

NOTES

GEOLOGY AND HYDROCARBONS IN COOK INLET BASIN, ALASKA¹Thomas E. Kelly²

ABSTRACT

The Cook Inlet basin of south-central Alaska is an intermontane structural basin approximately 14,000 square miles in area, encompassing almost 80,000 cubic miles of sedimentary rocks ranging in age from Upper Triassic to Recent. The basin coincides with most of the northern part of the Matanuska geosyncline - an arcuate Mesozoic trough located at the northwestern end of the Pacific Cordilleran mobile belt.

The Cook Inlet sedimentary trough, as contrasted with the structural basin, is defined as a Paleozoic-early Mesozoic eugeosyncline that received sediments from volcanic islands which were part of the volcanic archipelago bordering the Pacific Coast of North America. Middle Jurassic epeirogeny transformed southern Alaska into arcuate geanticlinal and geosynclinal belts with the Cook Inlet basin beginning as a half graben created by complex faulting on the east flank of the Talkeetna geanticline.

The Mesozoic embayment that collected marine sediments and occasional nonmarine wedges abutting cratonic source areas was semienclosed or silled as the Kenai and Chugach Ranges began to emerge following the early stages of the Laramide orogeny. During the early Tertiary, an abundant supply of nonmarine clastic sediments and carbonaceous material was widely distributed in the subsiding intermontane basin.

The structural grain of the major tectonic elements describing the basin architecture is preserved in trends of local structure. Intense folding and faulting are exhibited on the north, east, and west flanks. Several major buried anticlinal trends extend in a northeasterly direction through the interior.

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¹Editor's Note: Mr. Kelly's talk before the Houston Geological Society on May 13 was based primarily on the above titled paper, first presented before the AAPG at Denver, Colorado on April 27, 1961 and subsequently published in Symposium Memoir #2, "The Backbone of the Americas - Tectonic History from Pole to Pole." However, the Tectonic Map (Fig. 1) published herewith has been revised to show the results of developments subsequent to publication of the original paper. As a matter of convenience to our readers the diagrammatic cross sections of the Cook Inlet Basin (Figs. 6 & 7 of the original paper) are also reproduced here (page 16).

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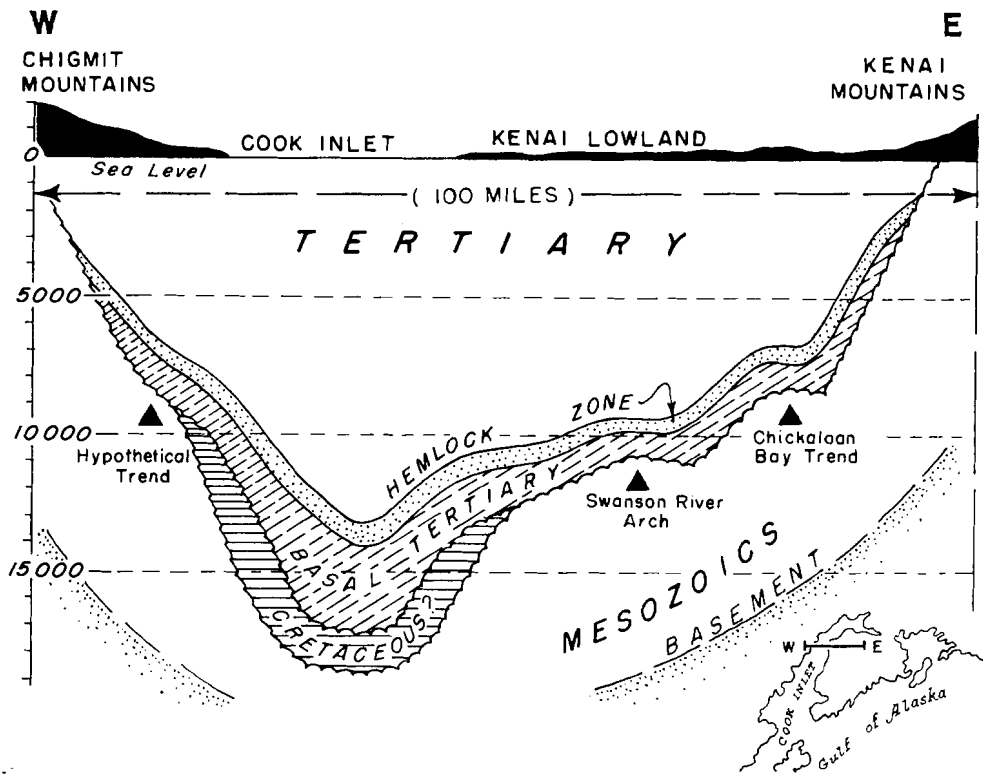


FIG. 6.—East-west diagrammatic structural cross section of Cook Inlet basin, Alaska.

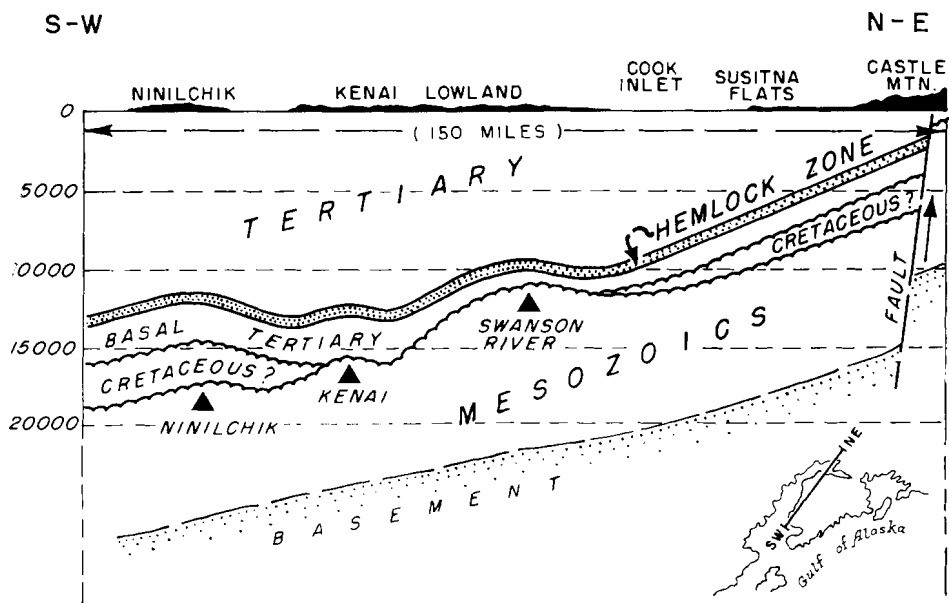
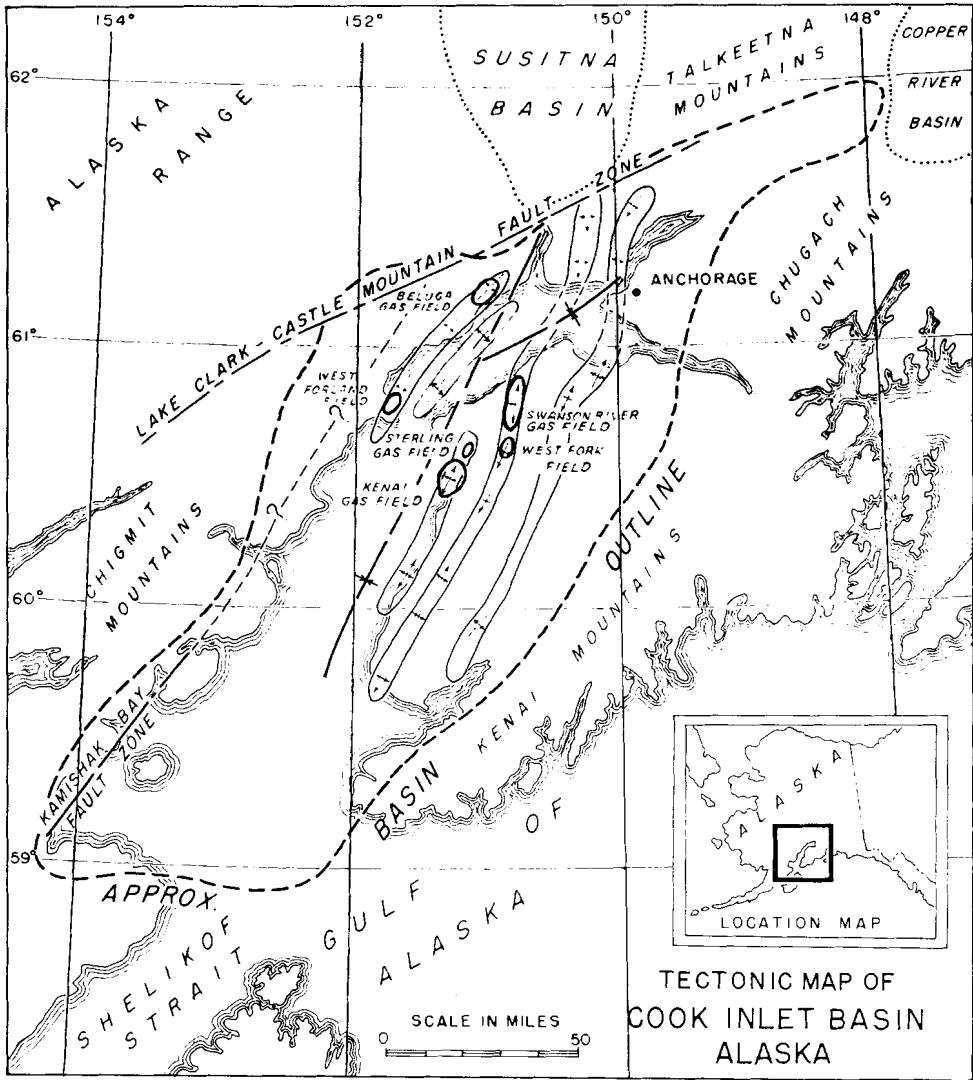


FIG. 7.—Northeast-southwest diagrammatic structural cross section of Cook Inlet basin, Alaska.



Mesozoic hydrocarbon accumulations associated with anticlinal traps are found on the western side of the basin. Minor quantities of oil, gas, and condensate have been produced from sandstones of the Middle Jurassic Tuxedni formation. The oil is believed to be indigenous to Jurassic beds.

Oil and gas accumulations in Tertiary beds will determine the significance of the Cook Inlet basin as an oil and gas province. Present oil production comes from the Hemlock zone, a sandstone and conglomerate unit near the base of the Tertiary Kenai Formation. Entrapment has been influenced by folding and faulting along trend of an interior basin high which lies adjacent and parallel to an

early Tertiary hinge belt. The Tertiary crude oils were probably derived from Eocene marginal marine strata or from upper Cretaceous marine shales which are unconformably overlain by the Tertiary sediments.

Significant quantities of gas - predominantly methane - are present in the loosely consolidated sands of the upper Kenai Formation. The two conditions necessary for gas accumulation anywhere in the basin are (1) abundance of lignite or coal beds in the section to serve as source rocks, and (2) a suitable trap.

The Cook Inlet basin is in its earliest stage of exploration and development. It is anticipated that many new fields will be discovered. Regional isopach maps of the interval between the Mesozoic beds and the base of the Hemlock zone are suggested as a basic approach to delineating old basin highs that may be sound Hemlock prospects. Cook Inlet should become a major gas basin regardless of its future as an oil province.