A robust and practical approach to VTI parameter estimation in a non-structural setting: case study from the Vulcan field, Alberta

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Natural gas exploration in a mature producing region requires the introduction of innovative techniques in order to optimize resource exploitation. One such approach involves interpreting the AVO characteristics of prospective gas targets in order to improve drilling success and overall project economics. Throughout the plains of Southern Alberta, an inherent problem in AVO analysis is the presence of strong Vertical Transverse Isotropy (VTI) within the marine shales of the Edmonton Group and Colorado Group. Published outcrop based refraction data in the Upper Colorado shales have documented velocity anisotropy in the order of 12%, further confirmed by the analysis of walkaway VSP data. Correcting for the non-hyperbolic moveout effects of VTI is not a new concept; however practical and robust estimation of the anisotropic parameters which underlie such a correction scheme is still a topic of great interest to the explorationist, especially in the absence of external information like walkaway VSP's, checkshot data, or detailed measurements of rock parameters.

In this paper we will demonstrate a robust approach to VTI parameter estimation which is consistent with our a priori assumptions of the underlying geology. Compared to conventional isotropic processing, this approach provides superior moveout correction of far offset data for the purposes of AVO analysis, as well as improved focusing in the poststack image. We will show real and synthetic data examples to illustrate the merits of the proposed VTI velocity correction methodology in the context of interpreting the Class II AVO response of the Belly River Group gas resource.