INTERACTION BETWEEN SIMULATED RAIN AND BARREN ROCK SURFACE*

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Abstract. During the latter decades extensive fish kills have been observed in the mountainous areas of southernmost Norway. These kills have been attributed to the increased acidity of the river-water. The increased acidity is generally assumed to be caused by acid precipitation. However, the relationship between precipitation and runoff quality is very complex. The present paper is concerned with the relationship between chemical composition of simulated rain and that of runoff from bare granitic rock, partly covered by lichens.

When supplying simulated rain with a pH value of approximately 5 the very first runoff had pH values between 4.1 and 4.3. However, the pH in the runoff increased rapidly and leveled out at values between 4.6 and 4.7. When supplying simulated rain with pH approximately 3.5, the pH in the first runoff varied between 3.8 and 3.6. The pH then gradually decreased to the same values as those in the simulated rain. Runoff from ‘rain’ with pH 4.3, obtained the same pH value as that of the ‘rain’. The pH of the runoff was dependent not only on the rain acidity, but also on its content of neutral salts.

1. Introduction

During the latter decades of this century extensive fish kills have been observed in the southernmost parts of Norway (Jensen and Snekvik, 1972; Leivestad et al., 1976). The fish kills are mostly attributed to increased acidity of the water-courses.

It is generally believed, that the greater acidity is due to increased amounts of acid air pollutants resulting from increased burning of fossil fuels (Dannevig, 1959; Jensen and Snekvik, 1972; Gjessing et al., 1976). Statistical indications of such a relationship have been put forward (Gjessing et al., 1976), however experimental evidence has not been produced. Rosenqvist (1977), on the other hand, argues that the input of hydrogen ions from the precipitation is considerably smaller than the production of hydrogen ions in terrestrial ecosystems. He claims that changes in vegetation and humus, due to changes in agriculture and forestry, are the main reasons for the increased acidity of fresh water.

Small watersheds have been used to study the effect of acid precipitation on fresh water chemistry, but so far clear effects have not been observed (Gjessing et al., 1976; Likens et al., 1977). However, a watershed is usually composed of variable vegetation, soil and often bedrock geology. The effect of acid precipitation on the water chemistry is likely to vary with these properties. This variation might well

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be masked in the pooled runoff from whole watersheds. Therefore, use of watersheds might not be the most efficient way to study the relationship between acid precipitation and water chemistry.

The present study is part of a series of investigations on the effect of acid precipitation on fresh water chemistry. In this study the effect of bare rock surfaces with a partial lichen covering is examined. In the areas of southernmost Norway where populations of fresh water fish have been destroyed, the watersheds are extremely poor. In eight of these watersheds utilized by the SNSF-project (Acid precipitation-effects on forest and fish), the proportion of barren rock amounts to approximately 30% of the area.

**2. Materials and Methods**

The experiments were carried out in the vicinity of Storgama watershed – one of the watersheds utilized by the SNSF-project since 1974 (Johannessen and Joranger, 1976; Gjessing et al., 1976). The experimental area is situated in Nissedal, Telemark county 8°E 59°N and about 600 m elevation.

The experiments were performed on a large, continuous expanse of bare, precambrian granite as shown in Figure 1. With the exception of one small patch of moss (ca. 1 dm²), the areas selected for the studies were free from vegetation other

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**Fig. 1.** The barren rock area where the experiments were carried out.