THE PRODUCTION OF DIORITIC MAGMAS BY FLUID INFILTRATION IN THE PLUTONIC IGNEOUS COMPLEX AT SOREL POINT, JERSEY, CHANNEL ISLANDS

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The plutonic igneous complex at Sorel Point, Jersey, Channel Islands. comprises a variety of rocks within the compositional spectrum gabbro-diorite-granodiorite-granite. Four temporally separable rock groups are present within the complex, each consisting of a number of lithologies which were originally present as coexisting magmas. Geochemical data confirms field, petrographic and mineralogical evidence that dioritic rocks were produced by infiltration of volatile-rich residual granitic liquids into coexisting gabbroic magmas. The compositional and mineralogical effects of this process decrease systematically with increasing distance from the original acid-basic magma interface. The selective and inhomogeneous nature of the process is demonstrated by non-linear trends and considerable scatter on variation diagrams.

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INTRODUCTION

The close association of acid and basic rocks in plutonic environments, together with evidence of physical and chemical interaction between them, is a widespread and widely reported phenomenon (e.g. Wiebe, 1980; Furman and Spera, 1985; Brown and Becker, 1986; Barbarin, 1988; D'Lemos, 1986, 1992, 1996; Cook, 1988; El Desouky *et al.*, 1996; Baxter and Feely, 2002). Physical constraints, such as viscosity contrast, inhibit the ability of the magmas to mix so that they survive as discrete entities with stable interfaces between them.

Chemical interaction between the magmas can take place up to (and possibly below) the point at which one of them reaches its solidus. Interaction may take the form of fluid or diffusional infiltration, or a combination of both. However, the slow rates at which diffusion is known to occur, mean that it has the capacity to affect only relatively small volumes either side of a magmatic interface. In order for larger volumes to be affected a process of fluid infiltration is required. During this process, fluid is able to physically cross the interface from one magma to the other.

The aim of this paper is to describe the geochemical variation seen in a group of closely related rocks from the Sorel Point Complex, and to discuss the nature of the post-emplacement interactions which brought about these variations. An important consequence of the interactions was the production of dioritic magma from gabbroic magma.

THE GEOLOGY OF SOREL POINT

Sorel Point lies on the north coast of Jersey, Channel Islands and consists of calc-alkaline plutonic rocks emplaced during the latter stages of the Cadomian orogeny (D'Lemos *et al.*, 1990, 1992). The Sorel Point Complex consists of a variety of rock types within the compositional spectrum gabbro-diorite-granodiorite-granite (Figure 1). Detailed field and petrographic descriptions are given in Salmon (1998). The rocks of the complex can be divided into four temporal groups (A to D) representing four separate intrusive episodes, with Group A being the earliest. Each group comprises at least two lithologies with contact relationships indicative of coexisting magmas. The intrusive episodes are separated by the time required for the preceding group of magmas to cool and solidify, so that contacts between the intrusive groups are planar and angular (i.e. brittle) in nature. The rocks of Sorel Point thus record an extended and complex history of magmatic intrusion and interaction (Salmon, 1998).

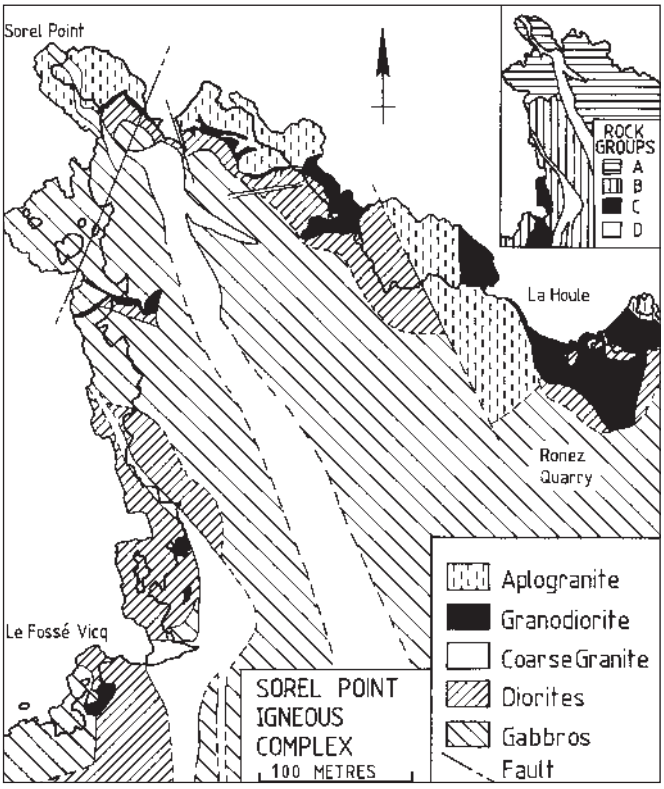

Figure 1. *Simplified geological map of Sorel Point (from Salmon, 1996, 1998). The inset shows the extent of rock groups A to D referred to in the text.*