This supplemental information file for "Neotectonic faulting and forearc sliver motion along the Atirro-Río Sucio fault system, Costa Rica, Central America" by Montero et al. contains descriptions of secondary faults of Atirro-Río Sucio fault system.

Omega fault

The Omega fault is an Atirro fault splay that branches westward off of the main trace at the Rincón de la Esperanza pressure ridge (Fig. 3 in manuscript). This fault traverses a series of linear valleys exhibiting abrupt scarps, dextral stream offsets, and drainage adaptations (Montero, 2003). The fault loses expression to the west-northwest where it truncates against the Pejibaye pull-apart basin. Where the Pejibaye River crosses the Omega ridge, it enters a narrow canyon (site 8, Fig. 7 in manuscript) that we interpret as an antecedent valley. Uplift here is thought to reflect a transpressive left step between the Atirro and Omega faults (Montero, 2003) (Fig. 3 in manuscript). In the past, the Omega fault may have continued to the northwest along either of the two arms of the Tucurrique fault that bound the Pejibaye pull-apart. If the Omega fault continued along the northern arm, it is now offset 0.5 km by dextral motion on the basin margin. If it continued along the Tucurrique fault's southern arm, the old trace is now covered by basin alluvium.

Chiz and Campano faults

The linear Chiz fault is one of several sub-parallel fault traces near the basin boundary (Fig. 3 in manuscript). The fault's southern end near the town of Tucurrique marks the contact between Pliocene volcanic rocks exposed in hills to the east, and Quaternary volcanic terraces to the west. The prominent scarp of this normal-slip fault reaches a maximum height of 500 m along the Alto Florencia crestal line (Figs. 7 and 9 in manuscript). Windows of Tertiary sedimentary rocks appear along the scarp surrounded by Quaternary lava flows (Fernández,

1987; Mora et al., 1990). The northeastern flank of the Alto Florencia has a gentler slope than the southwestern flank, causing an asymmetric drainage network in which streams are longer toward the northeast. Based on this asymmetry, the eastern block is tilted down to the northeast.

The Campano fault (manuscript Figs. 3 and 7), with down-to-the-east normal displacement, is inferred to mark the southwestern boundary of the Irazú-Turrialba pull-apart basin. It has a prominent triangular-faceted scarp, up to 300 m in height. South of the town of Tucurrique, the fault is coincident with a right deflection of the Vueltas river and with a beheahed stream afluent of the Pisirí creek (BC in manuscript Fig. 7), suggesting combined dextral and normal displacements.

Faults of the Irazú-Turrialba volcanic field

The Ariete-Río Guácimo fault (ARF in Fig. DR1) on Turrialba volcano is characterized by well defined 25 m scarps. South and west of Irazú volcano, several rectilinear to curvilinear fault traces stand out. The Irazú fault (Fig. DR1) displays a clear northwest-facing scarp with downthrown western side. A more curvilinear sub-parallel fault to the southeast also displays northwest-facing scarps. On the western side of Irazú volcano two curvilinear faults show faceted scarps and linear valleys (Fig. 2 in manuscript). A north-northeast alignment of monogenetic volcanoes including the Irazú active summit crater suggests an E-W to WNW extension within the Irazú volcanic field. This extension is concordant with the tensional stresses that open the Irazú-Turrialba pull-apart (Fig. DR1).

The splays of the Río Sucio fault

The easternmost Río Sucio fault splay (Figs. 10 and 11 in manuscript) is expressed by linear valleys and southwest-facing faceted 200-400m scarps. A transtensive relay near the southeast

end of the easternmost splay suggests a dextral component of slip (Figs. 10 and 11 in manuscript; Montero, 2003). Further east the easternmost fault splay is interrupted by the Finca Liebres volcanic depression. The central Río Sucio fault branch is also characterized by linear valleys and southwest-facing scarps. At the north end of the western Río Sucio fault branch, a small basin in a right stepping bend (Fig. 10 in manuscript) implies a releasing geometry and dextral slip along the fault.

The Blanquito fault

On the northern slopes of the Irazú-Turrialba volcanoes, Montero and Alvarado (1995) described some NNW-trending neotectonic faults. The most well expressed is the Blanquito fault (Figs. 2 and 10 in manuscript). The southern termination cuts the Finca Liebres volcanic depression. The fault is expressed by west facing scarps, linear valleys and adapted and displaced rivers. The northern end of the fault is located south of the Guápiles thrust fault (Fig. 10 in manuscript).

References

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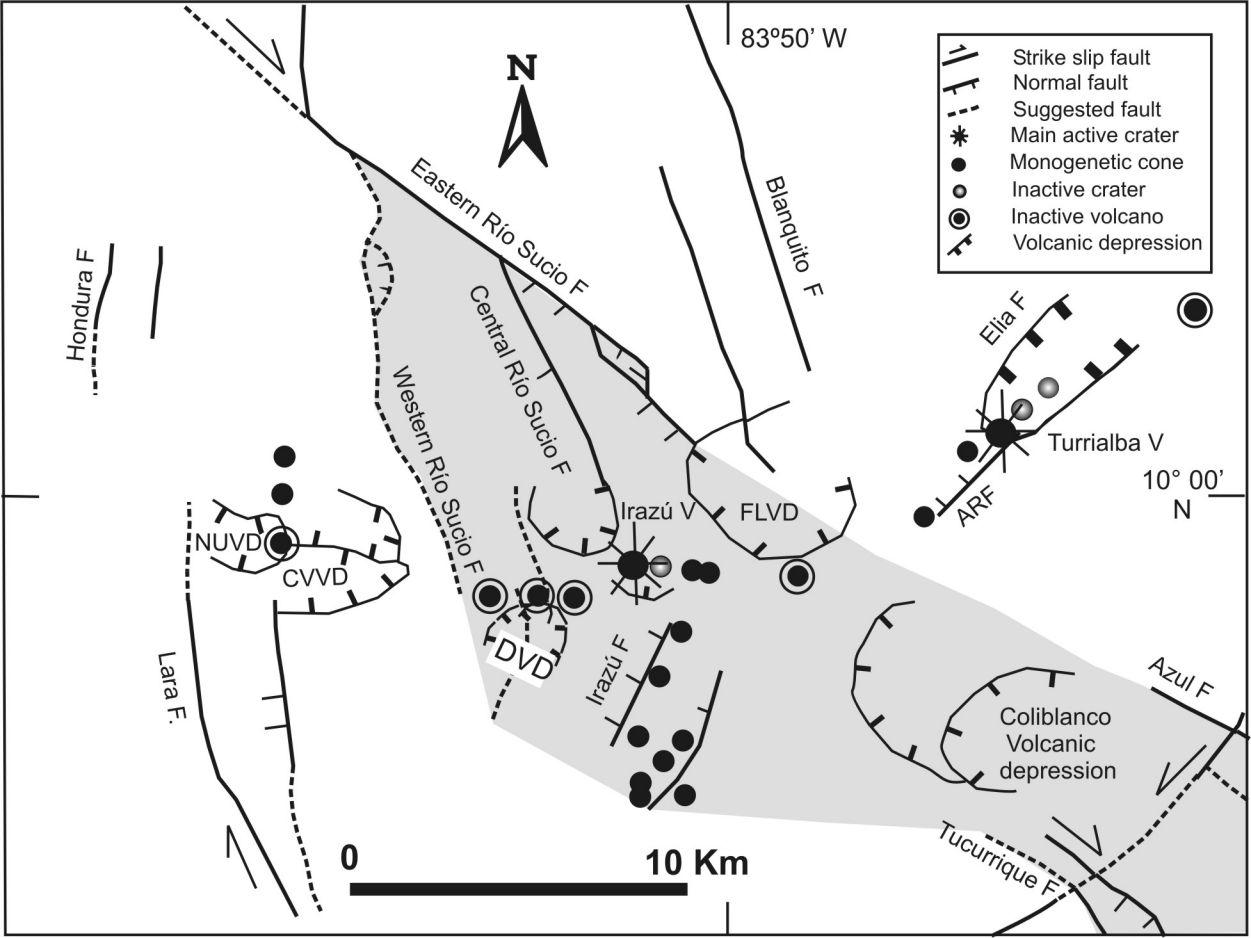
83°50' W
N
Strike slip fault
Normal fault
Suggested fault
Main active crater
Monogenetic cone
Inactive crater
Inactive volcano
Volcanic depression
Eastern Río Sucio F
Blanquito F
Hondura F
Central Río Sucio F
Western Río Sucio F
Elia F
Turrialba V
ARF
10° 00' N
Irazú V
FLVD
NUVD
CVVD
DVD
Irazú F
Lara F.
Azul F
Coliblanco Volcanic depression
Tucurrique F
0
10 Km

TABLE DR1. SUMMARY OF STRIKE-SLIP FAULT OFFSETS*

Fault name	Map symbol	Figure number	Offset feature	Offset minimum (km)	Offset maximum (km)	Piercing points and Notes
Oriente						
		7	North wall of Reventazón River canyon	0.15	0.27	Minimum 9° 51.55' – 83° 41.67' 9° 51.48' – 83° 41.61' Maximum 9° 51.55' – 83° 41.67' 9° 51.43' – 83° 41.55' Measured from intersection of fault scarp with trend of the downslope edge of the north canyon wall
		7	South wall of the Reventazón River canyon	0.35		9° 51.36' – 83° 41.53' 9° 51.21' – 83° 41.47' Measured from intersection of fault scarp with trend of the downslope edge of the south canyon wall
Tucurrique						
		7	Downslope edge of lower volcanic terrace	0.35		9° 51.74' – 83° 43.30' 9° 51.62' – 83° 43.23' Measured parallel to trend of the downslope edge of the terraces
		7	Downslope edge of lower volcanic terrace		0.55	9° 51.74' – 83° 43.30' 9° 51.49' – 83° 43.15' Measured away from the fault intersection and perpendicular to fault trace
		7	Contact between Pliocene volcanic basement and lower volcanic terrace	~0.30		9° 51.07' – 83° 43.04' 9° 50.91' – 83° 43.01' Measured from intersection of fault

					scarp with trace of contacts
		7	Contact between Pliocene volcanic basement and lower volcanic terrace	~0.80	9° 51.07' – 83° 43.04' 9° 50.71' – 83° 42.43' Measured from intersection of fault scarp with trace of contacts. Displacement accumulated between two fault traces
Turrialba					
		7	Pleistocene volcanic unit and ridge on the southern flank of the Alto Florencia ridge (north flank of the Reventazón river valley)	~0.95	9° 51.96' – 83° 40.64' 9° 51.39' – 83° 40.64' Measured from trend of contact to fault trace
		7	Pleistocene volcanic unit and ridge on the southern flank of the Alto Florencia ridge (north flank of the Reventazón river valley)	~1.20	9° 51.96' – 83° 40.64' 9° 51.39' – 83° 40.33' Measured from trend of contact to eastern fault trace

* Estimates of fault displacement where topographic gradients are steep along the Reventazón River are considered accurate to approximately ±10 m. In all other areas topographic gradients are less steep and colluvial cover is more abundant, therefore the estimates of displacement are considered accurate to approximately ±100 m.

TABLE DR2: FOCAL MECHANISMS ALONG THE ATIRRO-RÍO SUCIO FAULT SYSTEM, COSTA RICA, M ≥ 4.0

Event no.*	Event timing†	Location§			Magnitude#	Mechanism**	
	DDMMYYHrMi	Latitude (°N)	Longitude (°W)	Depth (km)		Nodal Plane (Az/Dp/Rk)	P Axis (Az/Ln)
1[1]	1911871602	09.733	83.584	19	$4.5m_b$ $4.3M_s$	309/33/117	200/14
2[2]	3101882331	09.870	83.610	(15)	$4.8m_b$ $4.4M_s$	239/90/000	012/00
3[3]	2108901915	10.073	83.964	14	$4.4M_d$ $4.4m_b$	145/80/090	235/35
4[4]	2504910755	09.606	83.568	12	$4.7\ M_d$	273/33/075	194/77
5[4]	2504911432	09.888	83.503	14	$4.7\ M_d$	112/80/057	176/63
6[4]	2704912259	09.897	83.396	14	$4.0\ M_d$	103/60/052	167/82
7[4]	2904911249	09.761	83.910	23	$4.7\ M_d$	033/74/-021	256/64
8[5]	1405911953	09.866	83.525	21	$4.4m_b$ $4.2M_d$	171/74/-177	033/13
9[5]	1705910122	09.838	83.397	18	$4.0M_d$	220/52/043	161/03
10[6]	0506911134	09.983	83.775	06	$4.2M_d$	177/64/136	240/13
11[6]	0506911140	10.002	83.766	05	$4.0M_d$	180/40/-167	027/40
12[6]	2006910811	09.958	83.854	05	$4.3M_d$	050/70/-044	000/44
13[3]	0212922103	09.975	84.000	18	$4.0M_d$	250/85/-085	166/50
14[1]	0807932319	09.748	83.687	14	$4.7m_b$ $4.6M_s$	068/61/-042	032/50
15[3]	0907930200	09.755	83.688	16	$4.3M_d$	253/83/-029	206/26
16[7]	1007932041	09.756	83.677	14	$5.3m_b$ $5.6M_s$ $5.8M_w$	168/90/-180	033/00
17[1]	1307931510	09.724	83.657	13	$4.6m_b$ $4.8M_s$	260/73/-058	208/55
18[8]	1606970905	09.963	83.832	03	$4.0M_d$	221/48/039	164/08

* Focal mechanism numbers shown in figure 12. The superscripts refer to the data sources as follows: [1]Montero (2001); [2]Dziewonski et al. (1989); [3]Fernández and Pacheco (1998); [4]Barquero and Rojas (1994); [5]Fan et al. (1993); [6]Barquero et al. (1995); [7]Dziewonski et al. (1994); and [8]Fernández et al. (1998).

†Timing given as follows: DD = day; MM = month; YY = year; Hr = hour and Mi = minute.

§The location for Event 16 comes from the Costa Rica Regional Seismic Network (RSN). Depth in paretheses indicates centroid tensor moment (CMT) depth.

#Magnitude is given using the following formats: m_b = body wave magnitude; M_s = surface wave magnitude and M_d = duration magnitude

**Mechanism columns use the following abbreviations: Az = azimuth; Dp = dip; Rk = rake of slip vector measured from strike such that nodal plane dips to the right (i.e., using the right hand rule) and Ln is the inclination of the P axis.

TABLE DR3. MESOSCALE FAULT POPULATION DATA

Fault		Striae		Slip	T-axis		P-axis	
Strike	Dip	Trend	Plunge	Sense	Trend	Plunge	Trend	Plunge
FP 81 - Tajo Oriente, Río Pejibaye								
265	74	278	38	NL	321	14	219	39
318	82	321	20	TR	273	20	006	08
282	86	282	06	NL	327	01	237	07
216	87	025	75	NR	320	40	111	46
123	81	296	37	NR	249	18	351	32
102	70	107	13	NL	329	05	061	24
333	80	335	10	TR	289	14	019	00
055	84	234	05	TL	279	08	010	01
054	81	221	54	TL	290	43	171	27
340	70	154	15	NR	293	03	201	25
311	73	314	10	TR	268	19	177	05
318	64	323	11	TR	278	26	183	10
062	64	067	11	NL	287	10	022	26
075	48	089	15	NL	301	17	046	41
030	66	162	59	TL	267	63	135	19
038	68	190	49	TL	265	53	153	16
072	83	089	67	TR	005	48	143	34
076	78	112	70	TR	006	54	153	31
FP 82 - Tajo Esperanza, Río Atirro								
295	58	306	18	TR	259	36	163	09
303	80	305	13	TR	259	16	349	02
338	82	156	14	NR	111	04	203	16
067	57	243	07	TL	285	28	024	17
045	65	050	11	NL	270	09	005	26
336	85	336	05	TR	291	07	021	00
286	40	075	23	TL	118	55	231	15
112	80	115	15	TR	068	18	159	03
025	34	037	08	NL	243	29	005	43
038	50	048	11	NL	262	19	006	36
286	82	298	55	NL	349	29	229	43
054	84	231	30	TL	282	25	184	16
040	16	140	16	TL	144	61	318	29
097	85	099	20	NL	145	10	051	18
242	73	060	07	TL	105	17	197	07
050	81	053	16	NL	097	05	006	18
042	38	080	26	NL	281	14	037	60
234	38	254	15	NL	100	22	217	48
282	75	284	08	TR	239	16	147	05
092	76	266	21	TL	315	25	223	05
261	74	269	27	NL	312	07	218	31
065	77	242	12	TL	288	18	019	01
053	65	057	09	NL	278	11	013	24
083	40	226	27	TL	272	59	024	13
070	50	230	23	TL	278	47	019	10
259	85	078	12	TL	124	12	033	05
098	80	277	05	NR	053	04	322	11
085	67	228	55	TL	316	59	195	18
265	86	079	56	TL	144	39	023	32
FP 83 - Tajo Las Quebradas, Bajo Pacuare								
270	40	358	40	TR	348	85	179	05
186	53	228	41	TR	158	63	253	02
180	64	185	11	TR	140	26	045	10
283	57	013	57	TR	193	78	013	12
164	68	210	61	TR	104	62	239	21
152	68	193	59	TR	095	60	225	20
142	87	147	59	TR	080	40	206	35
170	74	189	49	TR	120	47	232	20
162	78	174	45	TR	112	40	220	21
154	58	161	11	TR	117	31	019	14
226	20	272	15	NL	103	29	254	58
295	75	319	57	TR	239	51	002	24