The Middle Devonian Marcellus Shale occurs at depths of 1.5 to 2.5 km, with formation temperatures of 49°C to 4°C, and is one of the longest gas plays in North America. Microbial activity to acids in acids in Marcellus Shale has been studied to compare the microbial community structure from a less mature, liquids-prone wet in Wetzel County and a more mature, gas-prone well in Marcellus County. West Virginia. Ester-linked phospholipid fatty acids were extracted from samples collected at selected intervals and the total yield and variety of PLFA (proxy for recent, viable microbore, and DGFA (proxy for non-viable or relic biomass) profiles were examined. A priori comprehensive study of these cores suggests that the sediments in these cores were deposited in different geologic settings, total of 22 different PLFA fatty acids and a total of 20 different DGFA fatty acids in the range of C11 to C24 were detected. They consisted of satuaded, branched, monounsaturated, polyunsaturated, cyclopropyl fatty acids, and their variations are presented in their relative proportions (mol%). The yield of PLFA lipid fatty acids and profiles were in the more mature liquids-prone well compared to the more mature gas-prone well, while the variety of PLFA lipid profiles was the same for both wells. The yield of variety of DGFA lipid profiles were also higher in the less mature liquids-prone well compared to the more mature gas-prone well. The combination of fatty acids present in both cores showed indications of a potentially diverse assemblage of both aerobic and anaerobic bacteria, fungi and yeasts, and other microbial biomarkers, sulfure reducing bacteria, and microbes indicating terrestrial and marine influence. In the Marcellus, this is a possibility because of the alternating anoxic and oxic depositional environmental conditions and the limited nutrient supply or starvations associated with fine grained deep subsurface shales formations. However, it is important to note that the samples described here do not account for the introduction of microbial cells during drilling, collection, and sample storage as well as present and previous engineering practices used in the well field that could alter lipid profiles and biomass. Currently, a science driven coring effort is underway to obtain pristine shale core samples from a science well at the Marcellus Shale Energy and Environment Laboratory (MSEEEL) at West Virginia University, where our analyses will be used to assess the extant microbial life within the shale, prior to energy development along with biologic derivatives of relic communities within the formation.