RAKHIT

PETROLEUM CONSULTING LTD.

PETROLEUM MIGRATION AND CHARGE MODELLING, MURZUK BASIN, LIBYA

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1.0 INTRODUCTION/BACKGROUND

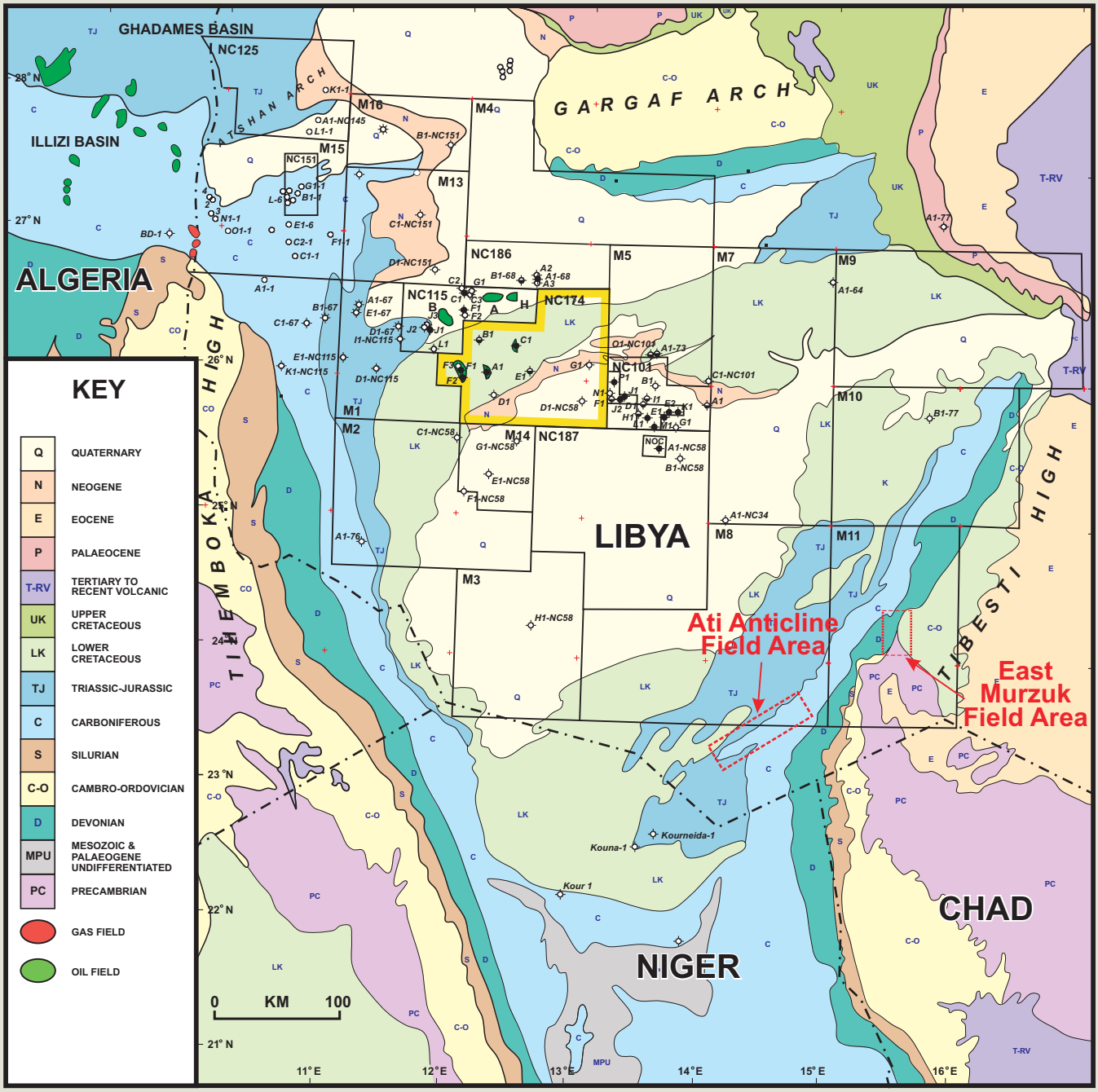
The study area for this project is the Murzuk Basin of southwest Libya, North Africa. The Murzuk is one of several incratonic sag basins present in north Africa. The Murzuk Basin is bordered by the Al Hamadah Basin in northern Libya and the Illizi Basin in Algeria to the west. The Murzuk Basin is bounded on three sides by prominent structural highs: the Tihemboka High to the west, the Gargaf (also called Al Quarqaf or Jabal Fazzan) Arch to the north and the Tibesti Uplift to the east (Figure 1). These structures together define the uplifted margins of the basin and each exhibits a wide Paleozoic outcrop belt at high topographic elevation. The southern edge of the study area is the border with Niger. The southern 250 km of the Murzuk Basin lies in Niger and was not analysed in this project.

The Murzuk Basin is an elliptical saucer-shaped intracratonic sag basin with a long diameter (north-south) approximately 880 km in length. The basin is 785 km wide at the centre narrowing towards its southern rim in Niger. The basin fill is predominantly Paleozoic and Mesozoic and the sediments are almost exclusively sandstones and shales, with rare limestones and no evaporites (Figure 2). The total sedimentary thickness is 3,500 m in the basin centre. The basin has been impacted by four major orogenic events: the Caledonian (pre-Devonian), the Hercynian (pre-Triassic), the Austrian (mid-Cretaceous) and the Alpine (Eocene-Oligocene). Major faults occur, which displace lower Paleozoic strata in excess of 600 ft. Most large faults appear to be concentrated in the central and western parts of the basin.

Figure 2 shows a composite stratigraphic column for the Murzuk Basin. The main petroleum reservoir is the upper Ordovician Memouniat Formation sandstone. Over parts of the basin, the upper Ordovician is absent and in many wells lacking Ordovician oil, the geology has not been differentiated beyond the designation Cambrian-Ordovician. Hence, the rock unit we are mapping is more properly called the Cambrian-Ordovician. The primary source rock in the basin is the Silurian Tanezzuft Formation and source rock facies of varying quality in the Tanezzuft Formation throughout the basin has been mapped. Where both formations are present, the Tanezzuft directly overlies the Memouniat. Mapping indicates that the entire Silurian section is absent over the northeastern quadrant of the basin. Basin modelling indicates that in the deeper parts of the basin, the organic shales of the Tanezzuft Formation have been oil generative since the late Devonian. As shown on the burial history curve for the B1-NC174 well (Figure 3), the Tanezzuft

entered the mid-mature oil window (0.7% Ro) in late Pennsylvanian time and started to generate late mature oil (1.0% Ro) during the late Cretaceous to Paleocene. Petroleum migration patterns since the late Pennsylvanian have changed in response to evolving basin structure and patterns of water flow. Since the basin was uplifted above sea level following the Hercynian Orogeny, meteoric water recharge at the exposed basin margins has complicated the pattern of oil migration and introduced the risk of flushing. Due to the complexity of the charge and flushing history of the basin, it was decided that further exploration in the basin may benefit greatly from petroleum migration modelling as a means of reducing risk.

Geology & Licence Map, Murzuk Basin



Map showing Geological Cross-Sections through the Ati Anticline.

RAKHIT PETROLEUM CONSULTING LTD.	JOB MBPM	BY DB	Geology & License Map Murzuk Basin	FIGURE 1
	DATE 05/25/2001	DRWN HJE		
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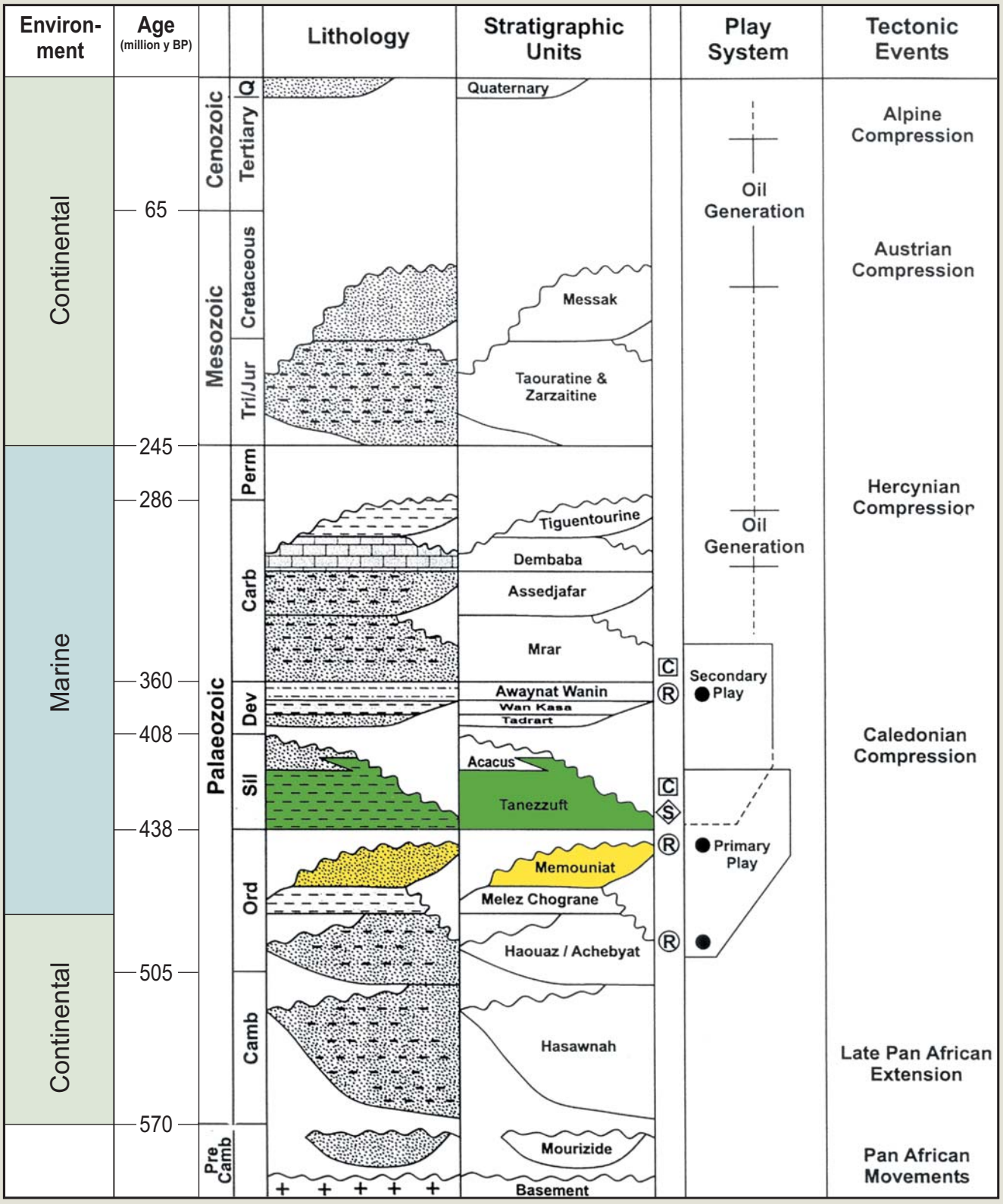
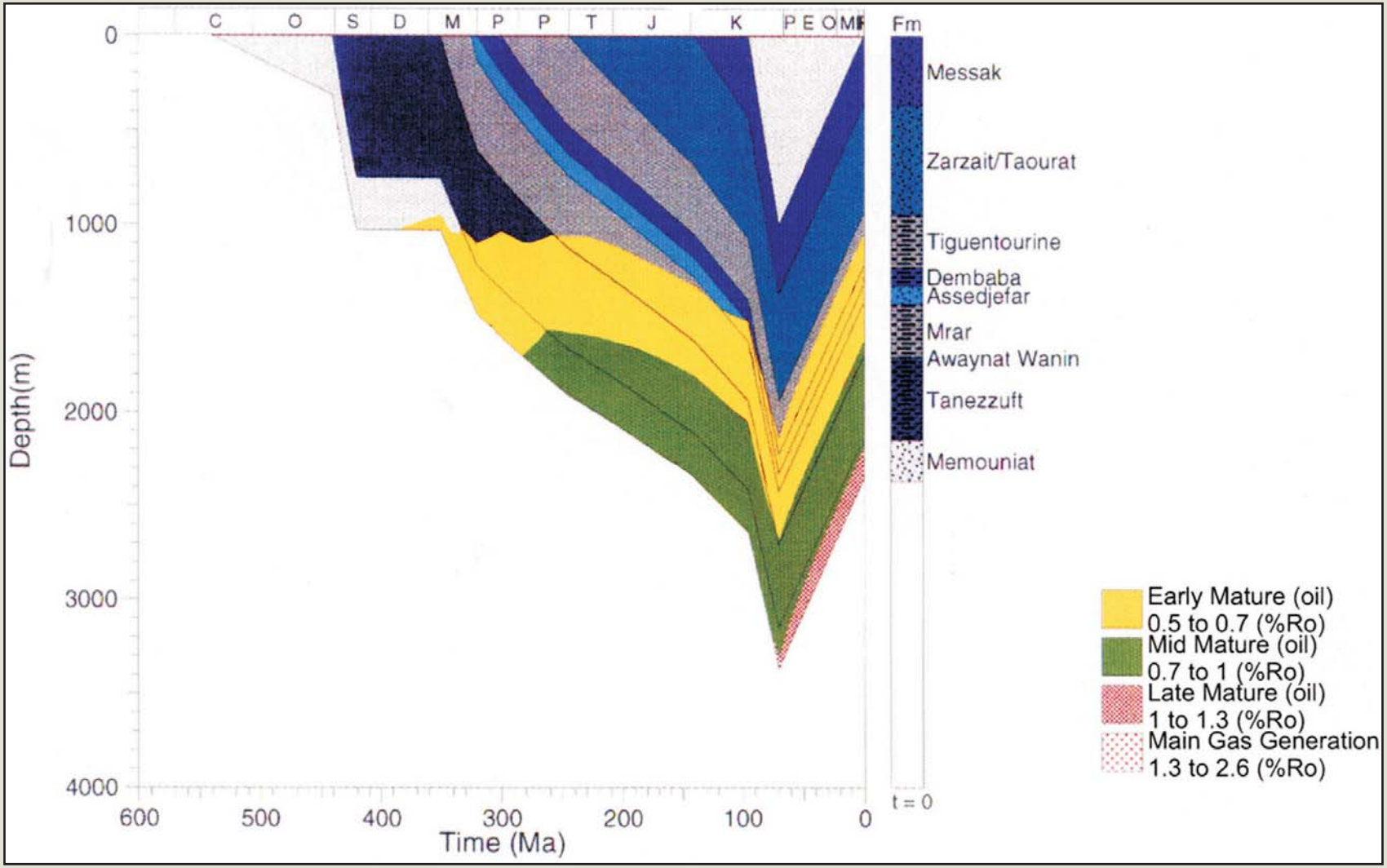


RAKHIT Petroleum Consulting Ltd.	JOB MBPM	BY DB	Stratigraphic Table Murzuk Basin
	DATE 05/29/2001	DRWN HJE	FIGURE 2
	FILE Figure02.cdr	CHKD DB	

Well B1-NC174 Basin Modelling



RAKHIT Petroleum Consulting Ltd.	JOB MBPM	BY DB	Well B1-nc174 Basin Modelling	FIGURE 3
	DATE 05/25/2001	DRWN HJE		
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