UNITED STATES DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY

PRELIMINARY MAP (IN 2 SHEETS) SHEET 1

MESOZOIC AND CENOZOIC TECTONIC ELEMENTS OF ALASKA

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The rocks of the Brooks Range geanticline, Colville geosyncline, and Chukchi basin are believed to extend westward beneath the broad, shallow marine shelf north of Siberia. The geology of Wrangell Island, at about lat. 71°N., long. 178°E., is similar to that of the northern part of the Brooks Range.

The dominant structural grain in the area of the Chukotsky-Seward uplift strikes east and represents early Cretaceous and possibly Jurassic phases of orogeny and intrusion. Superimposed on this older grain are north- to northeast-striking folds and faults that probably represent the early Tertiary (Laramide) orogeny. The strike of the younger structures parallels those in the adjacent Koyukuk geosyncline.

The belt of lower Cretaceous (Neocomian) and older Mesozoic rocks shown in the area marginal to the Gulf of Alaska represents a thick and extensive stratigraphic sequence that includes marine volcanic rocks. The sequence constitutes the Cordova geanticline, where it is older than upper Cretaceous rocks of the Chugach Mountains geosyncline to the north. It is believed to underlie the thick Tertiary deposits of the Yakataga geosyncline and Middleton shelf. The Orca group of Prince William Sound represents this sequence. Neocomian fossils found in the outer islands of southeastern Alaska are the only fossils indicative of age. Jurassic rocks probably are included but are of different facies than those in the Matanuska geosyncline.

DESCRIPTION OF TECTONIC ELEMENTS

(For further details and abbreviations see table, Sheet 2. Age of negative elements refers to time of subsidence and to age of rocks accumulated therein. Age of positive elements refers to time of erosion or little or no accumulation.)

1. ARCTIC PLATFORM. Age: Pal., Tr., J, K1.
Source area during Pal. time. Pal. fms. wedge out northward toward platform. Thin accum. of Tr and J.

2. ARCTIC OCEAN BASIN. Age: K2 to Recent.

3. BEAUFORT SHELF. Age: K3 to Recent.
Seismic work along coast indicates shelf was constructed by outbuilding into Arctic Ocean of 4,000 ft. or more of marine K3 and possibly Cenozoic sed.

4. BARROW ARCH. Age: Mesozoic.
Buried structure on which basement slates (pC?) are at shallow depth and over which Tr, J, and K rocks thin or pinch out.

5. COLVILLE GEOSYNCLINE. Age: Tr, J, K1-2.
Tr and J rocks thin northward toward Arctic platform. K2 sed. were built upward (marine and nonmarine topset zones) and northward (marine foreset zones) into Arctic Ocean, which occupied the geosyncline.

6. UMIAT BASIN. Age: K3 and Paleocene(?).

7. CHUKCHI BASIN. Age: K3 and Paleocene(?).

8. MEADE ARCH. Age: K3 and Paleocene(?).
A north-trending element on which K3 and Paleocene(?) rocks of 6 and 7 are absent. Exposed rocks are K2.

9. TIGARA UPLIFT. Age: Tert.(?).
Pal., and Tr rocks upfaulted and lying adjacent to great thickness of Mesozoic rocks.

10. ROMANZOF UPLIFT. Age: Tert.
Exposes mostly Pal. and pC. Originally part of Colville geosyncline but uplifted in Tert. along east-striking thrust faults, with removal of Mesozoic rocks.

11. BROOKS RANGE GEANTICLINE. Age: J, K, Paleocene.
Exposes mostly Pal.; some pC and Tr. Source of sed. in 5, 6, 7, and 15.

12. KOBUK TROUGH. Age: Eocene(?).
A topographic trench with remnants of Eocene(?) rocks. Analogous to Rocky Mountain trench of Canada.

13. COLEEN BASIN. Age: Eocene.

14. CHUKOTSKY-SEWARD UPLIFT. Age: Mesozoic.
Exposes mostly Pal., pC, J-K intrusives. Source of sed. in 15.

15. KOYUKUK GEOSYNCLINE. Age: K1-2; possibly Tr-J.
Divided into two forks by Hogatza uplift.

16. HOGATZA UPLIFT. Age: K2-3 or Tert.
Exposes K1 rocks, including intrusives. K2 rocks of adjacent forks of Koyukuk geosyncline are absent, due to K or Tert. uplift.

20. RUBY GEANTICLINE. Age: J and K.
Exposes pC, early Paleozoic, J-K intrusives. Source of sed. in 15 and 26.

21. RAMPART TROUGH. Age: Eocene.
A topographic trench, occupied by Yukon R. and Hess Cr., in which are remnants of Eocene rocks.

26. KUSKOKWIM GEOSYNCLINE. Age: Tr, J, K1-3.

27. GOODNEWS ARCH. Age: K2-3.
Exposes pC, Pal., Tr, J, and K1. Source of K2-3 sed. in adjacent forks of Kuskokwim geosyncline.

28. EUREKA SEGMENT (OF 26). Age: K1-2; Tr-J(?).
Part of Kuskokwim geosynclinal trend.

29. KANDIK SEGMENT (OF 26). Age: Tr, K1-2; J(?).
Part of Kuskokwim geosynclinal trend.

30. NATION ARCH. Age: K or Tert.
Exposes Pal. and pC rocks.

31. EAGLE TROUGH. Age: Eocene.

32. TANANA GEANTICLINE. Age: J-K.
Exposes pC, Pal., J-K batholithic intrusives. Source of sed. in 26, 28, 29, and 39.

33. COAST MOUNTAINS GEANTICLINE. Age: J-K.
Exposes pC, Pal., Tr, J-K batholithic intrusives. Source of J and K1 sed. in 41.

34. HEALY TROUGH. Age: Tert.
Mostly coal-bearing Eocene.

39. ALASKA RANGE GEOSYNCLINE. Age: Tr, J, K1-3.

40. NUTZOTIN SEGMENT (OF 39). Age: Tr, J, K1-3.
Part of Alaska Range geosynclinal trend.

41. SEYMOUR GEOSYNCLINE. Age: Tr, J, K1.
Same trend as Alaska Range geosyncline.

43. TALKEETNA GEANTICLINE. Age: Jmu, K1-3.
Exposes Pal., Tr, J1, J-K intrusives. Source of sed. in 39, 40 and 47.

44. PRINCE OF WALES GEANTICLINE. Age: Jmu, K1-3.
Exposes Pal., J-K intrusives. Source of sed. in 41 and in belt of Mesozoic sedimentary rocks bordering Pacific Ocean.

46. ADMIRALTY TROUGH. Age: Eocene.

47. MATANUSKA GEOSYNCLINE. Age: Tr, Jlmu, K1-3, and Paleocene(?). Paleocene(?) reported only in Matanuska Valley but may underlie Eocene in Cook Inlet basin and in 48.

48. SHELIKOF TROUGH. Age: Tert.
Contains nonmarine Eocene, continuing northward under Quaternary of Cook Inlet basin. Marine Eocene, Miocene, and Pliocene(?), overlying nonmarine Eocene, reported only in southwestern part (area of Pavlof and Herendeen Bays and Unga I.).

50. SELDOVIA GEANTICLINE. Age: Jmu, K1-3.
Exposes Pal., Tr, and J1 rocks.

51. CHUGACH MOUNTAINS GEOSYNCLINE. Age: K2(?), K3.
Mostly K3 but probably underlain by some K2 rocks.

52. CORDOVA GEANTICLINE. Age: K2-3.
Exposed rocks believed to be mostly J and K1. Possibly a source of K2-3 sed. in Chugach Mountains geosyncline.

53. YAKATAGA GEOSYNCLINE. Age: Tert.
Max. thickness more than 20,000 ft. (much greater than depth of Aleutian trench and Pacific floor). Includes Eocene, Oligocene, Miocene, and Pliocene.

54. MIDDLETON SHELF. Age: Tert.
Probably composed of Tert. rocks, built southward in shelf form. Continuous with but probably thinner than Tert. in Yakataga geosyncline.

55. SHUMAGIN SHELF. Age: Tert.(?).
Continuation of Middleton shelf. Similar history(?).

56. ALEUTIAN TRENCH. Age: Quaternary and Tert.(?).
The part adjacent to Middleton shelf is believed to be an area of thick Quaternary sedimentary accum. Subsid. and accum. may have begun in Tert.

CENOZOIC BASINS: 17, 18, 19, 22, 23, 24, 25, 35, 36, 37, 38, 42, 45, 49.

History of basins described below in 6 stages. For some stages two interpretations are possible, indicated as (a) or (b). For some basins (a), and for others (b), may be applicable.

(1) Paleocene(?) orogeny and erosion. Alaska reduced to surface of low relief.
(2) Eocene sedimentation. Subsid. and accum. greatest in basin areas.
(3) Post-Eocene deformation and erosion. Alaska again reduced to surface of low relief.
(4) Post-Eocene Tert. sedimentation, including Miocene(?).
  (a) Subsid. of basin areas renewed, with thick accum.
  (b) Little or no subsid. and accum.
(5) Strong Pliocene uplift and erosion.
  (a) Differential uplift; present highlands uplifted but not basins. Tert. preserved in basins. Basins topographically low because tectonically negative.
  (b) Both basin and highland areas uplifted. Most of Tert. sed. removed from basins. Basins topographically low because of removal of Tert. fill.
(6) Quaternary sedimentation.
  (a) Subsidence of basins with possibly thick accum. Applies to Middle Tanana basin, where Quaternary deposits below sealevel have been reported in well. May apply to other basins.
  (b) Little subsid. of basins. Quaternary deposits less than 500 ft. thick.

Marine Tert. fossils, probably Miocene, have been found in basal Quaternary deposits near Fairbanks at north edge of Middle Tanana basin (Troy L. Péwé, personal communication). They are believed to have been derived from marine Tert. rocks deposited in Yukon-Tanana plateau region and removed during Pliocene uplift. If (4a) and (5a) apply to Middle Tanana basin, marine Tert. rocks might be preserved there. They might also be present in other basins. Marine Tert. fossils have been reported in Nushagak basin (17th Ann. Rept., U. S. Geol. Survey, pp. 844-145, 847; 1896).

EXPLANATION

SEDIMENTARY ROCK UNITS

Pattern for area of given tectonic element represents youngest rock unit deposited in that area.)

Cenozoic. Underlying unit shown where age may be inferred. Quaternary deposits, known to be or possibly underlain by Eocene and younger Tertiary.

Tertiary, Eocene (?) and younger. Underlying unit shown where age may be inferred. Includes only those bodies of Tertiary rocks not lying in Quaternary basins and not extensively overlain by Quaternary deposits.

Cretaceous, upper part (Turonian-Campanian); and older Mesozoic rocks. Includes in some areas Paleocene (?) rocks that are conformable with Cretaceous rocks and that predate the early Tertiary orogeny (Laramide). Intruded by early Tertiary igneous bodies in 26, 39, 47, 51.

Cretaceous, middle part (Albian and Cenomanian); and older Mesozoic rocks. Intruded by Tertiary (?) igneous bodies in 15, 26, 39.

Cretaceous, lower part (Neocomian), and (or) Middle and Upper Jurassic; and older Mesozoic rocks. Intruded by Jurassic and (or) early Cretaceous igneous bodies in southern part of 5 and in 16, 28, 39, 40, 41.

Paleozoic and (or) pre-Cambrian. Includes Triassic and Lower Jurassic in some areas. In most areas includes igneous bodies of Jurassic and (or) early Cretaceous age; many are of batholithic size.

Most tectonic elements south of Brooks Range include bodies of Cenozoic extrusive rocks, some of large size. Active volcanoes in Aleutian Islands, Alaska Peninsula, Aleutian Range, and Wrangell Mountains

Topographic basin. Known to be or possibly caused by Cenozoic tectonic movement.

Boundary of tectonic element.

Geanticline or arch, indicating general strike of folds, faults, cleavage, and foliation. Arrow indicates plunge.

Geosyncline or trough, indicating general strike of folds, faults, cleavage, and foliation. Dotted where geosynclinal deposits have been uplifted and mostly eroded. Arrow indicates plunge.

Scale 1:5,000,000

50 0 50 100 150 Miles

Submarine contours in fathoms

Base from Alaska Map A

DEFINITION OF TECTONIC TERMS

GEANTICLINE: A large linear positive element that was either uplifted and a source of sediments or was an area of little or no accumulation. Comprises a belt of relatively old rocks flanked by belts of younger rocks.
ARCH: Similar to geanticline but not as extensive.
UPLIFT: Similar to geanticline but nonlinear in form.
GEOSYNCLINE: A large linear negative element in which sediments accumulated. Comprises a belt of relatively young rocks flanked by belts of older rocks.
TROUGH: Similar to geosyncline but not as extensive.
BASIN: Similar to geosyncline but nonlinear in form.
PLATFORM: A shieldlike element that was either emergent as a source of sediments or slightly submergent as an area of relatively little accumulation.
SHELF: A body of sediments built outward into an ocean.
GEOSYNCLINAL SEGMENT: A part of a geosynclinal trend that is separated from the main geosynclinal mass by uplifted older rocks.