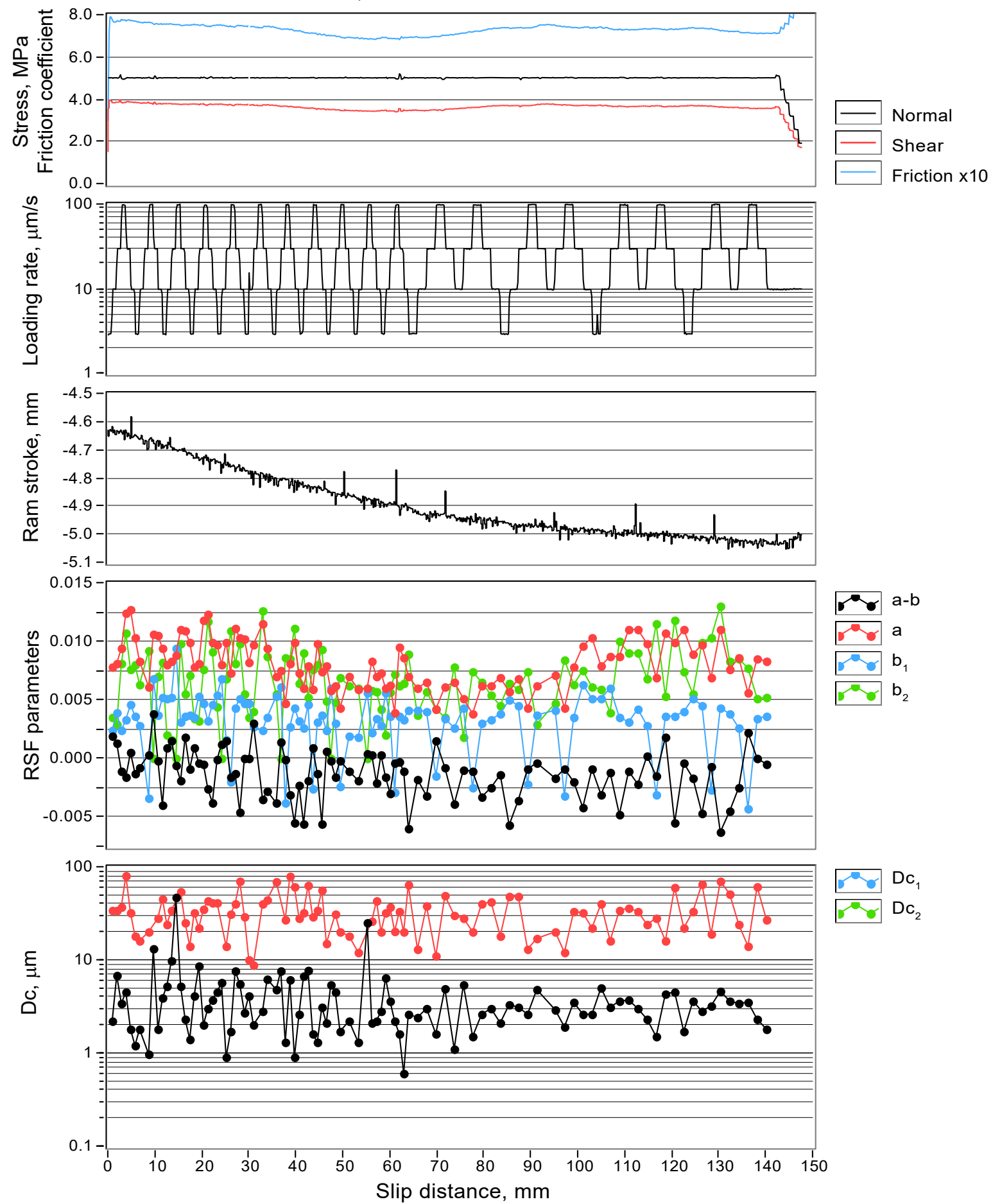


Figure S2. Same as Figure S1, but for Qz20220131.

Qz20220210

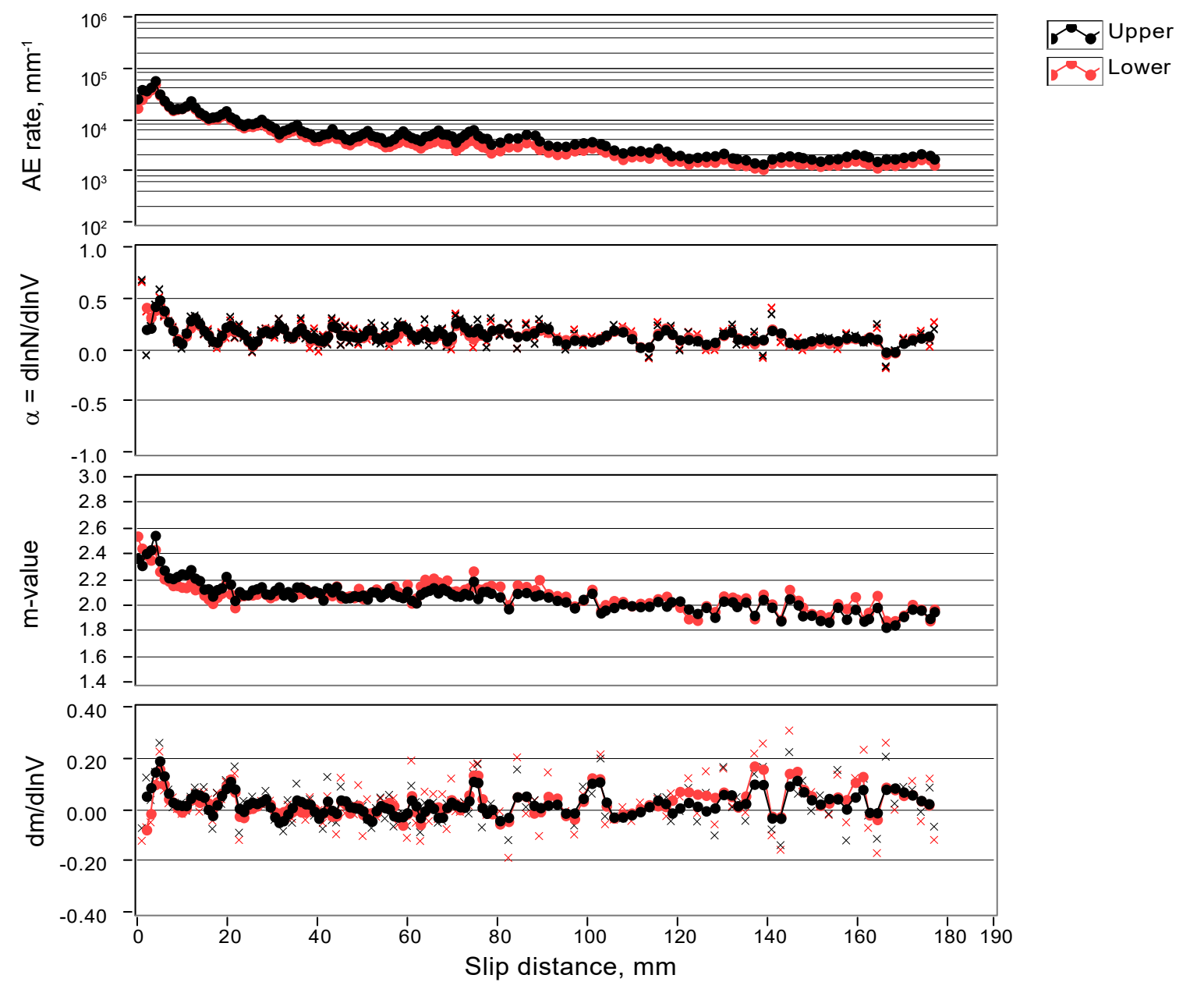
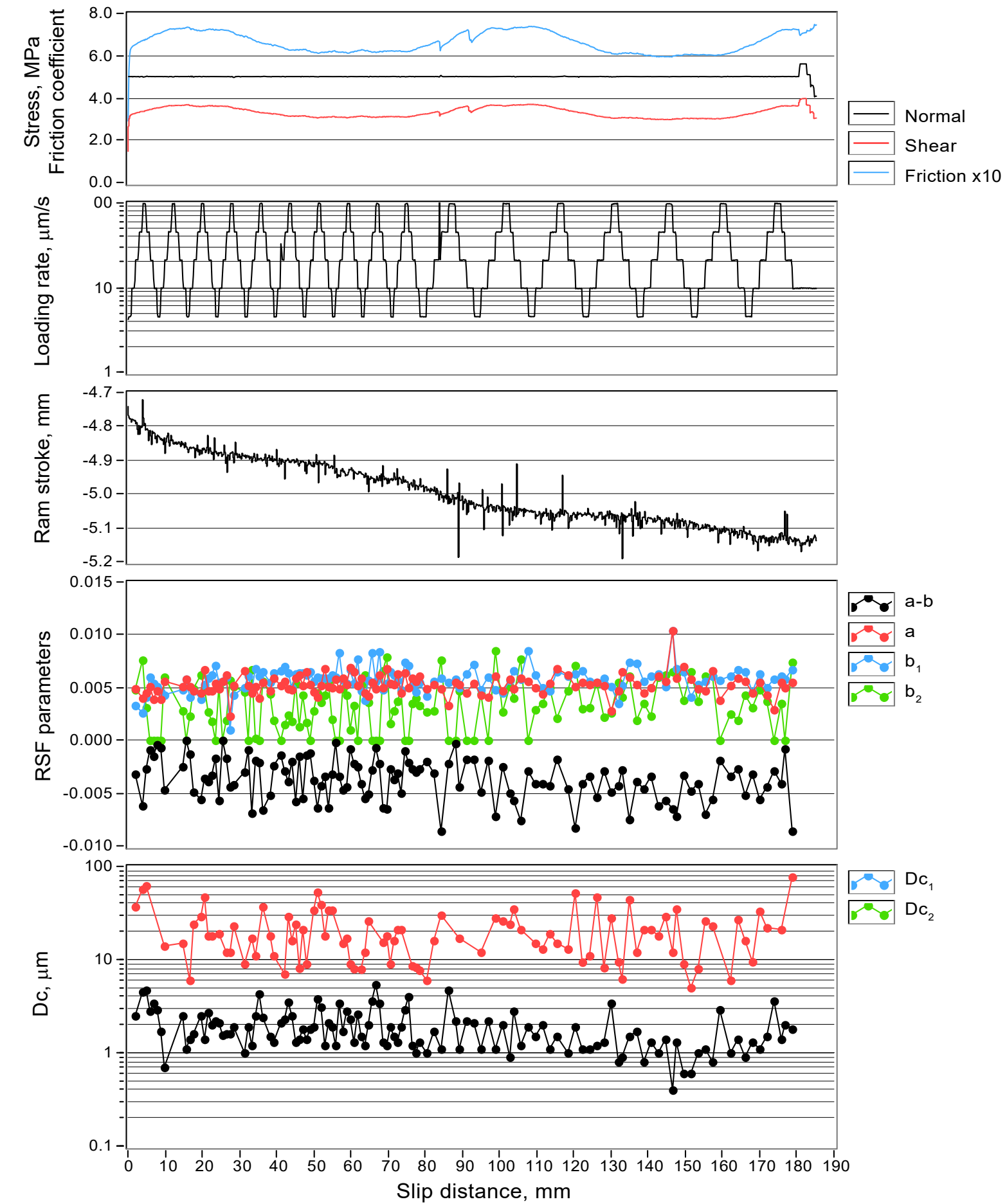


Figure S3. Same as Figure S1, but for Qz20220210.

Qz20230206

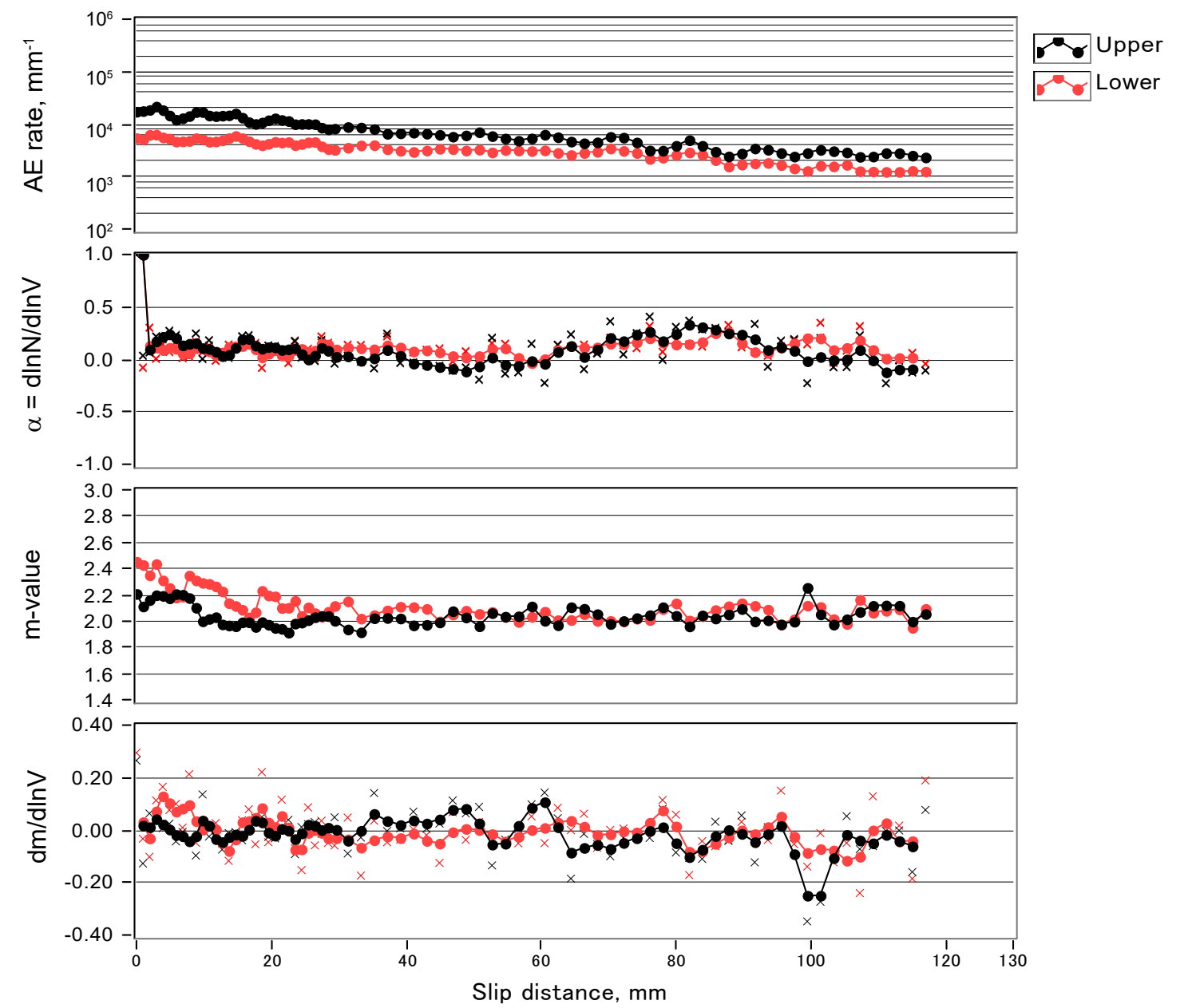
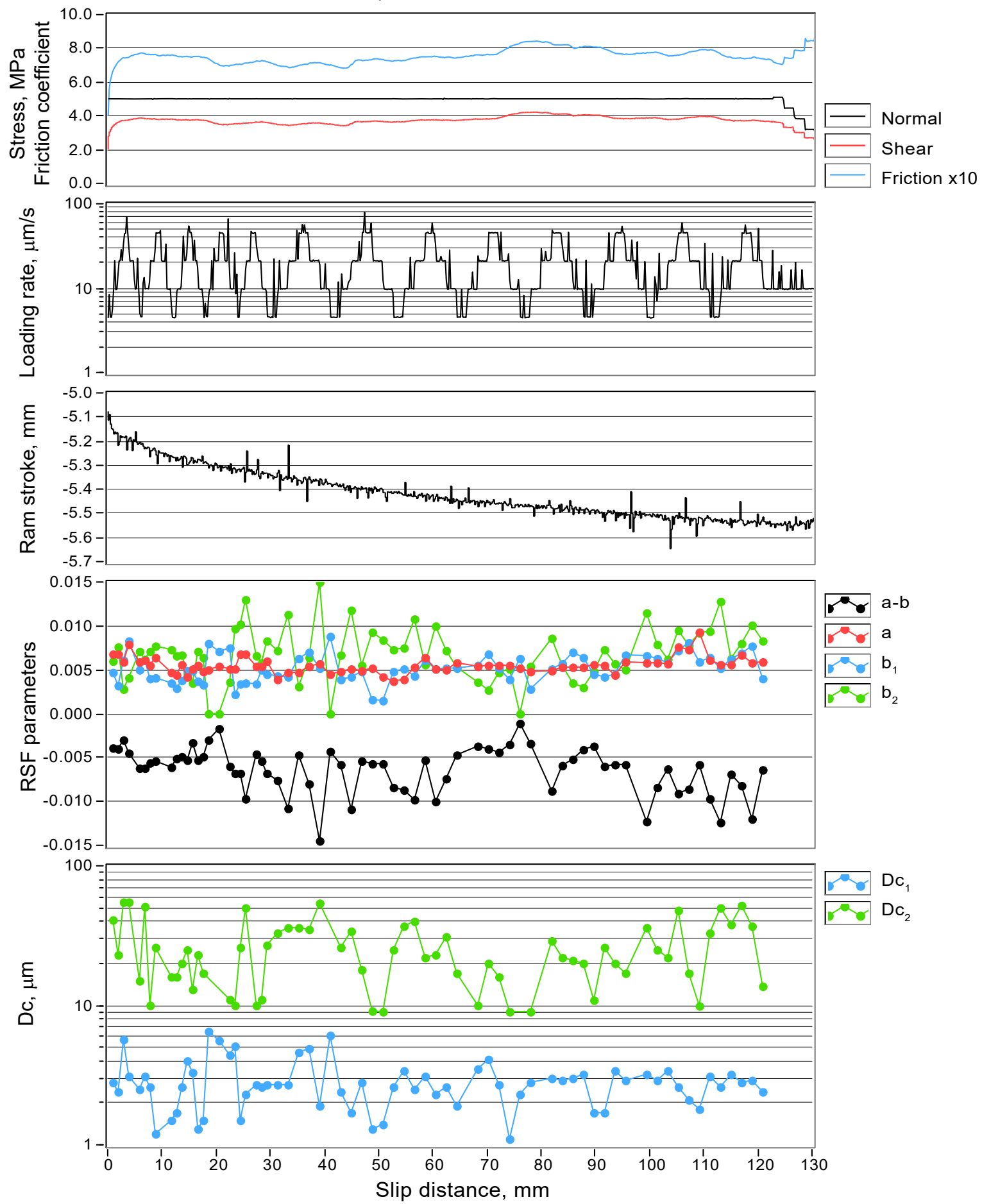


Figure S4. Same as Figure S1, but for Qz20230206.



Qz20230119

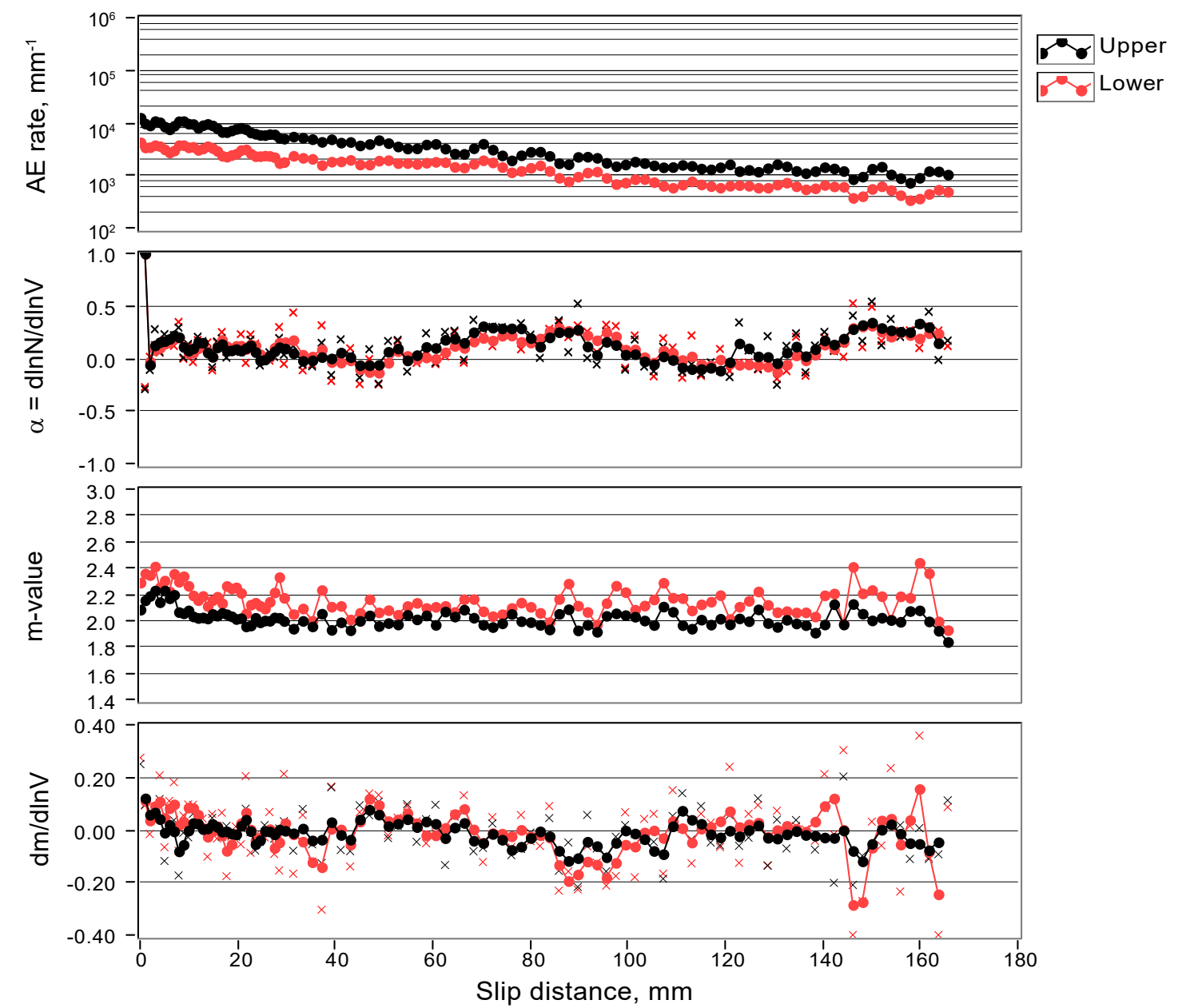
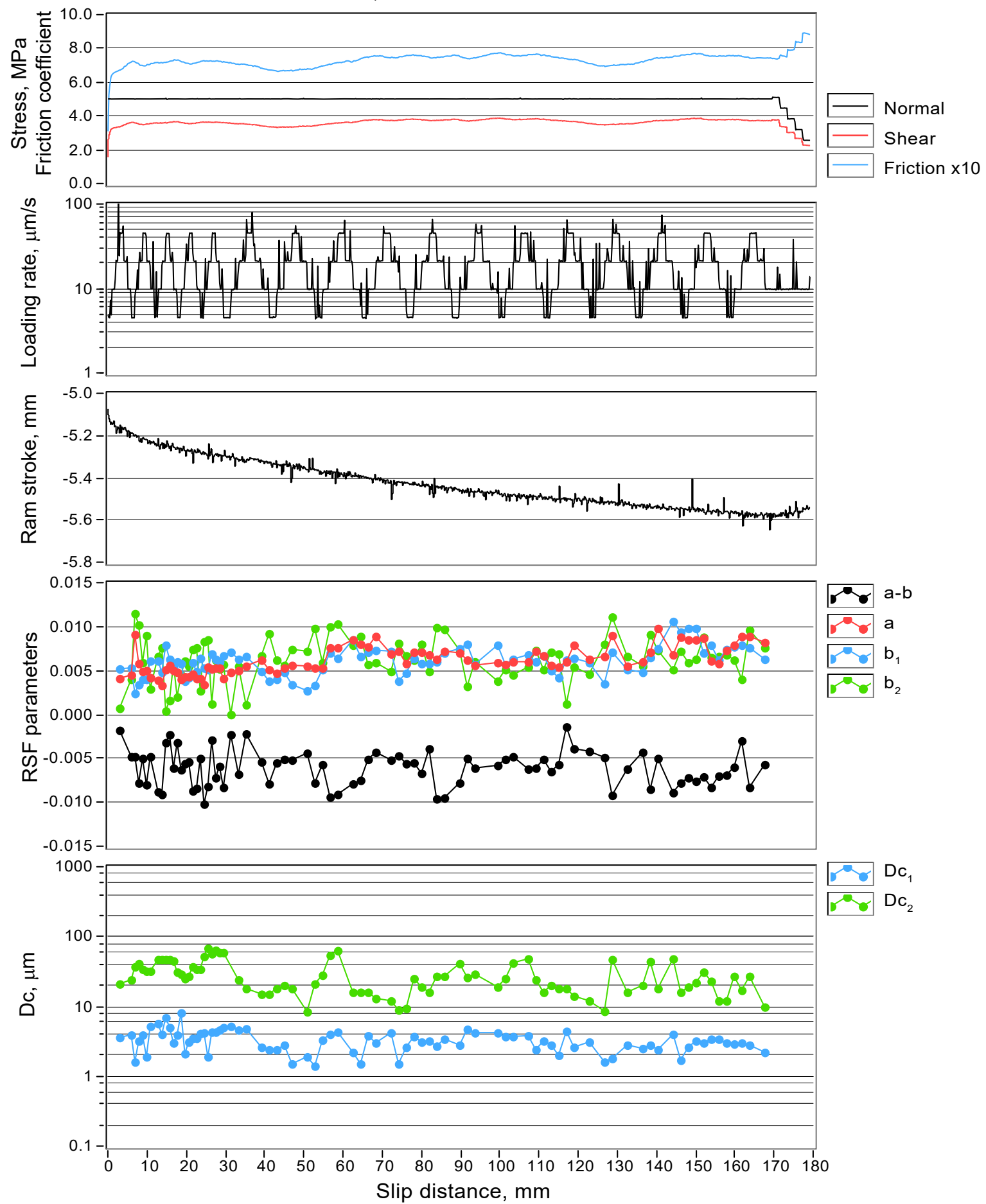


Figure S5. Same as Figure S1, but for Qz20230119.

Qz20230201

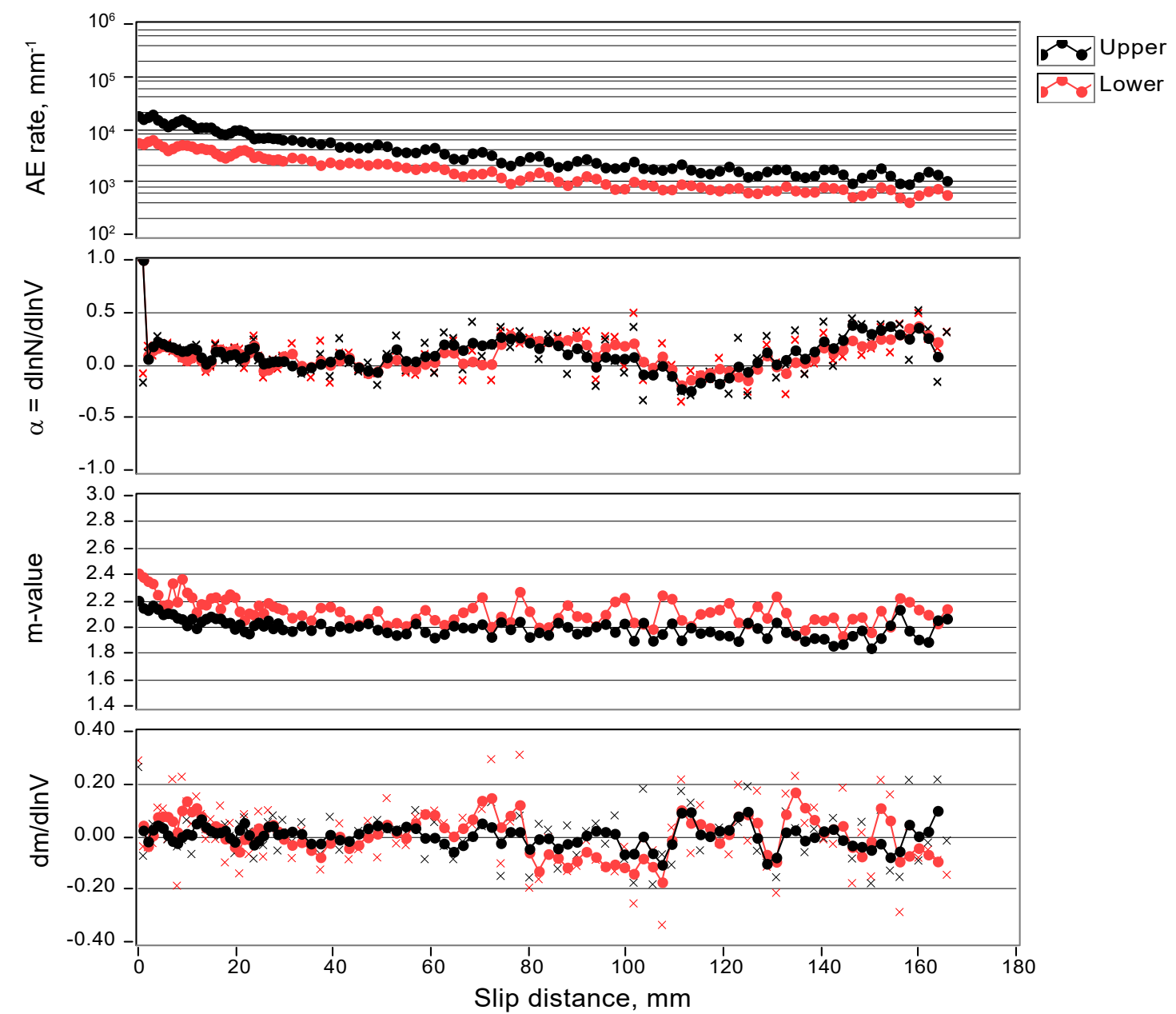
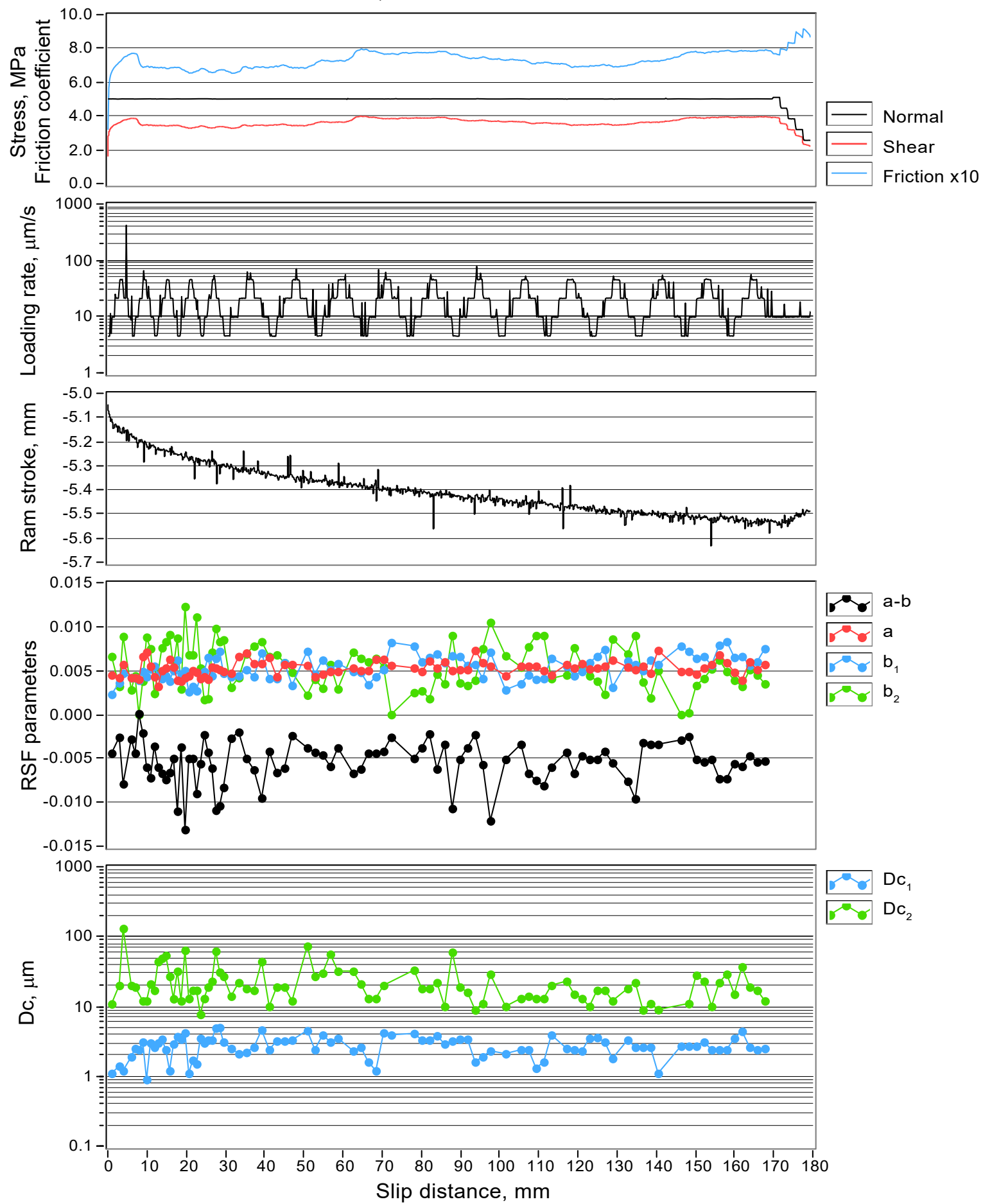


Figure S6. Same as Figure S1, but for Qz20230201.



Qz20230202

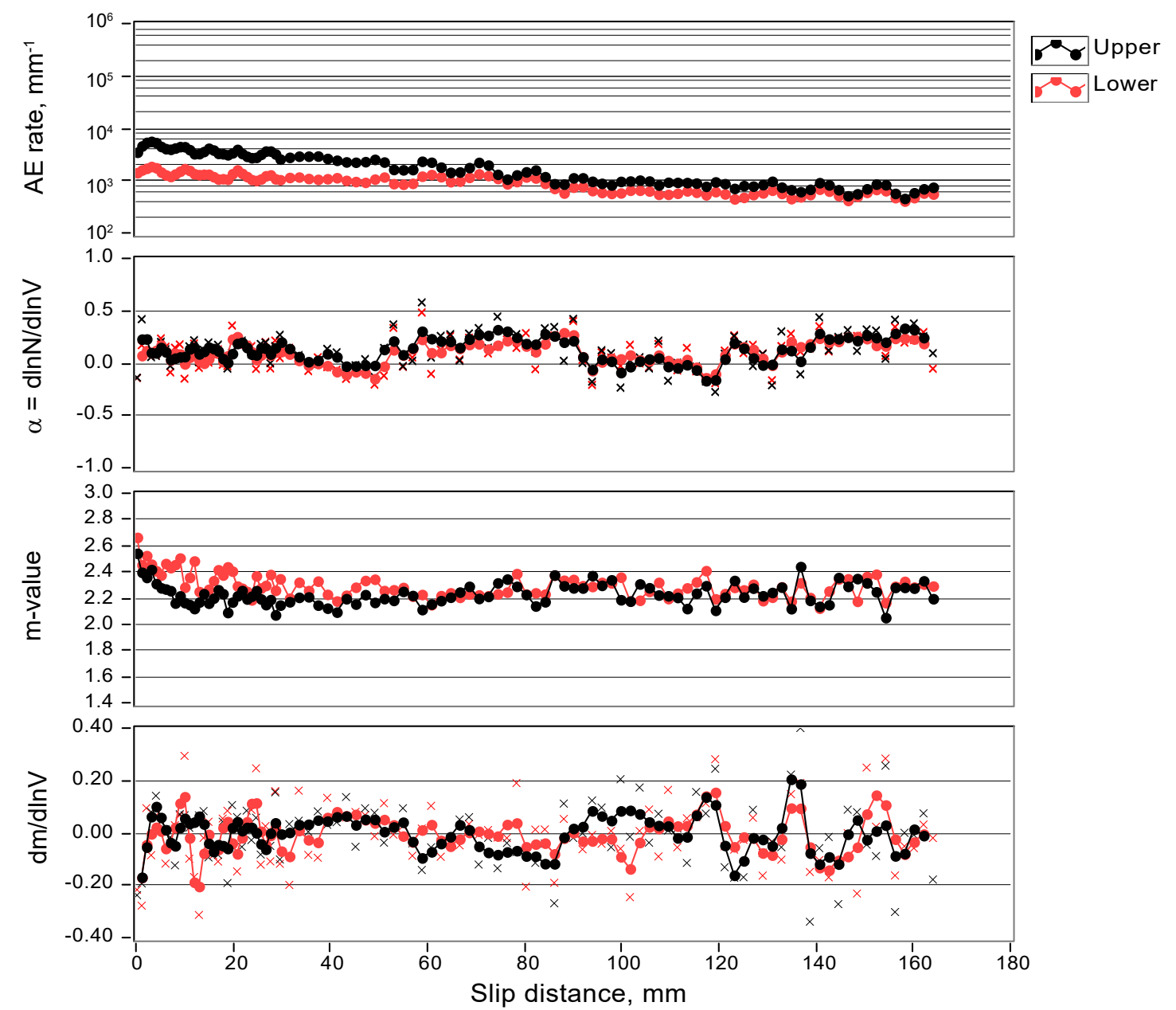
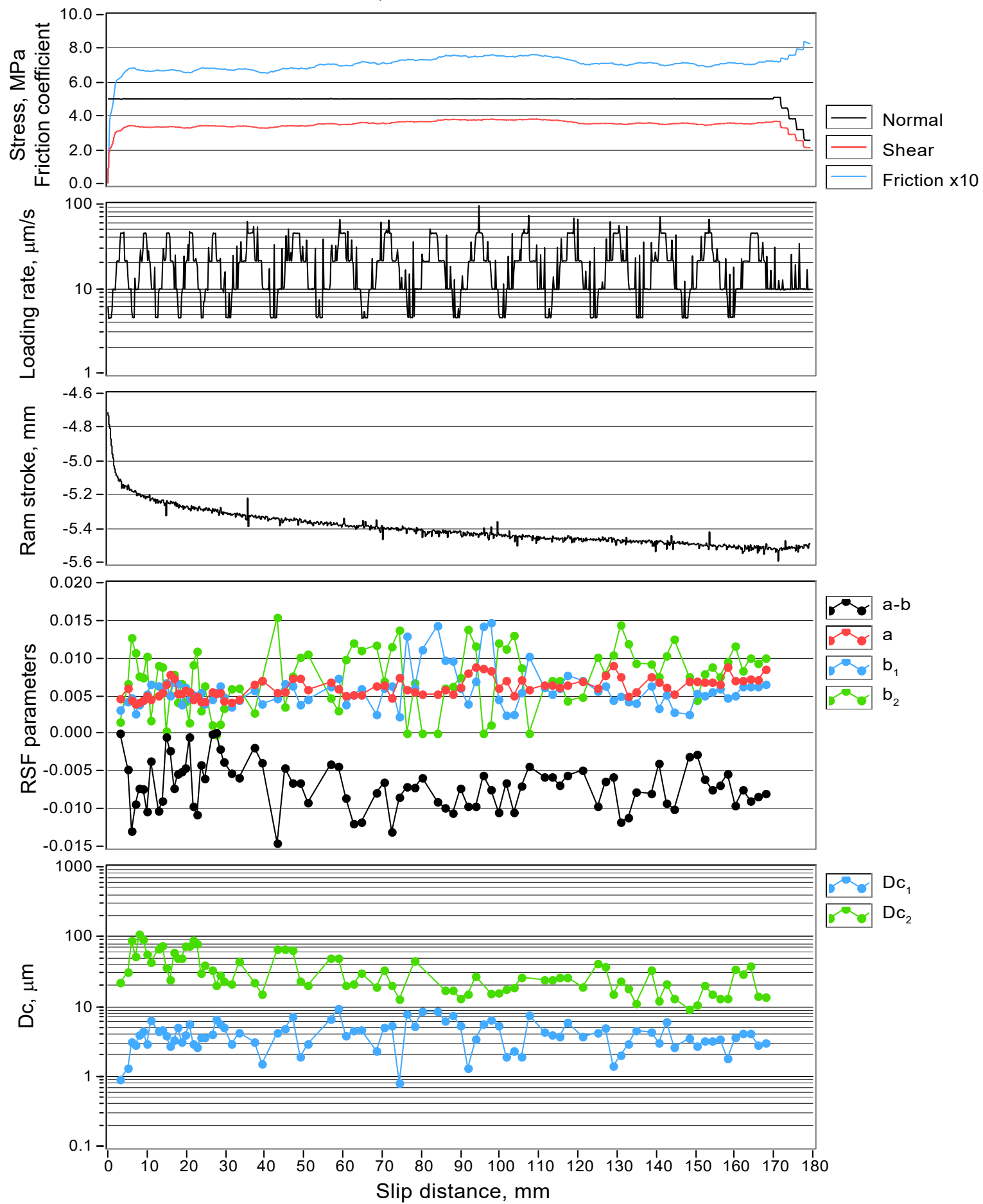


Figure S7. Same as Figure S1, but for Qz20230202.

Qz20230222

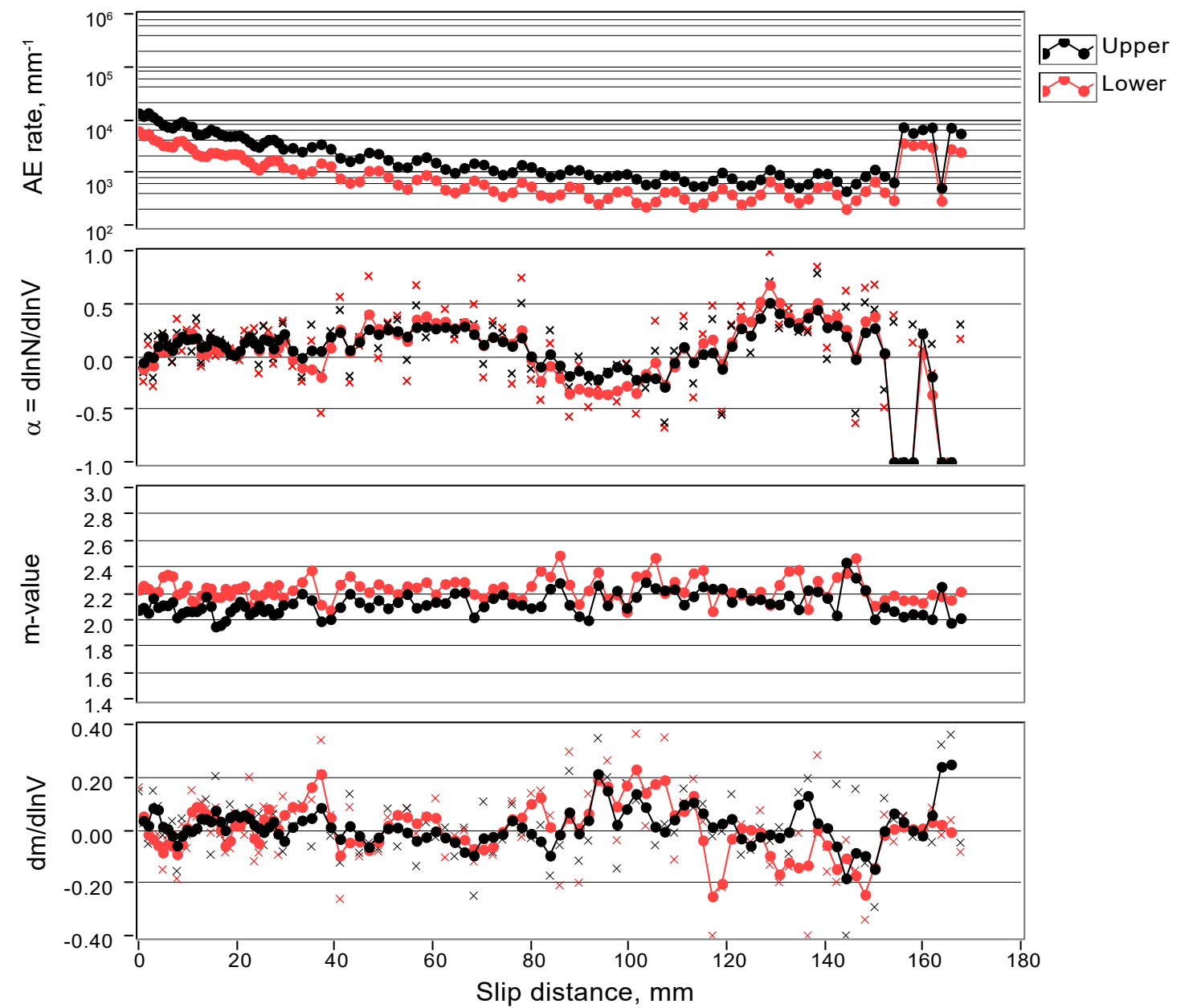
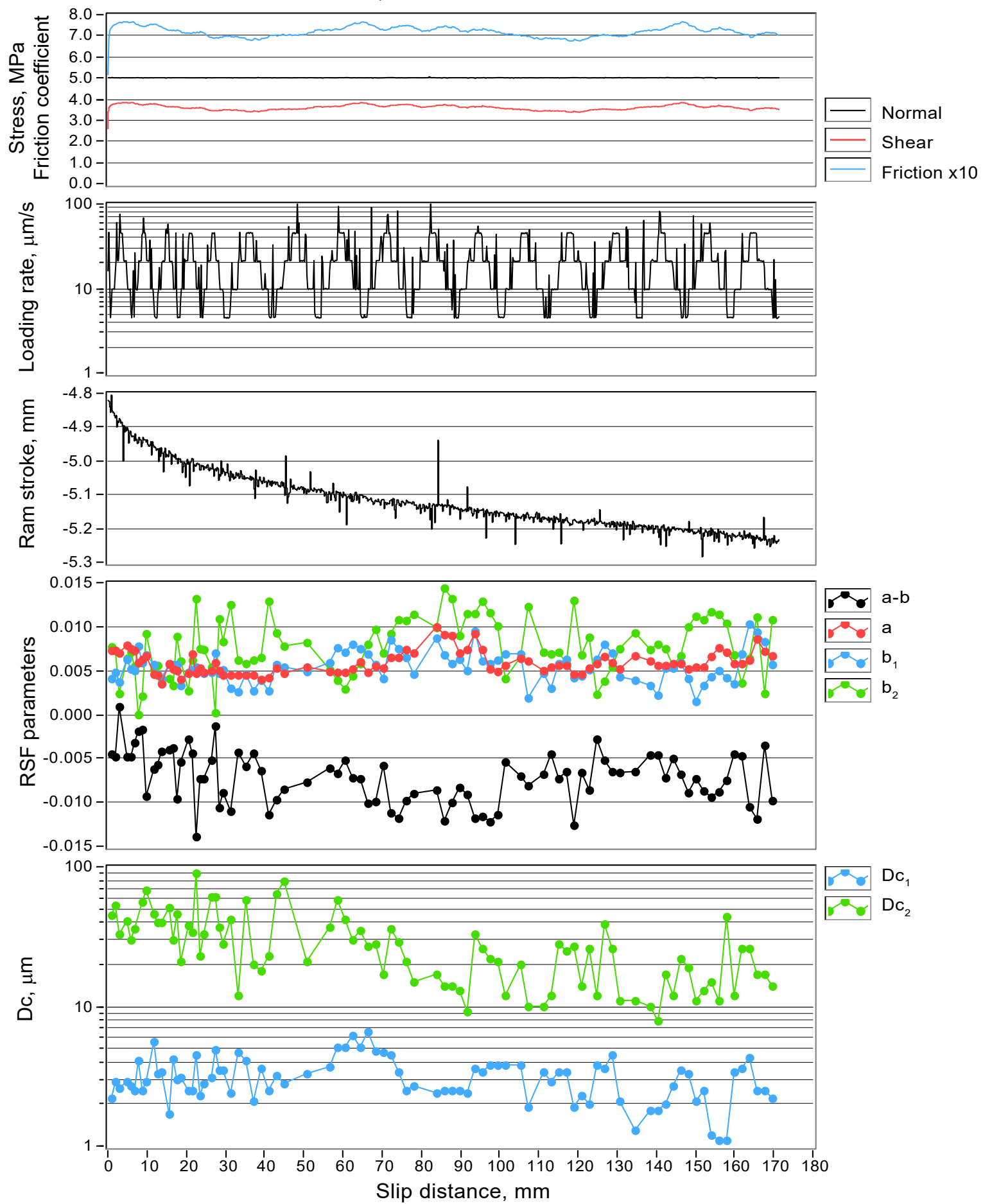


Figure S8. Same as Figure S1, but for Qz20230222.

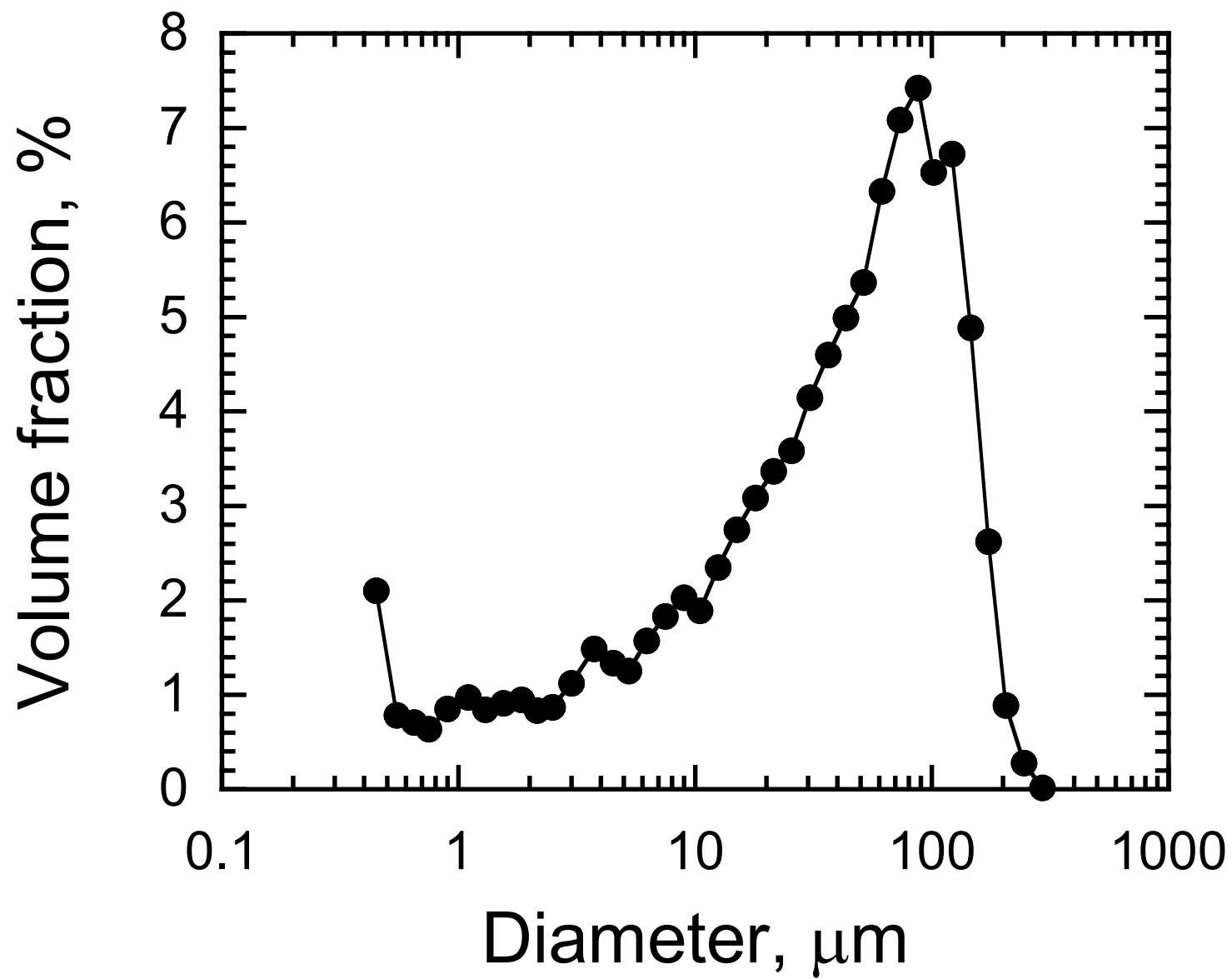


Figure S9. Grain particle size distribution measured by laser diffraction.