

Megaripples in the Trenton Group  
Inghams Mills, New York

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## Introduction

The outcrop below the dam on East Canada Creek at Inghams Mills in upstate New York includes excellent exposures of the Kings Falls Formation and the Sugar River Formation of the Upper Ordovician Trenton Group. The Trenton limestones were deposited on a carbonate platform that existed during the Ordovician. These limestones contain many sedimentary structures, abundant invertebrate fossils, and numerous trace fossils. At this location many beds containing megaripples can be observed and studied. Although the outcrops at Inghams Mills have been described by earlier workers (Keith, 1989; Titus, 1989), a comprehensive study of these megaripples has not been undertaken. The primary focus of my research is to determine the paleoenvironment and process of formation of these megaripples.

## Methods

At Inghams Mills I located all the megaripple layers that I could identify. I started at the Napanee Formation/Kings Falls Formation boundary and I studied all of the Kings Falls Formation and the beds of the Sugar River Formation that are exposed before the base of the dam. Once these layers were marked, I recorded the layers in a stratigraphic column (Figure 1 and Table 1). I then began to measure the well-defined ripple beds. On each individual ripple I measured maximum wavelength, minimum wavelength, average wavelength, and wave height. I measured the orientation of each set of ripples and if the ripple appeared to be asymmetrical I noted the direction of the asymmetry. If the asymmetry was well-defined I measured the length of the stoss side and the length of the lee side. If a large area of bedding plane was exposed and several sinuous ripples were defined I measured the length along the curved crestline, and if bifurcation was visible I measured the spacing and length of the 2 bifurcations along a single crestline. If the layer exhibited interference ripples I noted the various orientations of each set of ripples in the layer. I also noted any cross bedding that was visible in any of the ripple beds.

After these measurements were made I calculated a series of ripple indices (Tanner, 1966) to help determine the method in which the ripples were deposited. I used a total of five ripple indices. Each index helps determine how the ripples were deposited; by wind, wave, current, or swash; using a different criteria. The indices were the ripple index (RI), the ripple symmetry index (RSI), the parallel index 1 (PI 1), the parallel index 2 (PI 2), and the bifurcation index (BI). The equations for the indices are as follows:

$$\begin{aligned} \text{RI} &= \text{wavelength/wave height} \\ \text{RSI} &= \text{length of stoss/length of lee} \\ \text{PI 1} &= \text{distance along curved crest/} \\ &\quad \text{mean spacing(max.spacing/min. spacing)} \\ \text{PI 2} &= (\text{max.spacing} - \text{min. spacing})/\text{mean spacing} \\ \text{BI} &= \text{distance between two bifurcations/} \\ &\quad \text{mean spacing} \end{aligned}$$

## Data

In the Kings Falls and Sugar River Formations I found a total of 18 definite megaripple layers, one of them a layer of interference ripples. I measured six of the most defined beds in great detail. I also noted one other layer which might possibly be another layer of interference ripples. On the top of the Napanee Formation, directly below the Kings Falls Formation, there is another layer of more complex interference ripples.

The sets of ripples were all oriented in different directions (Figure 2). Although many of the beds exhibited asymmetry, many of them were too poorly defined to determine a sense of orientation for the symmetry. Of the beds that the asymmetry was defined, the orientations were in various directions (Figure 3).

There were two distinct layers of interference ripples, one in the Kings Falls Formation and the other on the top bed of the Napanee Formation. The orientations of the interference ripples were fairly well defined and in various directions (figure4).

#### Discussion

Although I used a total of five indices, each index could not be used on all of the layers. All five were used on only one set of ripples. Two indices were used on three sets of ripples, and one index was used on two sets of ripples. The certainty of the proposed method of deposition is related to the numbers of indices used, therefore four of the layers have been determined with relative certainty.

It is helpful to pair two of the indices with one another. According to Tanner (1966) the best pairs are RI vs. RSI and RI vs. PI1. The other pairs that I also used were RSI vs. PI2 and P vs. BI.

The numbers obtained from calculating the indices determines the method of formation. The results showed that three of the layers; 3, 8, and 11; were produced by wave action, layer 10 was most likely produced by wave action, but possibly by swash action, and layers 12 and 13 were produced by either wind or swash.

#### Conclusions

The results of these calculations and the relative frequency of the ripple layers throughout the Trenton Group lead to the theory that the ripple layers were storm induced, at least in the lower part of the Trenton where the layers of definite wave action are primarily located. During the period of Upper Ordovician carbonate deposition there may have been periodic large storms with waves of large enough dimensions to create megaripples on the sea floor which are now visible at the Inghams Mills outcrop.

#### References Cited

- Keith, B. D., 1989, Regional Facies of Upper Ordovician Series of Eastern North America: AAPG Studies in Geology # 29, p. 1-12.
- Tanner, W.F., 1966, Ripple Mark Indices and Their Uses: Sedimentology, v. 9, p. 89-104.
- Titus, R., 1989, Facies of the Trenton Group of New York: AAPG Studies in Geology #29, p. 77-84.

FIGURE 1.

STRATIGRAPHIC COLUMN  
INGHAMS MILLS

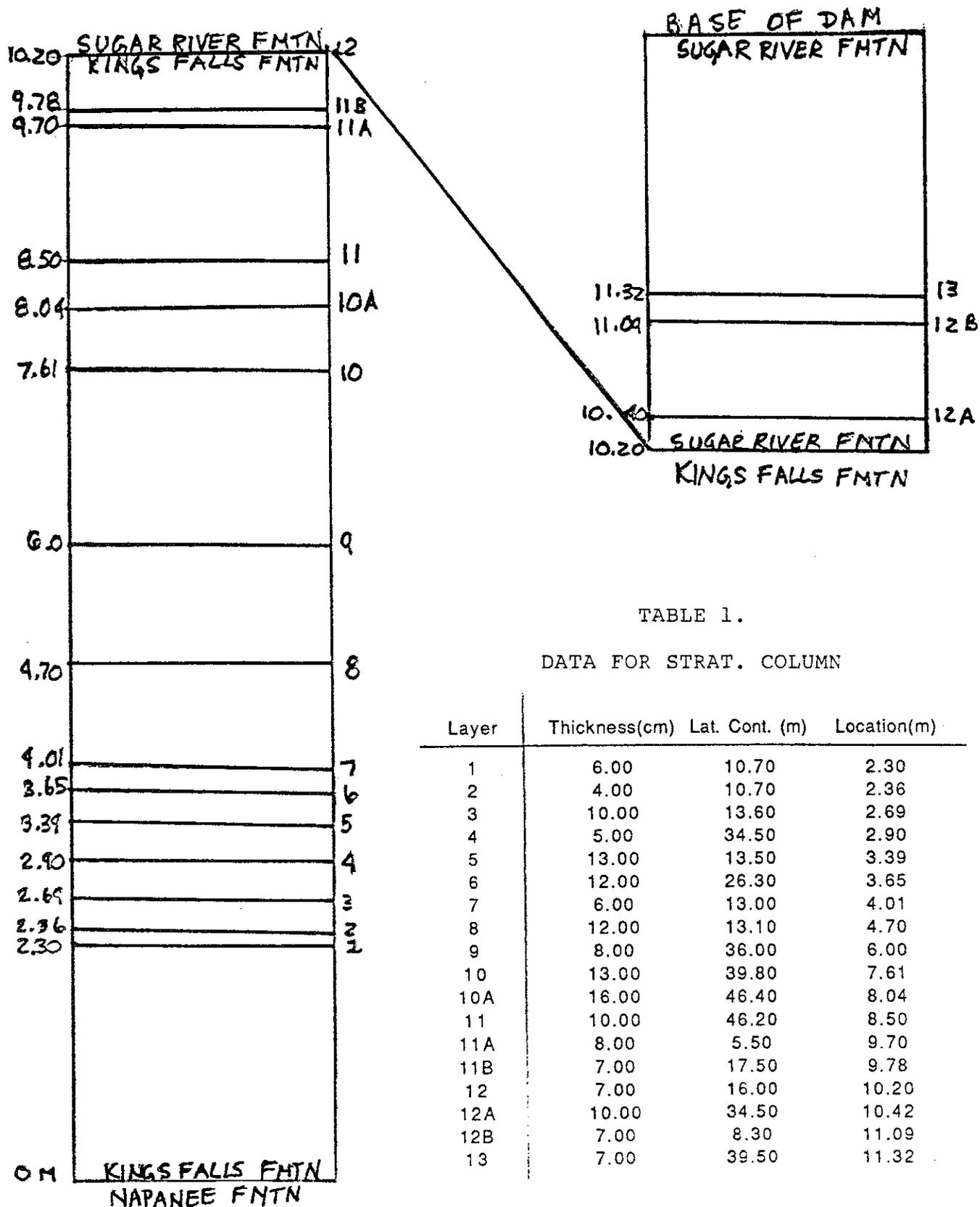


TABLE 1.

DATA FOR STRAT. COLUMN

Layer	Thickness(cm)	Lat. Cont. (m)	Location(m)
1	6.00	10.70	2.30
2	4.00	10.70	2.36
3	10.00	13.60	2.69
4	5.00	34.50	2.90
5	13.00	13.50	3.39
6	12.00	26.30	3.65
7	6.00	13.00	4.01
8	12.00	13.10	4.70
9	8.00	36.00	6.00
10	13.00	39.80	7.61
10A	16.00	46.40	8.04
11	10.00	46.20	8.50
11A	8.00	5.50	9.70
11B	7.00	17.50	9.78
12	7.00	16.00	10.20
12A	10.00	34.50	10.42
12B	7.00	8.30	11.09
13	7.00	39.50	11.32

FIGURE 2. ORIENTATION OF MEGARIPPLES

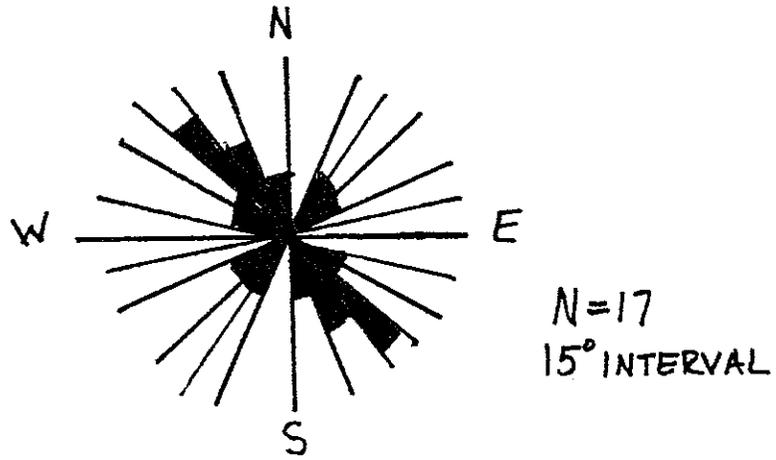


FIGURE 3. SYMMETRY OF MEGARIPPLES

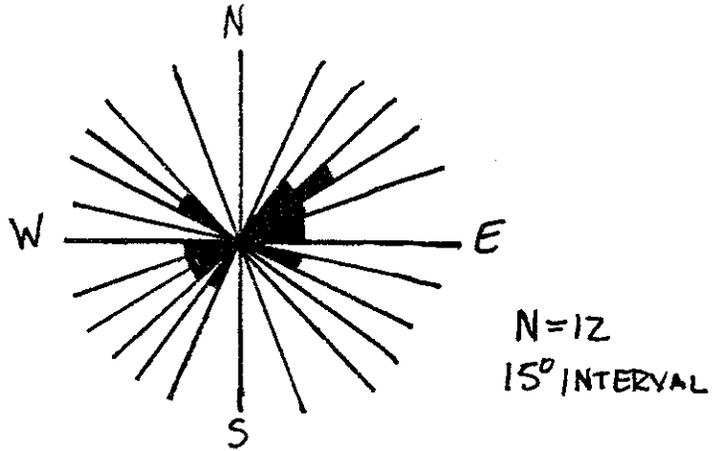


FIGURE 4. ORIENTATION OF INTERFERENCE RIPPLES

