made use of this method in studying oil and gas prospects, in addition to structural geology and geophysics.

By use of organic geochemistry there was later developed a new method of semi-direct surveying based on the development of density patterns in the surface soil by analysis for certain inorganic substances. It naturally followed that any radioactive inorganic elements contained in the surface soil would allow the development of a similar concentration pattern which could be mapped by the use of highly sensitive radiation counters.

Serious radiation surveys were begun about ten years ago with the use of an ionization-type instrument of suitable sensitivity and stability. These instruments were built to order and required a considerable period of testing and improvement to prove their reliability.

With the new interest in uranium exploration stimulated by the building of highly sensitive scintillometer devices, these instruments have also become available for oil exploration.

The successful use of all types of sensitive radiation-measuring instruments depends on the proper handling of numerous factors that tend to create false radiation values. Obviously this method, like geochemistry, is not simple. It is the purpose of this paper to attempt to describe and evaluate all factors which must be taken into consideration before a survey can be completed and the correct conclusions reached.

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Differential Thermal Analysis: Correlative Tool Where Other Methods Fail

Differential thermal analysis (DTA) provides a valuable scientific method for determining correlation markers and mineral composition of zones. It is based on the accepted technique of identification of chemical compounds through measurement of thermal reactions as the cuttings or cores are subjected to a controlled temperature rise. The thermal curves, plotted in log form, illustrate changes in formation mineralogy, and graphically point out type and amount of clays, carbonates, oxides, quartz, etc. Mineral trends, breaks, and stringers supply correlative values independent of formation fluids, secondary electrical and radiation properties, and presence of paleontological specimens. Because it depends only on basic mineral composition, DTA can succeed where logs and paleo are not diagnostic. In addition, this technique provides information essential to the full interpretation of in-the-hole logging and of core analysis.

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Geochemistry and Migration of Meteoric and Connate Waters as Related to Geologic Structure

Data obtained during geologic and geochemical studies in several areas of the Sacramento Valley have suggested correlation between subsurface structure and the occurrence of a type of saline water in the shallow water-bearing deposits. Sufficient data have been collected to permit construction of subsurface contours on the base of fresh water. These contours, which reflect general structure in the Sacramento-San Joaquin Delta area, represent the interface between fresh water and a specific type of saline water. This connate water contains high concentrations of sodium and chloride ions, low concentrations of sulphate and nitrate ions, and approximately equal concentrations of iodide and bromide.

Under hydrodynamic conditions, fresh water in the foothills with considerable head has apparently flushed the saline waters out of a part of the marine sediments. In the Delta area this connate water has been forced upward from the marine sediments to the surface along faults and from truncated marine sediments on anticlinal structures.

There are numerous other ground-water anomalies which may indicate the presence of buried structural features. A characteristic type of water apparently associated with faulting may be noted in the shallow water-bearing deposits. This water commonly has higher temperatures and greater concentrations of silica and boron than the normal ground water. Further geochemical studies of this type may be of value to the petroleum industry.

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Marysville Buttes: Geological and Geophysical Analysis

Marysville Buttes is an extinct complex volcanic plug surrounded by steeply folded and faulted Cretaceous and younger sediments. It occupies a circular outcrop area of approximately 20 square miles, and forms a bold topographic feature rising above the flat low Sacramento Valley.

The Marysville Buttes intrusive developed during post-Eocene time with the piercement and doming of 7,500 feet of Upper Cretaceous and middle and upper Eocene beds by a rhyolite and andesite plug approximately 4 miles in diameter. It is believed later andesite formed the central core and progressively deformed the sedimentary beds. During late Pliocene to Pleistocene, showers of pyroclastics, crudely interbedded with mudflows, were deposited on the denuded dome. This formed a cone, which has subsequently been deeply eroded.

Beneath the valley floor near Colusa, a similar large plug which has been indicated by seismic and well records lies concealed beneath approximately 5,000 feet of Cretaceous and younger sedi-