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Characterization of a normal fault zone by ASM, physical and geochemical properties (Corinth Rift, Greece)

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Studied fault zone is located in the southern part of the Corinth Gulf. Indeed, this area presents numerous active normal faults, directed E-W and north-dipping, due to the N-S extension. Pirgaki, Aigion faults, two of the recent active faults, and others, are sampled for petrophysical and geochemical analysis. From the mineralogical analysis, the repartition of clays in limestones through the section allowed us to distinguish two strain phases: (1) a ductile phase characterized by a progressive evolution of Chlorite and Illite-Smectite interstratified concentrations from the footwall and hanging wall toward through the gouge zone; (2) a fragile phase characterized by Illite formation exclusively in the gouge zone. From the structural point of view, modifications while approaching the gouge zone were studied by combining different tools: SEM, AMS; Hg-injections, permeability, and accoustic waves propagation along 3 perpendicular directions. Firstly, in the damage zones, normal stresses induced a re-using of the previous compressive structures, and new structure are developed within the fault core and within few centimeters in the footwall and the hanging wall closed to the core. Secondly, the porosity shows a progressive evolution toward the gouge zone and the porosity geometry and connectivity is clearly anisotrope and controls the anisotropic permeability. Permeability is high (2 10-16 m 2) in the damage zone of the footwall and in the brittle part of the fault core. Porosity is measured by mercury injection test involves from 0.4% in the protolith to 6 to 13 % in the brittle part of the fault core. A

variation over two orders of magnitude is measured between these areas and the low permeability zone of the "ductile part" of the fault core. In the direction perpendicular to the fault plane, a lowest permeability value is measured, with a decrease over two orders of magnitude. Its preferential orientation will be presented and compared to the orientation of larger scale fractures population. Based on isotopic analysis (O, C, Sr), calcite cements formed during fault activities were classed as far as possible by relative geochronology, and divided in three groups. It appears that, in the first group, calcite precipitated from deep water probably interacting with the crustal basement, in the second group from marine water contaminated more or less with methane trapped in sediments, in the third group from meteoric water contaminated more or less with CO_2. The rule of each fault elements, associated to strain and physical properties in one hand, and to specific fluids in the other one, is discussed in a hydro-mechanical model. supported by GdR Corinthe