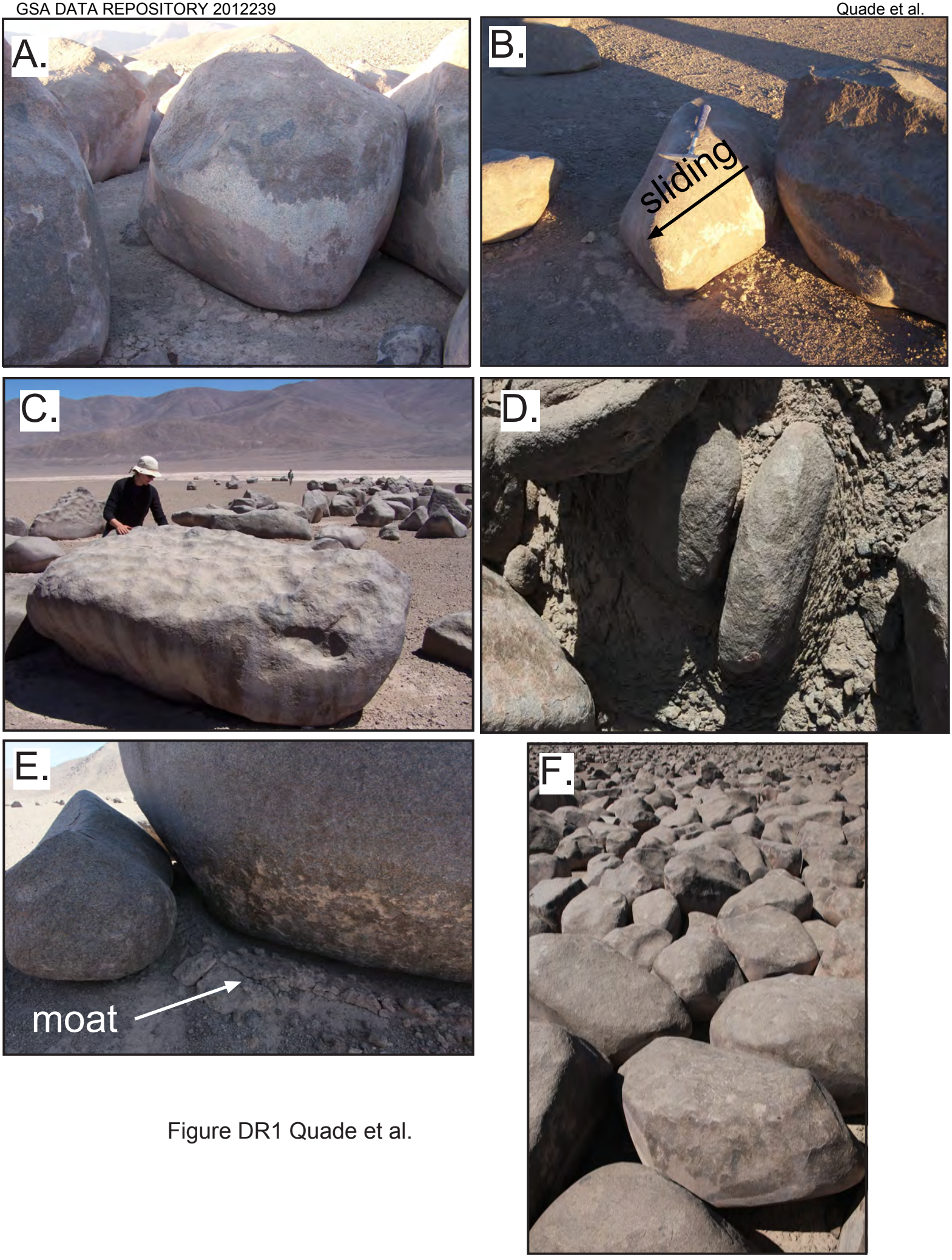

Figure DR1 Quade et al.

Figure DR1 Features of boulder fields at Sierra del Buitre, northern Chile. a. Boulder ~1.2 m high showing several generations of rubbing, b. boulder with white scratch marks as evidence of recent sliding past the adjacent boulder, c. large boulder with rubbing around the mid-section of the boulder and wind ventifacting of the top, d. onion skin weathering of corestones as they emerge from bedrock in the vicinity of site A (Fig. 1b, main manuscript), d) moat and smoothing of adjacent boulders, and e) general view in the vicinity of site D of the rubbing boulder fields. The large boulders in the foreground are 1-1.5 m across.

Figure DR2. Old polished surface on seismically rubbed El Buitre boulder, with thin Si-rich veener. Photomicrographs shown below.

Figure DR3. Microbreccia/micromelange developed along polished surface of granodiorite boulder from Sierra del Buitre. Scale bars in lower right of panels are divided into ten equal ticks.

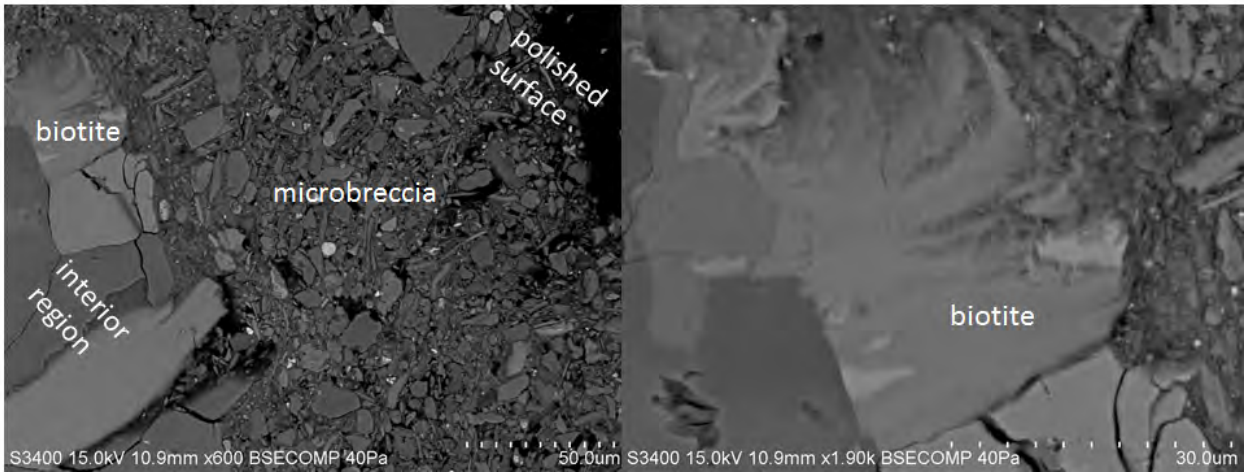

Figure SX3. Si-rich veneer similar to those reported in Curtiss et al. (1985), Perry et al. (2006), and Chemtob et al. (2010), developed on boulder surfaces. Example in lower right panel shows Si-rich veneer developed on top of region of micromelange resulting from seismic boulder rubbing.

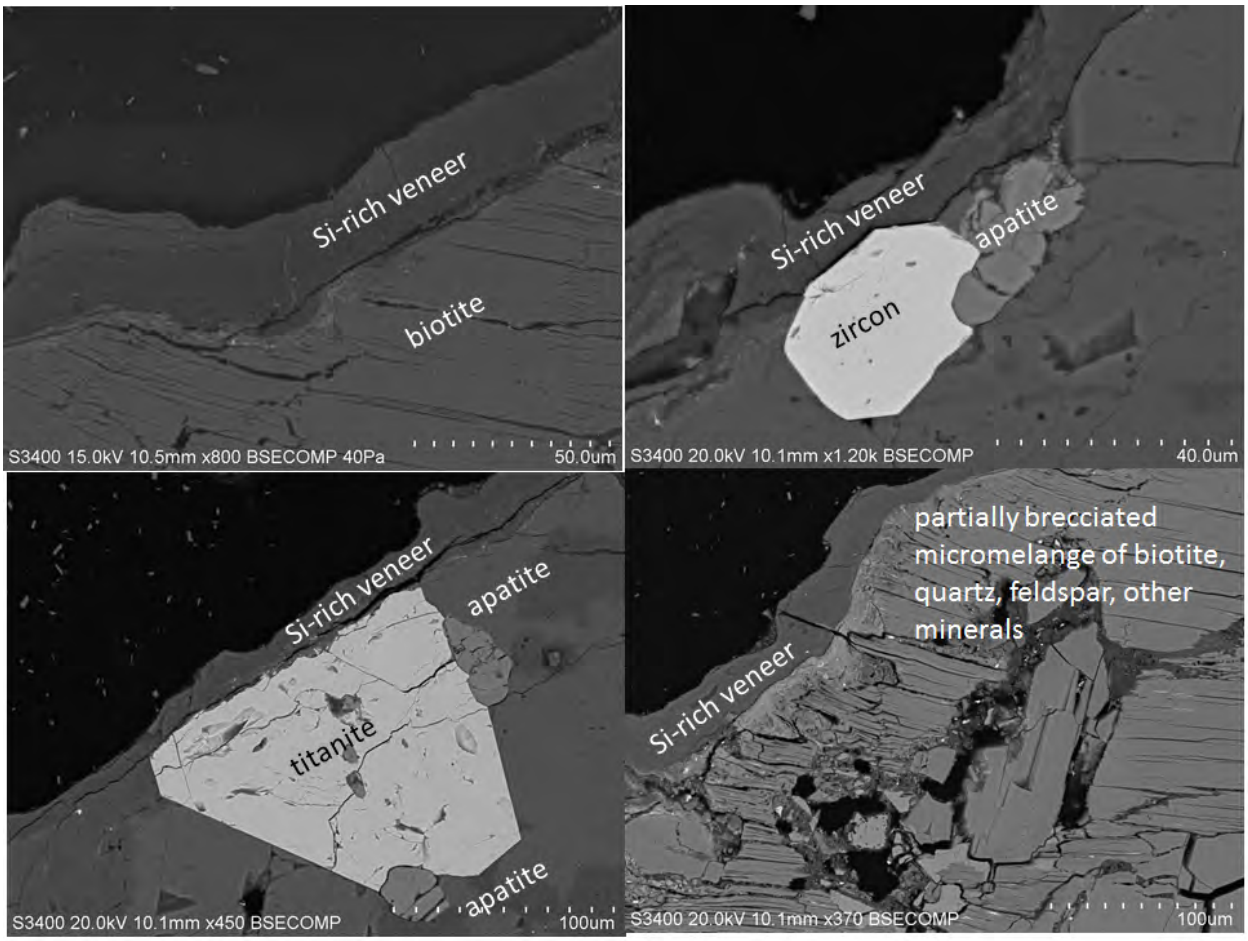
Si-rich veneer
biotite
S3400 15.0kV 10.5mm x800 BSECOMP 40Pa
50.0um
Si-rich veneer
apatite
zircon
S3400 20.0kV 10.1mm x1.20k BSECOMP
40.0um
Si-rich veneer
apatite
titanite
apatite
S3400 20.0kV 10.1mm x450 BSECOMP
100um
partially brecciated micromelange of biotite, quartz, feldspar, other minerals
Si-rich veneer
S3400 20.0kV 10.1mm x370 BSECOMP
100um

Table DR1 Calculated wind velocities required to sway boulders.

boulder x-section m2	mass (kg)	inertia F= mg=N Newtons	velocity required to move boulder drag: 1.2 m/sec	mph	drag:2 m/sec	mph
1.44	2267	22214	147	329	114	255
1.32	3001	29413	177	396	137	306
1.44	2267	22214	147	329	114	255
0.96	1511	14809	147	329	114	255
2.73	7162	70189	190	425	147	329
1.4	2938	28796	170	380	132	294
1.35	2125	20825	147	329	114	255
1.62	2267	22214	139	310	107	240
0.48	588	5759	130	290	101	225
1.68	3232	31675	163	364	126	282
0.8	840	8227	120	269	93	208
2.7	5667	55534	170	380	132	294
0.9	787	7713	110	245	85	190
1.54	2693	26396	155	347	120	269
1.68	2644	25916	147	329	114	255
2.28	3988	39080	155	347	120	269
1.2	1889	18511	147	329	114	255
0.585	512	5014	110	245	85	190
0.99	1212	11878	130	290	101	225
0.48	504	4936	120	269	93	208
1.82	2547	24956	139	310	107	240
0.49	386	3779	104	233	81	180
0.9	787	7713	110	245	85	190
0.49	514	5039	120	269	93	208
1.28	1567	15358	130	290	101	225
0.77	943	9239	130	290	101	225
1.87	2944	28847	147	329	114	255
1	787	7713	104	233	81	180
2.08	3638	35652	155	347	120	269
0.69	724	7096	120	269	93	208
0.91	1432	14038	147	329	114	255
4.03	8458	82890	170	380	132	294

constants

	g (m/sec2)	9.8
cylinder	drag coefficient (Cd)	1.2
flat surface	drag coefficient (Cd)	2
	air density (kg/m2)	1.1875

1 Newton = kg-m/sec2

assumed wind-force equation

F=A*P*Cd where A = area
P= wind pressure (=0.5*V^2)
V =wnd velocity
Cd = drag coefficient