1. The oldest nuclear volcanic regions and primary upheavals (*e.g.*, Yengr) existed during the Protogey geochron within the limits of the Aldan and Sino-Korea shields. After the consolidation of the early Archean mobile regions in interblock protogeosyncline subsidences, the Stanovik fold system formed. Later, around 1,900–1,800 m.y., a gigantic collapse (*Umbruch*) took place. During the last 300 m.y. of the Protogey geochron large sags developed.

2. During the 1,000 m.y. which comprised the Mesogey geochron, a calm, catastable regime predominated. At the beginning and end of the Mesogey, outbursts of volcanic activity occurred.

3. During the Neogey the following stages are distinguished. (a) The early Paleozoic, during which broad geosynclines formed. The geosynclines were filled mainly with terrigenous and carbonate material. The structures of the late Baikalides formed with widespread granitoid magmatism. (b) During the middle Paleozoic thick eugeosynclinal and miogeosynclinal downwarping occurred. (c) The late Paleozoic, an extension of the middle Paleozoic, was completed by orogenesis in the Mongol-Okhotsk, Sikhote-Alin, and Nippon systems. (d) In the Mesozoic several types of mobile regions and systems existed. The Verkhoyansk and Chukotsk geosyncline systems developed on weakly crushed basement with terrigenous sedimentation and trap-type magmatism. The Mongol-Okhotsk system formed on the depressed margins of rigid massifs. The Selenge-Yablonovyy and Stanovoy regions, with rift basins (Jurassic-Cretaceous), are uplifted mountain arches and block-faulted regions that developed on stabilized structures. They are characterized by continental sedimentation and intrusive (granitoid commonly alkaline) and effusive magmatism. The Chugoku (Japan), eastern Sikhote-Alin, Okhotsk-Chukotsk, and Nunivak (Alaska) regions are marginal-continental volcanogenic belts. Other regions were slowly evolving orthogeosyncline belts on the boundary between the continent and the ocean. (e) The Cenozoic was a period of intense mountain building accompanied by evolution of intermontane basins on continents and the formation of systems of island arcs in transitional continental-oceanic regions (Kuril-Kamchatka and Aleutian arc systems). During this time the accelerated rate of tectonic processes is apparent.

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Neotectonics of Arctic

The morphostructure and relief of the Arctic were formed chiefly by modern warping movements. The magnetic anomaly patterns of the Eurasian and the Scandic subbasin may be the result of successive inversions of strips of continental crust through time. To determine the total amount of warping which has occurred one must study the continental slope structure, where maximum warping may have taken place, and where the pre-Holocene section of the Arctic Basin may be studied.

Nonuniformity of neotectonic processes explains the various degrees of oceanization of the Arctic Ocean bottom. Oceanization has proceeded in orderly succession from the more ancient stabilized Atlantic to the young Pacific rim. The margins of the oceanized areas are the Laptev Sea, the East Siberian Sea, the Chukotsk and Beaufort Seas, the Canadian-Greenland shelves, and the Barents and Kara Seas. These surround the Amerasian subbasins that comprise the Arctic. The main feature contributing to the development of the Eurasian and the Scandic subbasins, in particular, has been the formation of the mid-ocean ridge, which extends through the Scandic basin and Eurasian basin.

A principal feature in the development of the modern continental structures has been the regular and repeated shift or orogenesis from the Atlantic Ocean to the Pacific through the areas of the present American and Eurasian basins. This repeated shift of orogenesis has formed symmetric chains in succession, from the ancient activated platforms of the Atlantic-Eurasian area to the modern Pacific geosyncline which is characterized by seismic activity and volcanism. The location of the zone of the Atlantic riftogenesis (Mid-Atlantic and Mid-Arctic Ridges) in the area of the most ancient stabilization (not younger than Caledonian) may account for the anomalous tectonic activity in this area during the latest stage of oceanization. The fact should be noted that the most active orogenesis occurred in areas of epi-Mesozoic platforms.

The main features of the modern morphostructural framework in the American and Eurasian continental structures also are inherited from Paleozoic morphostructures in the Atlantic (Scandic) coastal zone and Mesozoic morphostructures in the central Arctic (West Siberia, Central Siberia, northern Canada). The most recent morphostructures are (1) those inherited from the geosynclinal framework in Pacific coastal zones of epiplatform orogenesis and (2) the superimposed riftogenic activity which is outlined most clearly in the zones of oceanization.

The process of oceanization is observed in studies of the shelves, on Barents Sea-Kara Sea shelves in particular. Here, in the zones of ancient Paleozoic mobile belts, structural reconstruction is taking place. The ancient mountain ranges are being inverted into sags, grabens, and epicontinental troughs.

The concentric arrangement of the main elements of the modern Arctic geostructure with relation to the geographic pole may be related to the rotational regime of the earth. Considering the fact that this concentricity dates back at least to Mesozoic time, it is doubtful that significant migration of the poles can have taken place from late Mesozoic time to the present.

Another factor affecting the modern structures was the superimposition of glacial and ocean-water loads. The specific effect on the modern structures is determined by the structural features of the substrate.

The established directional regularity through time of the development of modern structure of the Arctic and the concepts regarding the Neogene-Quaternary riftogenesis and other activity, in particular, are based mainly on data from the Eurasian side of the Arctic. However, the similarity of the structure in the American Arctic provided a basis for extrapolating our observations to the whole Arctic region.

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Continental Shelf Structure and Sediments of Gulf of Anadyr

Interpretation of continuous seismic reflection profiles indicates that the continental shelf of the northwestern Bering Sea is underlain by up to 1 km of Tertiary and Quaternary sediments that were deposited in a basin formed by the subsidence of a lithified and folded Mesozoic basement complex. This Anadyr basin is evidently an extension of the depression containing up to 3 km of Tertiary strata below the Anadyr Lowland on the west of the Gulf of Anadyr. A basement sill extends eastward from the southwest corner of the gulf; apparently, the sill is the continuation onto the shelf of the Koryak Mountain structural province. Tertiary layers generally are little deformed over the basement sill, thus it is suggested that this broad arch has been in existence throughout the Tertiary. If the thick Tertiary deposits of the Anadyr, Bristol, Norton, and Chukchi basins are shallow marine in origin, the extent of an exposed Bering Sea shelf during the Tertiary may not have been as great as previously thought. Some draining of the shelf is suggested, however, near the end of Tertiary time by a distinct erosional unconformity below Quaternary sediments in the northwestern part of the Gulf of Anadyr.

On seismic profiles Quaternary sediments appear to be highly deformed across parts of the Anadyr shelf. These deformed Quaternary deposits are ascribed to continental ice encroachment on the shelf, and they define the outer limits of ice advance during the maximum glaciation as lying approximately along a line from St. Lawrence Island to a point 150 km east of Anadyr Bay, then south roughly parallel with the coast. Buried erosion surfaces and stream channels within the Quaternary sediments are evidence of sea-level fluctuations during that time.

Present bathymetry and the sediments and fauna of 1-m cores suggest a sea level stillstand at approximately −75 to −80 m. Lack of suitable material precludes dating of this stillstand.

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Organic Material in Modern Sediments of Arctic Ocean

The distribution and composition of the organic material in the modern sea and ocean sediments play a significant role in the process of sedimentation and in subsequent diagenesis.

Materials introduced by river flow, marine plankton, and to a lesser degree, benthonic organisms are the sources of the organic material in the sediments of the Arctic Ocean. These three sources do not have equal importance in the formation of the sea and ocean sediments.

River flow transports the principal organic components—allochthonous organic material which is transferred into the sea sediments. A less important source, plankton, provide the autochthonous organic material to the deep-sea sediments.

An analysis of much of the available data concerning the contents and distribution of the organic carbon in the sediments of the Arctic Ocean indicates close relations among the organic carbon centent, the character of the ocean water mass, the relief of the sea bottom, and the granulometric composition of the sediments.

The organic carbon content within the limits of 0.5–1.0% characterizes the general geochemical background of the sediments studied. A higher organic carbon content (1–2%) is observed (1) in the sediments of the Arctic seas that are affected by influx from the continents, and (2) in the sediments overlying the ocean ranges and continental slope in the areas where warm waters enter from the Atlantic and Pacific Oceans. The maximum organic carbon content (up to 3%) observed near the mouths of the large Siberian rivers, results from the transfer of organic material by continental river flow.

The minimum amount of organic carbon, less than 0.5%, is in the sediments of the deep ocean depressions, where the temperature of the bottom water is below zero. The concentration of organic material in the thin dispersion sediments is characteristic of the Arctic Ocean sediments.

Despite the small amount of data concerning the composition of the organic material, it has been found that the change of the diffused organic material is directed toward the bitumens.

Further study of the composition of the organic material and its distribution in the sediments will solve the problem of the tranformation of this material under Arctic lithogenetic conditions and the role of organic material in defining the medium of sedimentation.

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Tectonic Framework of Northern and Central Alaska

The traditional tectonic framework of northern and central Alaska, based on Payne's pioneering study of Mesozoic and Cenozoic history, is inadequate to accommodate new evidence of older tectonic events, revised general models arising from plate tectonics, and the current plethora of hypotheses, conflicting, concerning Arctic tectonics. New concepts must accommodate evidence suggesting (a) Precambrian eugeosynclinal terranes and subsequent fold belts in Romanzof Mountains, Seward Peninsula, Yukon-Tanana Upland, and central Alaska Range; (b) stable though negative conditions throughout Paleozoic time in Seward Peninsula and Yukon-Porcupine area; (c) early Paleozoic eugeosynclinal terranes and fold belts in and north of the Brooks Range, and thin carbonates and graptolitic shales in a zone parallel with, and southeast of, Payne's Ruby geanticline; (d) middle and late Paleozoic miogeosynclinal and south-directed clastic wedge deposition in Brooks Range; (e) successive initiation of later eugeosynclinal terranes between the Brooks and Alaska Ranges, from the Kuskokwim area during the late Paleozoic (largely sedimentary) northward to the Koyukuk area in early Mesozoic (largely volcanic), and subsequent northward progression of Cretaceous and Tertiary centers of clastic deposition across Brooks Range and North Slope; (f) disparity between patterns of Precambrian and Paleozoic elements of Alaska and those of the cordilleran tectonic regime, and possibility that Mesozoic and Cenozoic tectonic framework is inherited; and (g) gross translation of terranes in the Mesozoic and afterward, northwestward on Tintina fault and Livengood thrust zone, northeastward along Kaltag fault, Yukon-Porcupine lineament and thrusts in eastern Brooks Range, northward throughout the Brooks Range and Foothills thrust belt, eastward on thrusts in western Koyukuk area, and northward and eastward in Collier thrust belt on Seward Peninsula, as well as dislocation in Paleozoic time, evidenced by pre-Mississippian thrusting in the Romanzof Mountains.