

THE STRUCTURE AND TECTONICS OF
MESOZOIC DIKE SWARMS
IN EASTERN NEW ENGLAND

by

Mark T. Swanson

A Dissertation

Submitted to the State University of New York at Albany

in Partial Fulfillment of

the Requirements for the Degree of

Doctor of Philosophy

College of Science and Mathematics
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ABSTRACT

Continuous outcrop mapping (1:240) along coastal exposures in southern Maine has led to the recognition of a complex brittle structural history that established the pre-existing structural grain for, and culminated in, the intrusive development of several Mesozoic dike swarms. The structural grain within the Rye Formation of the southern part of the field area consists of a dominant NE-trending near-vertical gneissic (mylonitized) foliation on which is superimposed the intense brittle shear fracturing of the pseudotachylyte-bearing Fort Foster Brittle Zone. This brittle shear fracturing was responsible for the later localization of explosive igneous breccias and felsic melts above the largely unexposed Gerrish Island Igneous Complex. The later emplacement of the dominant N25E-trending dike swarm, possibly Late Jurassic to Early Cretaceous in age, was primarily independent of the pre-existing structural grain and directly related to a system of late rusty-weathering open brittle fractures. The structural grain within the Kittery Formation of the northern part of the field area consists of a prominent N60E-trending vertical planar bedding-anisotropy as limbs of Acadian fold structures and a second N45E-trending vertical planar cleavage-anisotropy related to a late Z-shaped asymmetric fold and dextral shear zone development. These bedding-cleavage anisotropies are responsible for the structural localization of a prominent N60-45E trending dike swarm, possibly Early Triassic to Early Jurassic in age, associated with the alkaline syenite complex at Agamenticus. The bedding-anisotropy is found to play an important role in determining the character of strain accommodation between en echelon dike terminations. A younger NNW-NNE trending secondary dike swarm is interpreted as a termination structure

for the prominent N25E-trending dike swarm exposed farther south at Gerrish Island. The emplacement of this N25E-trending dike swarm and the development of the related late brittle fracture system involves a N65W-S65E, Late Jurassic - Early Cretaceous, crustal extension and its interaction with the prominent N60E-trending vertical bedding-anisotropy and the large rigid cylindrical Agamenticus intrusion. Finally, a regional synthesis of Mesozoic structural developments in eastern North America results in a model for a complex decoupling history during central Atlantic rifting. This model incorporates the varied interaction between dextral shear, extension, sinistral shear and final crustal separation along a wide, arcuate, near-pole, small-circle transform system and the linear belt of pre-existing Appalachian structural grain. The N60-45E and N25E trending dike swarms studied in southern Maine would most likely be related to the Triassic-Jurassic extensional phase and final Jurassic-Cretaceous crustal separation phase, respectively, within the proposed model.

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- Plate 9 - Shear fracture pattern in thicker quartzite unit, York Cliffs layer-parallel sinistral brittle shear structure (1:2)

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