ANGRA DOS REIS: RECONCILIATION OF COMPOSITION AND TEXTURE, INVOKING IMPACT.

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Introduction: The angrite meteorites are ancient basaltic rocks from a highly differentiated body [1-5]. Angra dos Reis itself (AdoR) is unique in being a pyroxenite, not a basalt. By mineralogy and chemistry, AdoR has been interpreted as an igneous cumulate [1,6], but its texture (Figure [7]) suggests a more complex history.

AdoR Texture: AdoR consists of 93% fassaite pyroxene, with olivine, Mg-Fe spinel, merrillite, etc. [6]. The fassaite occurs in two textural patterns: poikilitic megacrysts up to 3 mm across, seen in thin section as disjoint grains in optical continuity; and equant 'groundmass' grains of ~100µm across (Figure [7]). Originally [6], groundmass grains were interpreted as cumulus and the megacrysts as intercumulus infill. Alternatively, [7] suggested that the megacrysts were porous phenocrysts, and that the groundmass represented devitrified magma. The former idea

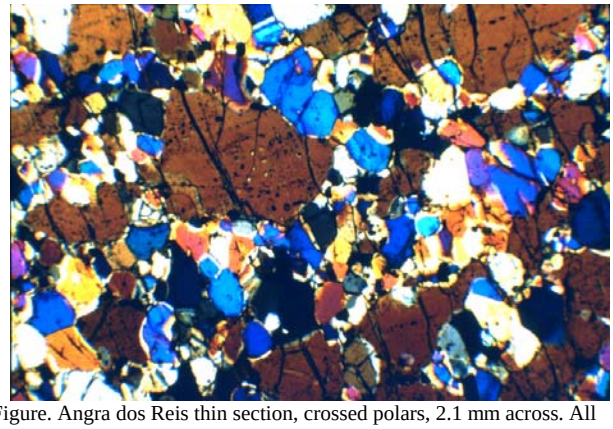

Figure. Angra dos Reis thin section, crossed polars, 2.1 mm across. All fassaite pyroxene. Megacryst of grains in optical continuity (brown), crossed by bands of smaller grains in random orientations.

is physically implausible [7], and the latter chemically difficult [1].

Yet Another Idea: By analogy with the 'granular bands' in the ALH 84001 meteorite [8], the 'groundmass' fassaite grains in AdoR could be interpreted as annealed [9] remnants of shock-deformed (or melted) material. The poikilitic megacrysts would be unrecrystallized remnants of original cumulus grains. This explanation reconciles AdoR's bulk composition (pyroxene cumulate) with its texture, at the expense of requiring a multi-stage history. The relatively young age of AdoR, 4557.6 versus 4564.4 Ma for quenched angrites [4,10], would then represent shock metamorphic equilibration. This evidence for strong shock deformation and extended cooling duration is consistent with the concept of an angrite planetesimal or dwarf planet [5].

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