Provenance and stratigraphy of the Devonian (Old Red Sandstone) and Carboniferous sandstones of Spitsbergen, Svalbard

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Abstract: The Wood Bay Group of central Spitsbergen consists of a Devonian sedimentary succession 2900 m thick, deposited in a fault-controlled basin that developed following the Caledonide orogen. The Wood Bay Group consists of a large-scale fining-upward succession of fluvial, paludal and marginal marine conglomerate, sandstone, and mudstone. Low-sinuosity braided channel processes dominated the lower portion of the succession; the middle portion is transitional, probably deposited in meandering channels and proximal levees and floodplains. The upper portion consists of floodbasin and marginal marine sediments. The Wood Bay Group of Spitsbergen has been correlated with the classic "Old Red Sandstone" of Great Britain based on the heterostracan (fish) fauna. The sandstones are quartzofeldspathic, reflecting a collisional-orogen provenance. Petrologic parameters indicate derivation from mid-crustal rocks and overlying metavolcanic, metasedimentary and sedimentary strata ascribed to different tectonostratigraphic units of the Caledonide orogenic belt.

The Wood Bay Group is unconformably overlain by a nearly horizontal Carboniferous succession, including the Hörbyebreen, Svenbreen and Ebbadalen formations (siliciclastic, carbonate, and evaporite). Siliciclastic strata of the Hörbyebreen, Svenbreen and Ebbadalen formations in the form of fluvial, beach, and supratidal facies, consist of quartz-rich sandstone and siltstone. These quartz arenites, which we interpret as reflecting a cratonal provenance, dramatically contrast with the composition of the Devonian sandstones.

Sandstone detrital modes change abruptly at the Devonian-Carboniferous unconformity, probably indicating changes in provenance as a result of the Silurian through Late Carboniferous tectonic activity (Caledonian and Ellesmerian collisions). The detrital modes of the sandstones record fundamental changes in the geotectonic setting of Svalbard. We interpret these changes to be due to shifts in paleogeography and geodynamic setting from an orogenic provenance, resulting from the dissection of an uplifted Caledonide orogenic belt, to a cratonal provenance, related to collision of the Siberian cratonal block with Laurentia-Baltica, and its subsequent rifting away.

Key-words: sandstone petrology, stratigraphy, provenance, Paleozoic, Spitsbergen.

Introduction

Svalbard is an arctic archipelago that consists of several small islands and three major islands, Spitsbergen, Edgeøya, and Nordaustlandet. This region has been the subject of a variety of studies regarding the tectonic evolution of the northern Atlantic province. These studies have provided

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