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Relationships between fluids and deformations in the Nankai accretionary wedge

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We present a study of the relationships between fluids and deformations in the Nankai accretionary wedge. This work is based on the results of the two recent 190 and 196 Ocean Drilling Program Legs. We center our study of the relationships between the onset of strains and fluid circulation in the decollement at the toe of the wedge. We first present an estimation of the fluid pressure in the formations above and below the decollement, from the study of the core measured porosity. It shows that the decollement is not a barrier for the fluid pressure, and we propose that the porosity discontinuity at the decollement is the result of a discontinuity of the stress state across the decollement. Then, we study the fluid chlorinity anomaly in the Shikoku Basin around the décollement. We show that this anomaly can be explained by clay compaction and smectite to illite transformation. We have also realized permeability measurements on wedge samples under stress with a triaxial press. These measurements are necessary to realize numerical simulations of the fluid circulation in the wedge. The measured permeabilities range between 10-18 and 10-19 m2. Samples rupture induces a permeability increase at low confining stress, but no permeability modification at a confining stress corresponding to the sample in-situ vertical stress. Next, we present a comparison of the core measured porosity and the porosity of the formation calculated from a resistivity log. We show that the decollement zone presents both compactive and dilatant strain structures. We estimate the fractures dilatancy of the decollement zone between 2 and 8 %. We propose an incremental model of decollement propagation coupling episodic fluid pressure transfer and mechanical deformation at the tip of the decollement. Finally, we present a 2D numerical study of the fluid pressure solitary

wave propagation along the decollement, supposing an effective pressure dependant permeability in the decollement zone. We show that the pressure waves can propagate rapidly along the decollement. Hydromechanical coupling between the stress state in the subducted sediments and fluid pressure in the decollement is proposed as a possible mechanism to initiate and maintain the pressure wave.