

The Creation of Snow Crystal Identification Guidelines Through Photographic Analysis

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Introduction

Snow crystal metamorphism is a continuous process which creates different identifiable forms such as facets and rounds.

By the nature of metamorphism, there are few clear observable lines to differentiate the differences between forms that occur through varying stages of metamorphism (Fig. 1).

The objective is to survey snow science professionals on their snow crystal identification guidelines. The study will be completed by asking the participant to identify the crystals shown in a series of photographs (Fig. 2).

The need to understand personal guidelines for crystal identification is supported by the use of crystal form when describing snow pack and avalanche conditions. While snow crystal form is only "a piece to the puzzle" in describing avalanche conditions, clear identifiable boundaries should be developed to assist with uniform interpretation.

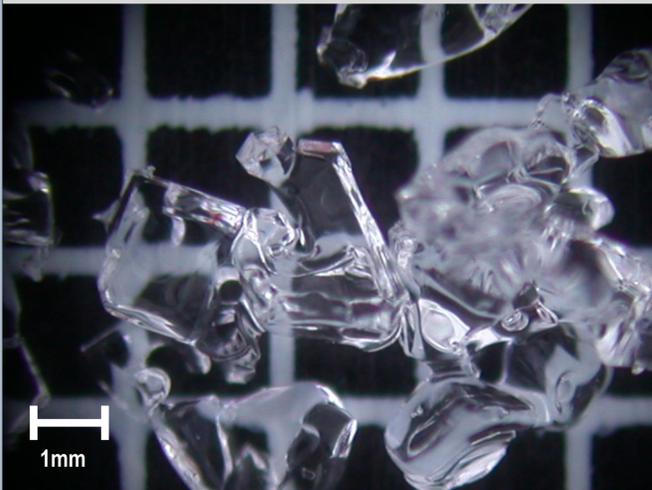


Figure 1. Facets, mixed forms or other? The presence of rounded and sharp corners, strait edges and bonding causes classification difficulty. Shown on 2mm grid.

Results

Due to the fact that this study is an opportunity to collect data, rather than display new ideas and findings, there are no discernable results available at this time.

Both quantitative and qualitative results are anticipated from these surveys. Anticipated findings are the classification of snow crystal forms through measurable characteristics such as size, radius of curvature, proportionate length of grain boundary and the presence of internal characteristics such as air and striations (Colbeck, 1982; Colbeck, et. al., 1990, Green, et. al., 2009)

Materials and Methods

Who

The Yellowstone Club Ski Patrol and Montana State University's (M.S.U.) Engineering department have been working in collaboration for several years. Through the partnership with M.S.U., the Yellowstone Club Ski Patrol has taken thousands of snow crystal photographs.

Where

All of the photographs shown were taken in Big Sky, Montana, USA, located in the southwestern corner of the state. Specifically, the photographs were taken at the Yellowstone Club in the Madison Mountain range. A sample of photographs are used to represent all aspects and depths of a snow pack in relation to crystal types.

What

This is a survey of how you (the observer) classify snow crystals. To participate in the study, please take one of the binders and record your best interpretation of the crystal classification, subclass and size of the photographs provided (Fig. 2). To avoid confusion, it will be helpful if the survey taker uses words to describe the crystal rather than symbols.

Example:

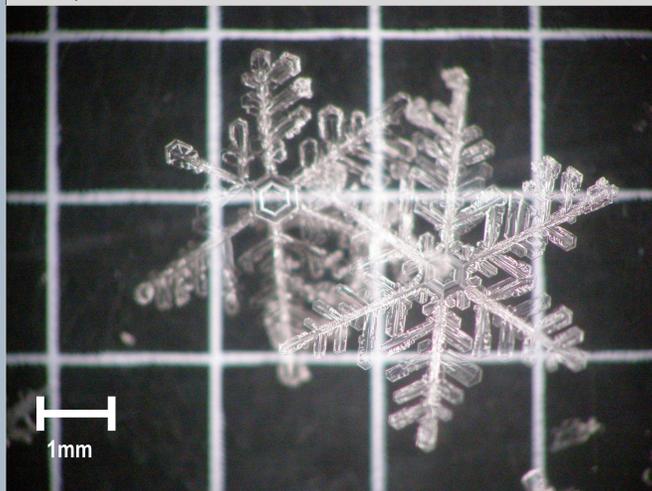


Figure 2. Survey taker would write : New Snow, Stellar 4mm. Shown on 2 mm grid.

Why

The observation and documentation of snow crystals is an industry wide practice. However, the guidelines for identifying crystals do not provide specifics about what point in the metamorphism process the crystal is in. While it may be impossible to standardize the methods of snow crystal classification, understanding observer discrepancies will aid in the interpretation of snow crystal documentation such as snowpack profiles and written description of field conditions (Fig. 3).

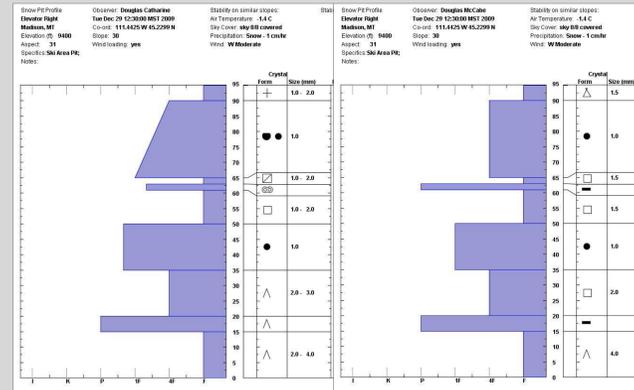


Figure 3. One snow profile observed by two people. The overall result is similar, however subtle differences may alter ones' interpretation.

How

The photographs used were taken with several different cameras. Through the years, a Panasonic PV-500, Olympus SP-510 UZ and a Nikon Coolpix have been used. The 10x loupe portion of a Brunel 8 x 30 ocular microscope was attached to the camera through a series of t-rings and extension tubes (Fig 4). Camera settings were varied, but the best quality photos were generally obtained through custom settings.

How to Review the Results of this Study

It is the intention of the presenters to compile all data collected at this conference and present the findings at a later time. Upon completion, a summary of the collected data and results will be submitted for publication in the Avalanche Review and the 2012 International Snow Science Workshop.



Figure 4. A researcher using a digital camera and 10x loupe to take a photograph in the field.

References

- Colbeck, S.C., 1982. An Overview of Seasonal Snow Metamorphism. Reviews of Geophysics and Space Physics. 20, 45-61.
- Colbeck, S., Akiyata, E., Armstrong, R., Gubler, H., Lafeuille, J., Lied, K., McClung, D., Morris, E., 1990. International Classification for Seasonal Snow on the Ground. International Commission for Snow and Ice (IAHS), World Data Center for Glaciology, University of Colorado, Boulder, CO, USA.
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