deformed late Cenozoic non-marine strata by the Hidden Spring fault zone, a branch of the nearby San Andreas.

Northeast of the Orocopia schist a mile-wide wedge of gabbro, diorite, anorthosite, gneiss, and alaskite lies between a northeast-dipping fault, at places folded, and a high-angle major fault marked by great crushing. These rocks, intruded by volcanics and highly deformed, resemble rocks in the western San Gabriel Mountains, about 150 miles northwest.

Northeast of the high-angle fault, augen gneiss with migmatite on the southeast and granite on the north underlies unconformably about 4,800 feet of newly discovered fossiliferous marine Eocene strata which are probably correlative with Coast Range middle Eocene. Unconformably overlying this sequence is a 5,000-foot thick variable series of undated non-marine conglomerate, sandstone, shale, and tuff, with volcanic flows and intrusions. In this series, lenses of granitic breccia characterize the northwest, and platy tuffaceous sandstone with gypsum-bearing interbeds the southeast.

Major faults separate the area into tectonic blocks of different geologic history, and local correlation across the faults is not possible. Understanding of the significance of these faults and others in the vicinity, like the San Andreas, awaits regional study such as that now underway. Strike separations dominate over dip separations on minor faults associated with complex folds.

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Eocene Stratigraphy and Paleontology of Orocopia Mountains, Southeastern California

Marine Eocene strata underlie about 26 square miles in the northeastern Orocopia Mountains, Riverside County. The newly discovered section, which totals about 4,800 feet in thickness, lies in a structural trough within basement rocks and is overlain unconformably by about 5,000 feet of undated non-marine clastic and volcanic rocks.

The Eocene beds consist of interbedded siltstone, sandstone, and breccia with some sandy limestone and conglomerate. On the east, at the base of the section, large granitic boulders up to 30 feet in diameter lie along the unconformity with granite. These give way upward to thick lenses of coarse granitic breccia with interbeds of buff siltstone and arkosic sandstone. The upper part of the section on the east consists of massive buff siltstone with sandstone and boulder beds. On the west the section consists largely of interbedded siltstone and sandstone with conspicuous isolated boulders of granite.

Mollusks and Foraminifera, including orbitoids, occur at many localities throughout the section. Some of the characteristic forms are: *Turritella andersoni* cf. *lawsoni* Dickerson, *Turritella uvasana* cf. *applini* Hanna, *Clavilithes* sp., *Marginulina mexicana* (Cushman) var., *Pseudophragmina* (*Proporocyclina*) *psila* (Woodring) and *Pseudophragmina* (*Proporocyclina*) *clarki* (Cushman).

This fauna indicates middle Eocene age, and the strata are possibly correlative with similar rocks of the Coast Ranges.

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Aeromagnetic Study of Copper River Basin, Alaska

An aeromagnetic survey was made of approximately 6,000 square miles of the Copper River Basin, Alaska, in 1954 and 1955. North-south flight lines spaced one mile apart were flown from Latitude 61°45′ to 63°00′. The eastern and western borders of the surveyed areas are at Longitudes 145°00′ and 147°22′.

The magnetic patterns closely parallel the generally east-west arcuate geologic "grain" and seem to be correlative with lithology and with geologic structure. Outcropping areas of volcanic rocks are reflected by the configuration of the magnetic contours. A large area of low-amplitude magnetic anomalies extends from the Chugach Mountains north to about Latitude 62°30′. This area may possibly outline a structural basin of Tertiary age superimposed upon a depositional and structural trough of Jurassic and Cretaceous age. Anomaly-producing rock masses in this area are estimated to be a mile or more beneath the surface and are interpreted to be most deeply buried beneath the southern part of the Copper River Basin.

The magnetic data suggest that lower Jurassic volcanic rocks exposed in the Talkeetna and Chugach mountains underlie the marine and non-marine sedimentary rocks of the southwestern part of the surveyed area. The change in the magnetic pattern at the northern front of the Chugach Mountains is caused by a contact between these volcanic rocks and the younger sedimentary rocks on the north. The magnetic data suggest that the Wrangell lavas of Tertiary and Quaternary age are present at shallow depths beneath the basin in the vicinity of Mount Drum.

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Aeromagnetic Reconnaissance of Cook Inlet Area, Alaska

Fourteen aeromagnetic profiles were flown east-west across the Cook Inlet area in 1954, nine extending from about the Triumvirate and Capps glaciers to the Chugach Mountains, and five from the Iniskin-Chinitna Peninsula to the Kenai Peninsula. These profiles show several magnetic features that seem to have geologic significance.

The over-all arched character of the profiles suggests a block-shaped rock mass underlying Cook inlet at great depth. A 1,600-gamma anomaly was observed over Mt. Susitna, a granitic intrusion. A two-dimensional anomaly observed over Knik Arm may reasonably be attributed to a zone of buried granitic intrusive rocks continuous with the intrusive cropping out at Eklutna. This intrusive, or zones of intrusives, appears to deepen southward, reaching estimated depths of 5,000–6,000 feet at the lower end of Knik Arm. Anomalies observed over the Susitna flats indicate that the magnetic basement is buried 12,000–14,000 feet.

An abrupt magnetic rise of 300–400 gammas observed over the coast line of the Iniskin-Chinitna Peninsula is caused by a significant change in rock type, suggesting the possible existence of a fault with a vertical displacement of several thousand feet. East of this area, no near-surface anomaly-producing rock masses are present. It is likely that here the depth to magnetic basement is very great.

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Stratigraphic Classification and Terminology

Certain types of stratigraphic units are based primarily on objective features of rocks which are physically discernible or physically measurable, such as lithologic character, fossil content, and electrical character. Other types of stratigraphic units are of a more subjective nature and are based on interpretation, in terms of geologic age, environment of deposition, etc., of the evidence supplied by the various objective features.

Rock-stratigraphic and bio-stratigraphic units are dominantly objective; time-stratigraphic and eco-stratigraphic units are dominantly subjective. Countless pages of geological literature have been wasted in fruitless controversy merely because of failure to differentiate these two types of stratigraphic units by clear and precise systems of classification and terminology. Likewise, effectiveness in the application of stratigraphic thinking to petroleum geology has been impeded by the existing confusion in stratigraphic classification and terminology. An attempt is made here to bring out the proper relations between rock-stratigraphic, bio-stratigraphic, time-stratigraphic, eco-stratigraphic, and other kinds of stratigraphic units.

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Gravity Exploration

The relation between the gravity field of the earth and the various properties of the earth, its geology, and the mineral deposits is described. The instruments and methods used for investigating the gravity field of the earth and its anomalies are discussed, and, finally, the methods of interpreting the gravity anomalies, that is, the methods of determining the objectives of gravity exploration, are critically reviewed.

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Stratigraphy of North Coastal Area of Olympic Peninsula, Washington

A sequence of sedimentary and volcanic rock totaling more than 33,000 feet in thickness is exposed in the northern part of the Olympic Peninsula, Washington. These rocks range in age from early Eocene (?) to Miocene and occur in a structural belt that was undergoing deformation during most, if not all, of Tertiary time. Lithologic units recognized include the following, listed from oldest to youngest.

Unnamed sequence of argillite and graywacke
Crescent formation: splitic pillow lava, flow breccia, and tuff
Unnamed unit: siltstone
Lyre formation: conglomerate and sandstone
Twin River formation of Arnold and Hannibal, 1913 (to be redefined): sandstone and siltstone
Clallam formation: sandstone and conglomerate