

Ambient vibration technique to explore mud volcanoes structure

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Mud volcanoes are characterized by emissions of fluids and fragmented sedimentary rocks that may create large structures with different morphologies. The development of these structures occurs due to the presence in the subsurface of a) clay-bearing strata that can be buoyant in the surrounding units and b) over-pressured fluids that facilitate the formation of diapirs through sedimentary rocks, as well as structural and/or lithologic discontinuities. Mud volcanoes have been observed and studied in different localities on the planet. In this framework, we tested ambient vibration methods, which are common tools used for site effect investigations aiming to assess the thickness of the sediments and the body wave velocities. The approach commonly used for this type of studies is based on the ratio of the horizontal to vertical components of ground motion (HVSr) and on passive array techniques. The HVSr generally enable to recognize peaks that point out to the fundamental frequency of the site, which usually fit quite well the theoretical resonance curves. The combination of HVSr and shear wave velocity, coming from passive array techniques, enables to collect valuable information about the subsurface structures. Here we present new data collected at mud volcano and sedimentary hosted hydrothermal system sites in order to investigate the depths of the main discontinuities and of the hypothesized hydrocarbon reservoirs. Our results indicate that the ambient vibrations study approach, represents a swift and simplified methods that provides quick information on the subsoil structure of the investigated areas. This methodology allowed us to delineate a preliminary sketch useful to plan more specific and detailed investigations settled to outline a comprehensive model of the explored targets.

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