Tectonic Growth of a Collisional Continental Margin: Crustal Evolution of Southern Alaska

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THE
GEOLOGICAL
SOCIETY
OF AMERICA

Special Paper 431

3300 Penrose Place, P.O. Box 9140 ■ Boulder, Colorado 80301-9140

2007

Published by The Geological Society of America, Inc.
3300 Penrose Place, P.O. Box 9140, Boulder, Colorado 80301-9140, USA
www.geosociety.org

Printed in U.S.A.

GSA Books Science Editor: Marion E. Bickford

Library of Congress Cataloging-in-Publication Data

Tectonic growth of a collisional continental margin : crustal evolution
of southern Alaska / edited by Kenneth D. Ridgway . . . [et al.].
p. cm. — (Special paper ; 431)
Includes bibliographical references and index.
ISBN-13: 978-0-8137-2431-7 (pbk.)
1. Geology, Structural—Alaska. 2. Plate tectonics—Alaska. 3.
Continental margins—Alaska. 4. Geology, Stratigraphic—Cenozoic. I.
Ridgway, Kenneth D., 1958–
QE627.5.A4T435 2007
551.809798—dc22
2007018635

Cover:

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10 9 8 7 6 5 4 3 2 1

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Preface

INTRODUCTION

The convergent margin of southern Alaska is considered one of the type areas for understanding the growth of continental margins through collisional tectonic processes (e.g., Coney et al., 1980; Plafker and Berg, 1994). Collisional processes that formed this margin were responsible for multiple episodes of sedimentary basin development, subduction complex growth, magmatism, and deformation. Two main collisional episodes shaped this Mesozoic-Cenozoic continental margin. The first event was the Mesozoic collision of the allochthonous Wrangellia composite terrane. This event represents the largest addition of juvenile crust to western North America during the last 100 m.y. The second event is the ongoing collision of the Yakutat terrane along the southeastern margin of Alaska. This Cenozoic event has produced the highest coast mountain range on Earth (Saint Elias Mountains), the Wrangell continental arc, and sedimentary basins throughout southern Alaska. Active collisional processes continue to shape the southern margin of Alaska, mainly through crustal shortening and strike-slip deformation, large-magnitude earthquakes, rapid uplift and exhumation of mountain belts, and high sedimentation rates in adjacent sedimentary basins. The objective of this publication is to integrate new geophysical and geologic data, including many field-based studies, to better link the sedimentary, structural, geochemical, and magmatic processes that are important for understanding the development of collisional continental margins.

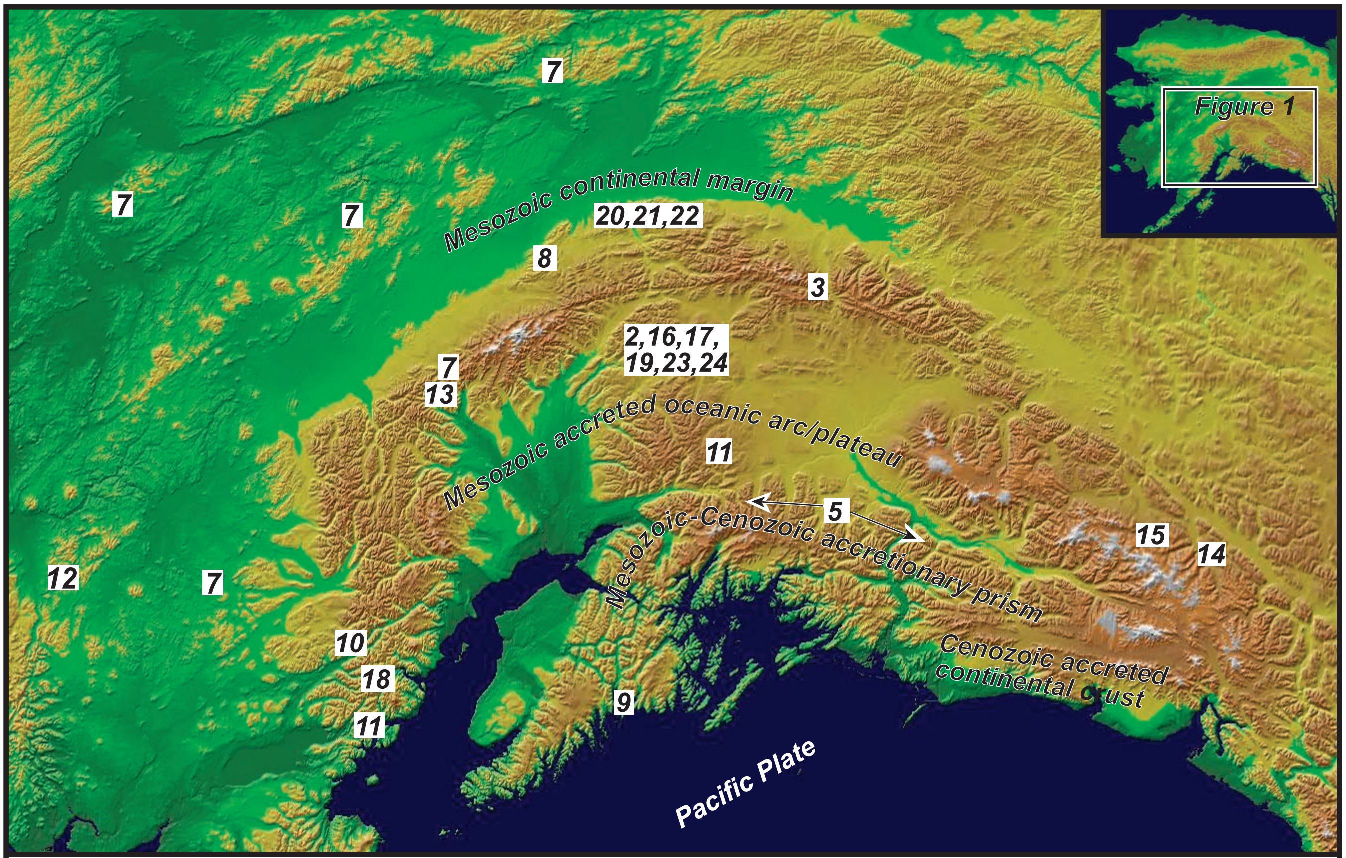
VOLUME HIGHLIGHTS

Papers in this volume are divided into four main groups: syntheses of the regional geophysical and geological framework (Chapters 1–7); Mesozoic magmatism, deformation, and basin development (Chapters 8–17); Cenozoic magmatism, deformation, and basin development (Chapters 18–22); and investigations with bearings on mineral exploration (Chapters 23–24). Figure 1 shows the general location of the study area discussed in each chapter. A summary of the central themes of individual papers follows.

Regional Crustal Structure and Geologic Framework

Chapter 1. Rick Saltus, Travis Hudson, and Ric Wilson integrate geophysical and geological data to examine the crustal characteristics of southern Alaska. Aeromagnetic and gravity data demonstrate that dense, highly magnetic crust >40 km thick extends >1500 km across southern Alaska. This major geophysical feature, known as the southern Alaska magnetic high, corresponds with the previously mapped extent of the accreted Wrangellia and Peninsular terranes. The authors propose that the geophysical character of this feature is a product of discrete episodes of mafic magmatism within the Wrangellia and Peninsular terranes during Late Triassic and Early Jurassic time, respectively. Results of this study provide insight on both the geophysical properties and geologic evolution of accreted crustal fragments that make up much of southern Alaska.

Chapter 2. Jonathan Glen, Jeanine Schmidt, Louise Pellerin, Darcy McPhee, and Mike O'Neill present new geophysical data that help characterize the crustal structure of the suture zone between accreted oceanic terranes and the Mesozoic continental margin. Prominent gravity, magnetic, and magnetotelluric gradients reveal a 2–8-km-deep, steeply northwest-dipping crustal discontinuity. This crustal break is located approximately where the previously mapped Talkeetna fault juxtaposes the accreted Wrangellia terrane against Jurassic–Cretaceous basinal strata (Kahiltna assemblage). Results of this study provide insight on the nature



Regional crustal structure and geologic framework
1 - Saltus, Hudson, and Wilson - Regional geophysical features and crustal evolution of southern Alaska
2 - Glen, Schmidt, Pellerin, McPhee, and O'Neill - Geophysical character of the Talkeetna Mountains
3 - Fisher, Pellerin, Nokleberg, Ratchkovski, and Glen - Geophysical character of the Denali fault system
4 - Trop and Ridgway - Sedimentary record of Mesozoic-Cenozoic convergent margin tectonics
5 - Pavlis and Roeske - Cretaceous-Cenozoic deformation along the Border Ranges fault system
6 - Nokleberg and Richter - Cretaceous-Cenozoic reconstruction of collisional tectonics
7 - Bradley, McClelland, Wooden, Till, Roeske, Miller, Karl, and Abbott - Detrital zircon record of interior Alaska

Mesozoic Magmatism, Deformation, and Basin Development
8 - Till, Harris, Wardlaw, and Mullen - Stratigraphic links between Triassic rocks in the Alaska Range suture zone
9 - Kusky, Glass, and Tucker - Mesozoic suprasubduction zone ophiolite, Chugach Mountains
10 - Amato, Bogar, Gehrels, Farmer, and McIntosh - Mesozoic suprasubduction zone ophiolite, Lake Clark region
11 - Amato, Rioux, Kelemen, Gehrels, Clift, Pavlis, and Draut - Mesozoic volcanic record of the Talkeetna oceanic arc
12 - Miller, Bradley, Bundtzen, Blodgett, Pessagno, Tucker, and Harris - Mesozoic basin development, southwest Alaska
13 - Kalbas, Ridgway, and Gehrels - Mesozoic collisional basin developent, western Alaska Range
14 - Manuszak, Ridgway, Trop, and Gehrels - Jurassic-Cretaceous collisional basin development, eastern Alaska Range
15 - Snyder and Hart - Cretaceous magmatism within the Wrangellia terrane, eastern Alaska Range
16 - Hampton, Ridgway, O'Neill, Gehrels, Schmidt, and Blodgett - Mesozoic stratigraphic framework, Talkeetna Mountains
17 - Davidson and McPhillips - Along-strike changes in metamorphism within the Alaska Range suture zone

Cenozoic Magmatism, Deformation, and Basin Development
18 - Amato, Foley, Heizler, and Esser - Cretaceous-Cenozoic magmatism in southwestern Alaska
19 - Cole, Layer, Hooks, Cyr, and Turner - Cenozoic post-collisional magmatism and deformation, Talkeetna Mountains
20 - Ridgway, Thoms, Layer, Lesh, White, and Smith - Cenozoic foreland basin development, Alaska Range
21 - Bemis and Wallace - Active deformation within a Neogene fold-and-thrust belt, northern foothills, Alaska Range
22 - Lesh and Ridgway - Geomorphic record of active deformation and foreland basin development, Tanana basin

Tectonic Configuration of Southern Alaska - Bearings on Mineral Exploration
23 - Glen, Schmidt, and Morin - Geophysical crustal structure and mineral exploration, northern Talkeetna Mountains
24 - Schmidt and Rogers - Exploration models for mafic-ultramafic mineralization, Talkeetna Mountains/Alaska Range

Figure 1. Digital elevation map of southern Alaska showing location of studies in the volume. Inset shows map area. Chapters 1, 4, and 6 provide regional syntheses that cover most of the map area.

of the crust upon which various sedimentary basins within the Alaska Range suture zone formed, and thus complements several chapters that center on basin development within the suture zone (Chapters 12, 13, 14, and 16).

Chapter 3. Mike Fisher, Louise Pellerin, Warren Nokleberg, Natalia Ratchkovski, and Jonathan Glen integrate geophysical and geologic data to better characterize the geometry of the Denali fault system; they also interpret two stages of deformation within the Alaska Range suture zone. Their results provide insight on compressional structures attributable to Mesozoic collision of the Wrangellia composite terrane and strike-slip structures related to Cenozoic regional transpressional deformation. The authors demonstrate that the present Denali fault dips steeply to depths of 30 km and is characterized by recent large-magnitude earthquakes. Seismic reflections image an older set of structures that extend to depths of 20–30 km. These older structures are inactive based on recent seismicity, including the 2002 M_w 7.9 Denali fault earthquake. This study complements chapters in this volume that document Mesozoic shortening of collisional basinal strata within the suture zone (Chapters 13, 14, and 16) and Cenozoic transpressional tectonics along the Denali fault system (Chapters 4, 20, 21, and 22).

Chapter 4. Jeff Trop and Ken Ridgway provide a synthesis of the sedimentary record of Mesozoic and Cenozoic continental growth through terrane accretion, basin development, magmatism, and accretionary prism development. The authors show that Mesozoic and Cenozoic strata of southern Alaska are the product of two major collisional events, the Mesozoic collision of the Wrangellia composite terrane and the Cenozoic collision of the Yakutat terrane. Previous syntheses of the geologic framework of southern Alaska have emphasized the nature and distribution of accreted terranes and structural elements. This study, in contrast, focuses on the collisional record contained within sedimentary basins that formed between and upon colliding terranes and adjacent to major structural elements. The paper explores linkages between depositional and deformational processes related to the collisional convergent margin tectonics that formed much of the northwestern Cordillera. New paleogeographic maps and cross-sections integrate new datasets reported in this volume with previous investigations.

Chapter 5. Terry Pavlis and Sarah Roeske provide the first comprehensive review of Mesozoic–Cenozoic deformation along the entire Border Ranges fault system. This major fault system extends for >2000 km and defines one of the principal tectonic boundaries along the southern margin of Alaska. This structure separates the accreted Wrangellia composite terrane and magmatic belts to the north from coeval subduction complex strata to the south. This paper carefully documents temporal and spatial changes in the nature of deformation along the entire fault system. The authors present mapping data that demonstrate that this regional fault system varies along strike from a narrow fault zone <1 km wide to broad zones of deformation >30 km wide. New geologic mapping and piercing points also provide improved constraint on the timing and magnitude of Cretaceous–Paleogene deformation along individual fault segments. The authors, for example, propose that >100 km of Paleogene dextral strike-slip displacement was transferred from the Border Range fault to the adjacent Castle Mountain fault through a strike-slip duplex in the northern Chugach Mountains and Matanuska Valley. The paper also presents a regional model showing the relationship between the Border Ranges fault system and other major structures in southern Alaska with implications for the Mesozoic–Cenozoic strike-slip fault displacement budget.

Chapter 6. Warren Nokleberg and Don Richter (deceased) synthesize the amalgamation history of accreted terranes that comprise much of south-central Alaska. The authors present new descriptions of several narrow terranes that are exposed within the Alaska Range suture zone between the more extensive Wrangellia and Yukon composite terranes. Regional paleogeographic maps and stratigraphic summaries synthesize Jurassic-recent collisional tectonic events. Their work complements chapters in this volume that synthesize the crustal structure and sedimentary record of the Alaska Range suture zone (Chapters 1, 3, and 4).

Chapter 7. Dwight Bradley, Bill McClelland, Joe Wooden, Alison Till, Sarah Roeske, Marti Miller, Sue Karl, and Grant Abbott report >700 sensitive high-resolution ion microprobe (SHRIMP) U-Pb detrital zircon ages from several terranes that make up much of interior Alaska. Results of this study tighten the maximum depositional ages and provenance of sandstone and metasandstone from the Farewell, Mystic, Wickersham, Yukon-Tanana, Ruby, and Angayucham-Tozitna terranes, as well as the Minook Complex and Rampart Group. In light of these data, the authors propose new correlations between the sampled terranes and surrounding crustal blocks, including cratonic North America and Siberia. More broadly, this study provides the initial framework for a detrital zircon database from aerially extensive but largely unexplored rocks that make up much of interior Alaska. Many of these terranes formed the backstop for Mesozoic collisional events that shaped southern Alaska; some of these terranes also provided detritus to sedimentary basins that formed in the suture zone (see Chapters 13 and 16).

Mesozoic Magmatism, Deformation, and Basin Development

Chapter 8. Alison Till, Anita Harris, Bruce Wardlaw, and M. Mullen discuss Upper Triassic metasedimentary rocks exposed along the northern margin of the Alaska Range suture zone. The authors present new conodont biostratigraphic data and geologic mapping that indicate a close pre-Cretaceous relationship between the para-autochthonous Yukon-Tanana terrane and Upper Triassic marine strata exposed within the Alaska Range suture zone. The present distribution of conodont biofacies within the suture zone indicates complex post-Triassic deformation.

Chapter 9. Tim Kusky, Adam Glass, and Robert Tucker examine fault-bounded mafic–ultramafic bodies that crop out within the McHugh subduction complex. The McHugh subduction complex is exposed outboard (oceanward) of the accreted Wrangellia composite terrane. The mafic–ultramafic rocks were previously interpreted as either offscraped fragments of an oceanic plate or the structurally displaced core of the accreted Talkeetna oceanic arc. The authors present new U-Pb geochronologic data that demonstrate that the mafic–ultramafic bodies were emplaced concurrent with formation of the McHugh subduction complex and prior to Talkeetna arc magmatism. These new timing constraints, combined with new chromite geochemical and geologic mapping data, allow the authors to reinterpret the mafic–ultramafic bodies as a suprasubduction zone ophiolite. This chapter complements Chapter 10, which also discusses Triassic suprasubduction-zone ophiolite generation, and Chapter 11, which presents new constraints on the timing of Talkeetna arc magmatism.

Chapter 10. Jeff Amato, Matt Bogar, George Gehrels, Lang Farmer, and William McIntosh present new geochemical, geochronologic, and petrologic data from the Tlikakila Complex in the Lake Clark region. These metasedimentary and meta-igneous rocks record Triassic–Jurassic magmatic, depositional, and metamorphic processes in an area that formed between the Talkeetna arc to the south and inboard terranes to the north. The authors interpret the Tlikakila Complex as a dismembered suprasubduction-zone ophiolite that originated near a trench above a north-dipping subduction zone during Late Triassic time, prior to the main phase of magmatism within the Talkeetna arc. New rare-earth element and isotopic data indicate Tlikakila magmatism took place within a primitive island arc setting. Detrital zircon ages from metasedimentary rocks suggest derivation from both the former continental margin and the Wrangellia composite terrane. This chapter complements basin analysis studies (Chapters 13, 14, and 16) that document Mesozoic collision of island-arc assemblages against inboard terranes, and Chapter 9, which also discusses Triassic suprasubduction-zone ophiolites in southern Alaska.

Chapter 11. Jeff Amato, Matt Rioux, Peter Kelemen, George Gehrels, Peter Clift, Terry Pavlis, and Amy Draut present new geochronologic data that tighten the age range of magmatism within the accreted Talkeetna arc. This arc represents one of the most complete accreted oceanic arc crustal sequences known worldwide. Igneous and sedimentary rocks of the Talkeetna arc make up much of the allochthonous Peninsular terrane of southern Alaska. Although recent studies report geochronologic data from Talkeetna arc plutons, ages from the related volcanic rocks are sparse. Results of this study include the oldest reported age from the volcanic succession and the first detrital ages from sedimentary rocks that directly overlie the volcanic succession. The authors also infer that part of the arc was emplaced into oceanic crust that was overlain by a clastic apron containing continentally derived sediment, based on the presence of Archean–Paleozoic detrital ages and isotopic data. Chapters 13 and 16 report detrital zircon ages from sedimentary strata of the Alaska Range suture zone that are consistent with the refined age range of the Talkeetna arc outlined by this chapter; this link suggests that erosion of the Talkeetna arc provided sediment for inboard basins.

Chapter 12. Marti Miller, Dwight Bradley, Tom Bundtzen, Robert Blodgett, Emile Pessagno, Robert Tucker, and Anita Harris analyze a poorly known succession of Mesozoic sedimentary and volcanic rocks that crop out in the Taylor Mountains of southwestern Alaska. This unit, defined as the restricted Gemuk Group, is at least 2250 m thick. Integrated biostratigraphic and geochronologic data provide the first robust constraints on the Triassic–Cretaceous depositional age of this unit. Modal sandstone analyses and detrital geochronologic data from these strata suggest derivation from Mesozoic igneous rocks, possibly the nearby Togiak arc. From a tectonic perspective, the authors propose that the restricted Gemuk Group formed either as part of an oceanic plate or within a marine backarc basin that was attendant to the Tokgiak magmatic arc.

Chapter 13. Jay Kalbas, Ken Ridgway, and George Gehrels discuss new sedimentological, provenance, and geologic mapping data that suggest that the Kahiltna assemblage exposed in the western Alaska Range represents a Late Early Cretaceous to Late Cretaceous marine basin that formed in response to oblique collision between an oceanic terrane and the Mesozoic continental margin. This paper is the first to report that the Kahlitna assemblage in this area is a minimum of 5560 m thick based on measured sections and that it consists of siliciclastic lithofacies that represent submarine-fan systems in a base-of-slope environment of deposition. Geologic mapping from this study shows that the depositional basement for the Kahlitna assemblage consists of Upper Triassic–Lower Jurassic marine volcanic and volcaniclastic strata of the Mystic terrane. Compositional and detrital geochronologic data from this study indicate that by Early Cretaceous time, both the continental margin and the accreting oceanic terrane were in close enough proximity for both to contribute sediment to the Kahlitna basin that is now uplifted in the western Alaska Range. Readers interested in studies of equivalent strata in the eastern and central Alaska Range should see Chapters 14 and 16, respectively.

Chapter 14. Jeff Manuszak, Ken Ridgway, Jeff Trop, and George Gehrels present the first detailed analysis of Upper Jurassic–Lower Cretaceous sedimentary strata of the Nutzotin basin. These strata, called the Nutzotin Mountains sequence, crop out in the eastern Alaska Range. Interpretation of new stratigraphic, geologic mapping, and provenance data suggest that the Nutzotin basin formed as a retroarc basin related to regional shortening and denudation of arc-related rocks of the allocthonous Wrangellia terrane. The Nutzotin Mountains sequence was subsequently incorporated into an accretionary wedge related to northward underthrusting of basinal strata beneath the former continental margin. This study is the first to recognize a decollement at the base of the Nutzotin Mountains sequence. Regionally, the Nutzotin Mountains sequence represents part of a series of sedimentary basins located along the inboard margin of the Wrangellia composite terrane that have similar depositional styles, and were all subsequently incorporated into accretionary wedges that dip toward the former continental margin. These deformed strata define a continental-scale suture zone along the northwestern Cordillera from Washington to southwestern Alaska. Readers interested in studies of equivalent strata should see Chapters 13 and 16.

Chapter 15. Darin Synder and Bill Hart provide a detailed characterization of mid-Cretaceous igneous rocks that intrude the Wrangellia terrane in the eastern Alaska Range. The authors integrate petrologic, geochronologic, and geochemical data to evaluate the nature and origin of a granitoid suite in the White Mountain area. Major, trace, and rare-earth element data, combined with Sr and Nd isotopic data, indicate granitoid emplacement within a magmatic arc that did not involve substantial recycling of evolved continental crust, either an oceanic island arc or an immature continental margin arc. ^{40}Ar/^{39}Ar ages and isotopic compositions demonstrate that plutonism may have been related to coeval and spatially associated volcanic rocks of the Chisana magmatic arc. This study complements basin analysis studies of sedimentary strata in the Alaska Range suture zone that record sediment derivation from mid-Cretaceous igneous source terranes (Chapters 13, 14, and 16).

Chapter 16. Brian Hampton, Ken Ridgway, Mike O'Neill, George Gehrels, Jeanine Schmidt, and Robert Blodgett examine Mesozoic strata of the northwestern Talkeenta Mountains. These strata are exposed in the regional suture zone between the allochthonous Wrangellia composite terrane and the former Mesozoic continental margin. New geologic mapping, measured stratigraphic sections, detrital geochronologic ages, and compositional data define a distinct three-part stratigraphy for these strata. A similar Mesozoic stratigraphy appears to exist in other parts of south-central and southwestern Alaska along the suture zone based on previous mapping studies. This study is the first to recognize that (1) The Kahiltna assemblage in the Talkeetna Mountains may be a minimum of 10–15 m.y. younger than previously reported. (2) That much of the northern Talkeetna Mountains consists of previously unrecognized nonmarine strata informally referred to here as the Caribou Pass formation. (3) That there was a fundamental shift from mainly arc-related sediment derivation from sources located south of the study area during Jurassic–Early Cretaceous (Aptian) time (Kahiltna assemblage) to mainly continental margin-derived sediment from sources located north and east of the study area by Albian–Cenomanian time (Caribou Pass formation). Readers interested in the Mesozoic stratigraphy of the suture zone should also see Chapters 13 and 14, which discuss related stratigraphy in the western and eastern Alaska Range, respectively.

Chapter 17. Cam Davidson and Devin McPhillips present new petrologic and geochronologic data that provide insight on latest Cretaceous–Paleocene metamorphism and magmatism within the Alaska Range suture zone. Mineral assemblages and geochronologic data demonstrate that rocks exposed in the eastern part of the suture zone were metamorphosed at depths $>$25 km, whereas rocks exposed 100 km to the west were metamorphosed at shallower depths of ~11 km. The authors interpret these results as evidence for larger amounts of exhumation in the eastern part of the suture zone. Results of this study complement basin analysis studies that record subaerial uplift and deformation of the suture zone during Late Cretaceous–Paleocene time (Chapters 13, 14, and 16).

Cenozoic Magmatism, Deformation, and Basin Development

Chapter 18. Jeff Amato, Cheryl Foley, Matt Heizler, and Richard Esser report new geochronologic and geochemical data from Cretaceous–Eocene igneous rocks in the Lake Clark region of southwestern Alaska. Results of this study provide insight on magmatism within the Peninsular terrane following Jurassic oceanic arc magmatism and accretion to the former continental margin. ^{40}Ar/^{39}Ar and U-Pb ages from igneous rocks document discrete magmatic episodes during Albian, Paleocene, and Eocene time. Major, trace, and rare-earth element signatures from these rocks indicate Albian rift-related magmatism followed by Paleocene–Eocene subduction-related calc-alkaline magmatism.

Chapter 19. Ron Cole, Paul Layer, Benjamin Hooks, Andy Cyr, and Julie Turner report the first detailed geochemical and structural analysis of volcanic and intrusive rocks that crop out in the Jack River area of the northern Talkeetna Mountains. These igneous rocks were emplaced within the suture zone separating the Wrangellia composite terrane from inboard terranes. Field mapping and stratigraphically constrained ^{40}Ar/^{39}Ar geochronologic data demonstrate that magmatism took place from 62–49.5 Ma. Major, trace, and rare-earth element compositions support derivation of these igneous rocks from mantle-derived magmas and crustal melts that involved assimilation of Jurassic–Cretaceous argillaceous sedimentary rocks (the Kahlitna assemblage). Geochemical compositions indicate that post-collisional magmatism within the suture zone was transitional between subduction-related arc and intra-plate tectonic settings. Results of this study demonstrate that post-collisional igneous rocks emplaced along terrane suture zones may closely post-date preceding arc magmatism, and that strata of syncollisional sedimentary basins may influence post-collisional anatectic melts that form the felsic end-member of a bimodal volcanic suite.

Chapter 20. Ken Ridgway, Evan Thoms, Paul Layer, Mark Lesh, James White, and Shane Smith examine the Neogene stratigraphic record of the Tanana basin located on the north side of the central Alaska Range. This study presents stratigraphic, palynological, and compositional data from the Miocene Usibelli Group and Pliocene Nenana Gravel to suggest that these strata represent a continuum in the evolution of a transpressional foreland basin. This study also presents the first reported ^{40}Ar/^{39}Ar dates from detrital feldspar grains of the Nenana Gravel, showing that two main suites of plutons contributed sediment to the Pliocene Tanana basin. The age distribution documented in detrital feldspars of the Nenana Gravel is interpreted as representing a progressive northward exhumation of plutons that provided sediment to the Pliocene foreland basin. This chapter discussing Miocene and Pliocene foreland basin development links with Chapters 21 and 22, which discuss neotectonic shortening and foreland basin development on the north side of the Alaska Range.

Chapter 21. Sean Bemis and Wes Wallace examine the structural and geomorphic record of neotectonics in the northern foothills of the central Alaska Range. The authors combine geologic mapping, longitudinal stream profiles, and surveys of deformed Quaternary terraces to demonstrate shortening and differential uplift associated with an orogenic wedge deforming above a south-dipping decollement. This is the first study to show that the foothills north of the Alaska Range represent an active fold-and-thrust belt that is propagating northward into the Tanana foreland basin. The authors also point out that the Neogene fold-and-thrust belt should be considered in seismic hazard assessment of south-central Alaska.

Chapter 22. Mark Lesh and Ken Ridgway present geomorphic data from rivers in the Tanana foreland basin and northern foothills of the Alaska Range that show that this is an actively deforming landscape. Interactions between fluvial systems and inferred active structures of the Tanana basin provide a surface record of regional transpressional deformation. Deformation of the Tanana basin appears to be a product of strain partitioning between strike-slip faults (e.g., Denali fault), an active Neogene fold-and-thrust belt along the northern flank of the Alaska Range, and rotating crustal blocks between the Denali and Tintina fault systems. Chapter 21 by Bemis and Wallace addresses the structural elements and geometry of the Neogene fold-and-thrust belt that is paired with the Tanana foreland basin.

Tectonic Configuration of Southern Alaska—Bearings on Mineral Exploration

Chapter 23. Jonathan Glen, Jeanine Schmidt, and Robert Morin present new gravity and aeromagnetic data to characterize the crustal structure of the northern Talkeetna Mountains. These data help delineate the location of major crustal domains and structures, including a new interpretation of the location and geometry of the boundary between the Wrangellia and Peninsular terranes. Newly mapped mafic–ultramafic bodies from this study hold important implications for mineral exploration strategies.

Chapter 24. Jeanine Schmidt and Robert Rogers discuss the results and economic implications of their recent geologic mapping of Triassic mafic–ultramafic successions within the Wrangellia terrane. Their geologic mapping and geochronologic studies demonstrate that these igneous rocks of the Nikolai Greenstone extend at least 80 km farther southwestward in the Talkeetna Mountains than previously recognized. The authors also show that these largely unexplored Triassic successions hold significant economic potential for copper, nickel, and platinum-group elements. To aid future exploration, the authors provide a metallogenetic model for the Talkeetna Mountains and review known mineral occurrences associated with Triassic mafic–ultramafic successions in south-central Alaska. The Nikolai Greenstone forms much of the southern Alaska convergent margin and has similarities to other large igneous provinces, including the Siberian traps and North American Mid-Continent Rift.

ACKNOWLEDGMENTS

This volume is dedicated to the many field geologists and geophysicists who contributed to the regional geologic mapping of southern Alaska. Without this geologic framework, the studies presented in this volume would not have been feasible. We are indebted to the following reviewers for providing thoughtful reviews of the manuscripts: John Aleinikoff, U.S. Geological Survey; Jeffrey Amato, New Mexico State University; Christopher Andronicos, Cornell University; David Barbeau Jr., University of South Carolina; Dwight Bradley, U.S. Geological Survey; Ronald Bruhn, University of Utah; Laurel Burns, Alaska Division of Geological and Geophysical Surveys; Doug Christensen, University of Alaska, Fairbanks; Ronald Cole, Allegheny College; Brian Currie, Miami University; Brian Darby, Louisiana State University; Cam Davidson, Carleton College; Susan DeBari, Western Washington University; Amy Draut, U.S. Geological Survey; Julie Dumoulin, U.S. Geological Survey; Cynthia Dusel-Bacon, U.S. Geological Survey; Donald Fisher, Penn State University; Carol Frost, University of Wyoming; John Fournelle, University of Wisconsin–Madison; George Gehrels, University of Arizona; Jonathan Glen, U.S. Geological Survey; Stephan Graham, Stanford University; Peter Haeussler, U.S. Geological Survey; Marc Hendrix, University of Montana; Cari Johnson, University of Utah; Timothy Kusky, Saint Louis University; Paul Layer, University of Alaska; Timothy Little, Victoria University of Wellington; Paul McCarthy, University of Alaska, Fairbanks; Edwin McKee, U.S. Geological Survey; Marti Miller, U.S. Geological Survey; Warren Nokleberg, U.S. Geological Survey; Christopher Nye, U.S. Geological Survey; Michael Orchard, Geological Survey of Canada; Michael O'Neill, U.S. Geological Survey; Lewis Owen, University of Cincinnati; William Patton, Jr., U.S. Geological Survey; Kenneth Ridgway, Purdue University; Bradley Ritts, Indiana University; Brian Rodriguez, U.S. Geological Survey; Sarah Roeske, University of California, Davis; Richard Saltus, U.S. Geological Survey; Colin Shaw, Montana State University; Virginia Sisson, Houston, Texas; Jeffrey Trop, Bucknell University; Wesley Wallace, University of Alaska, Fairbanks; Michael Whalen, University of Alaska, Fairbanks; Laura Webb, Syracuse University; and Sandra Wyld, University of Georgia.

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