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GEOLOGIC MAP OF SOUTH AUGUSTINE ISLAND, LOWER COOK INLET, ALASKA

By Richard T. Buffler

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INTRODUCTION

Mesozoic fossils in sedimentary rocks along the beach and in stream gulleys on the south flank of Augustine Island were first discovered by U.S. Geological Survey geologists in 1972. On the basis of fauna and lithologic similarity, most of these rocks were correlated with the Upper Jurassic Naknek Formation found nearby along the west side of Cook Inlet and on the Alaska Peninsula to the south (Detterman, 1973; Detterman and Jones, 1974). One outcrop area containing Upper Cretaceous fossils was tentatively correlated with the Kaguyak Formation exposed to the south in the Katmai area (Detterman and Jones, 1974). Prior to this discovery, the sedimentary rocks on south Augustine were thought to be only Tertiary in age (Detterman, 1973). Although subsequent visits by the USGS and other field parties (mainly petroleum companies) confirmed the presence of Mesozoic rocks, the exact distribution and nature of the rocks still was not known. There even was some doubt as to the actual presence of Tertiary rocks on the island.

Interest generated by these discoveries prompted the Alaska Division of Geological and Geophysical Surveys to sponsor a brief reconnaissance geologic field investigation of the outcrop area. The purpose of this investigation was to describe and map in more detail the sedimentary rocks on the south side of Augustine Island. Approximately 1 week was spent in the field during July, 1974.

ACKNOWLEDGMENTS

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PRELIMINARY RESULTS AND CONCLUSIONS

The main result of this quick reconnaissance study is the accompanying geologic map and brief description of the rocks. Most of the important descriptive information is presented in this manner. A few additional comments, however, regarding the environments of deposition, regional setting, and geologic history are included below.

1. The eastern subfacies of the lower Naknek sandstone unit (Jn_1) contains abundant ripple cross bedding, including flaser bedding. The latter sedimentary feature apparently is typical of sandy tidal-flat environments. The adjacent sandstone channel grades into finer material toward the top and may represent some type of point-bar sequence deposited in a tidal channel or fluvial channel cutting S-SE across the

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sandy tidal flats. A nonmarine origin is supported by the complete lack of fossils in this entire unit, whereas marine fossils are abundant in the two overlying units.

2. The middle siltstone and sandstone unit (Jn_2) contains marine pelecypods that "indicate a very shallow, marginal marine environment with brackish water nearby" (Detterman and Jones, 1974). The abundant ripple and small-scale cross bedding indicate significant wave or current action in shallow water, while the abundant organic debris (including logs) suggests a nearby land source. Perhaps these sediments were deposited in some type of restricted marine environment such as a protected shelf, bay, or estuary.

3. The upper sandstone unit (Jn_3) apparently represents some type of "high energy" beach or shallow marine bar environment, possibly located just seaward and protecting a restricted bay or estuary represented by the underlying unit. The flat or gently inclined bedding, small-scale cross bedding, and large-scale cross bedding are all sedimentary features found in sandy, shallow marine environments such as offshore bars or the foreshore and shoreface zones. Marine pelecypods similar to those in the middle unit are found throughout this unit, further substantiating the "very shallow, marginal marine environment" (Detterman and Jones, 1974).

4. This three-part section suggests a depositional model involving a marine transgression from a sandy tidal-flat environment through a protected bay environment to a higher energy beach or offshore bar environment.

5. There are no distinct sedimentary features in the Upper Cretaceous beds to further refine its depositional environment. The marine fossils "indicate deposition in a neritic environment" (Detterman and Jones, 1974).

6. The Mesozoic sedimentary rocks dip seaward, away from the central core of Augustine volcano, indicating that uplift was related to the origin of the volcano. These tilted rocks, however, are overlain by horizontally bedded volcaniclastics (Q_1), which may represent the initial stages of volcanic eruption after uplift of the sediments. Perhaps this tilting represents doming by the volcano along the south side of an east-west fracture zone just prior to the initial eruption. An east-west fault zone is suggested by geophysical studies of the University of Alaska Geophysical Institute, which indicate the sedimentary rocks are several thousand feet lower on the north side of the volcano. This zone may have provided the initial conduit or zone of weakness for the volcano. Numerous small faults in the sedimentary rocks radiate away from the volcano and probably represent tensional fractures associated with the doming.

7. The sandstone outcrops located along the west end of the beach section are correlated with the upper sandstone unit (Jn_3) based on fossils, color, sedimentary texture, and sedimentary structures. The location of the rocks, however, and its erratic strikes and dips suggests that it represents a large landslide block, which may have slid down the dip slope of the underlying siltstone unit.

8. The outcrop area appears to consist entirely of a conformable section of Naknek Formation plus the Upper Cretaceous rocks along the western edge of the map area. No evidence was found for any Tertiary rocks in the area, although Tertiary fossils were reported earlier from outcrops along the beach (Detterman, 1973). These "Tertiary" outcrops appear to be the same outcrops that contain Upper Jurassic pelecypods later reported by Detterman and Jones (1974). This apparent lack of Tertiary on Augustine suggests that the Cook Inlet Tertiary Basin may not extend westward into the Kamishak Bay area. This could have some bearing on future petroleum exploration in lower Cook Inlet.

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