

THE ORIGINS OF ABNORMAL FLUID PRESSURES

ORIGINS SUBCOMMITTEE, H.G.S. ABNORMAL PRESSURE STUDY GROUP

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ABSTRACT

This paper has been prepared to serve petroleum geologists who may be responsible for planning and executing drilling programs. Several modes of origin of abnormal fluid pressures are discussed: each contains a brief qualitative sketch of the nature of the related abnormal pressure, and where practical, some estimate of the value of pre-drilling detection techniques.

Abnormal fluid pressures are considered both within a reference framework of hydrostatic and hydrodynamic environments and in relation to potential energies within subsurface fluids. Various normal hydrostatic gradients are discussed, and a practical normal gradient for the Gulf Coast is justified.

The normal compactional process produces a stress system in sediments. The stress system is in equilibrium when the overburden pressure on a given rock equals the sum of the fluid pressure and the grain pressure within the rock. Processes which impose changes in the stress system may generate abnormal pressures, and several different modes of origin are analyzed in relation to the stress system. Abnormal pressures may be generated if changes in overburden pressure result from vertical compression, horizontal compression, or uplift. Abnormal pressures may also result if changes in fluid pressure result from fluid density contrast or recharge, or if some mechanical or physical processes inhibit the expulsion of fluid from compacting rocks, such as faulting, adsorption, osmosis, and diagenesis.