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Trenching in S. Jorge (Azores): the Cume da Fajã do Belo fault zone

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The island of S. Jorge (Azores) is a 55 km long, 6.7 km wide, WNW-ESE trending volcanic ridge that rises 1053 m above sea-level. The island, produced by basaltic fissural volcanism along WNW-ESE to E-W rift axis, presents active volcanism (3 eruptions since settlement in mid-15th century) and tectonics (active faulting and seismicity). The island's western region is dominated by two main fault zones (F.Z.), the WNW-ESE Picos F. Z. and the E-W Pico do Carvão F. Z, along which important volcanism occurred during the Upper to Middle Pleistocene (Rosais V. C.) and Holocene (Manadas Volcanic Complex). The eastern region, formed by the Middle to Lower Pleistocene Topo V. C., presents two major WNW-ESE trending fault zones with surface rupture: the Urze-S. João F. Z. and the Cume da Fajã do Belo F. Z. (C.F.B.F.).

Data obtained from neotectonic analysis and trenching on the C.F.B.F. is presented. The fault trace is marked by a ∼1.5 km long set of fault scarps, facing both to the north and south, forming narrow depressed areas (up to 10 m wide graben structures); further west and east the fault trace is interrupted by the north sea-cliffs. The southward facing scarps are dominant. Trenches were open across the main south-facing scarp and the southernmost northward-facing scarp. The north trench (15 m long), across a 2 m-high scarp, exposed the main fault linked directly to the scarp. The fault trends N55-66W and has an average dip of 65-75º to the south. Slickensides pitching 4º to 50º to the west indicate dextral normal slip. The upthrown (north) block is composed of weathered lapilli and scoria dusky-red tuff (unit 1) from the Topo V. C.; south of the fault this unit is below the trench floor. The succession in the downthrown (south) block is formed by: unit 2– a sequence of alluvial breccias dipping 10º to 15º to the south, truncated by an erosional surface dipping gently (∼10º) towards the fault; unit 3– a 45 cm-thick yellowish-brown clay containing occasional small (1-2 mm) basalt and scoria clasts, truncated by an erosional upper surface; unit 4– a 40 cm-thick olive-grey clay decreasing in thickness to the south, were it becomes discontinuous, truncated by an erosional surface that dips less than 5º to the north; unit 5– a 70 cm-thick wedge of colluvium containing small blocks of red scoria and lapilli (from unit 1) set in an earthy matrix; unit 6– a 40 cm-thick wedge of colluvium, formed by basalt and scoria clasts (from unit 1) set in an earthy matrix, which rests on the erosional upper surface of colluvium 5. The present soil (unit 7) completes the sequence. The fault surface exposed on the scarp is an almost uneroded free-face devoid of soil.

The two youngest C.F.B.F surface rupturing events, represented in the stratigraphy by colluvia 5 and 6, accumulated 2.7 m of dip-slip and were produced by paleoearthquakes with estimated Mw 6.6 and 6.9 (using Wells & Coppersmith's, 1994, M/MD correlation). At the base of the north sea-cliff, two littoral platforms may have been formed by landslides triggered by those earthquakes.

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Wells, D.L. & Coppersmith, K.J. (1994) New empirical relationships among Magnitude, Rupture Length, Rupture Width, Rupture Area, and Surface Displacement. Bull. Seism. Soc. Am. 84(4): 974-1002.