It’s All About Snow

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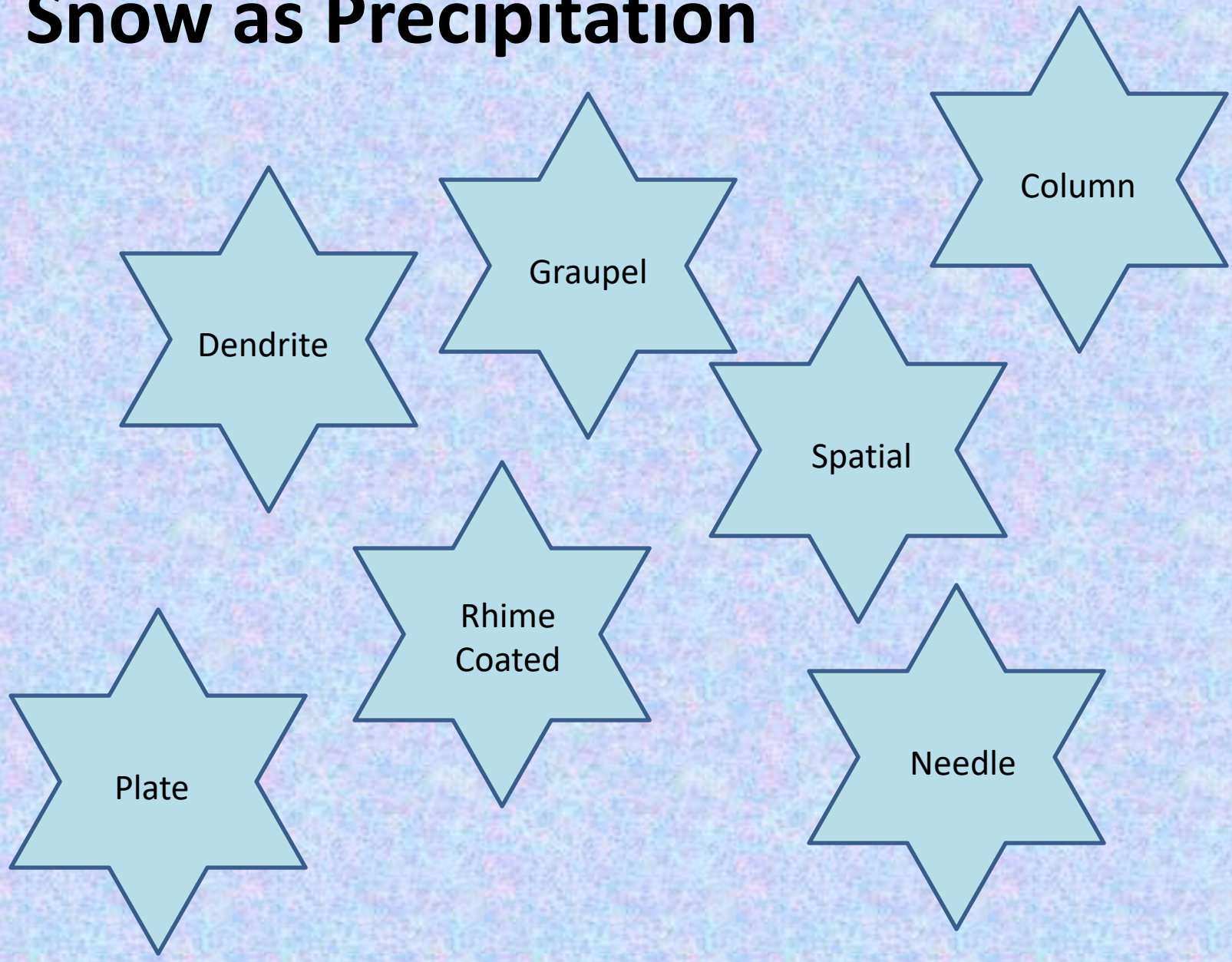
Snow 101
Consistency
Manipulation
Measurements
Snow Around the World
Ice

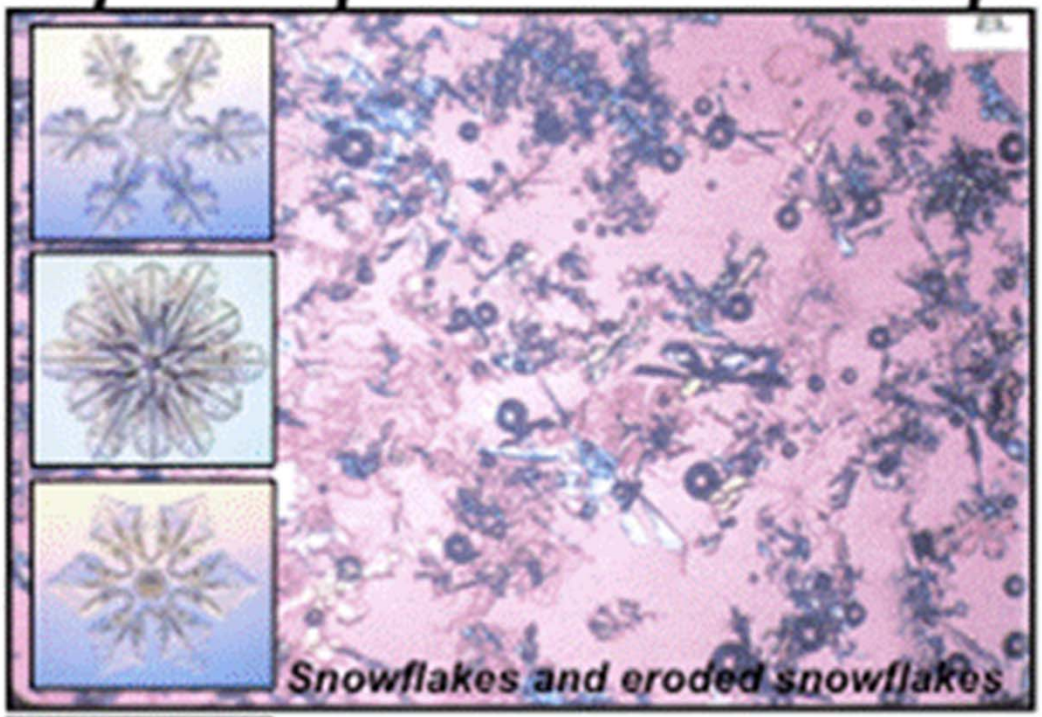
Snow as Precipitation



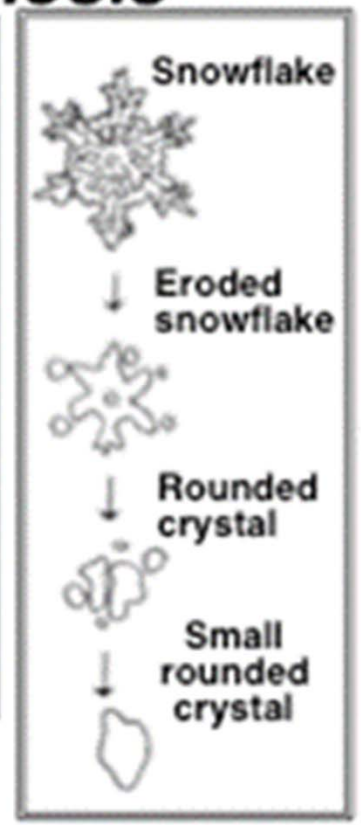
Metamamorphism

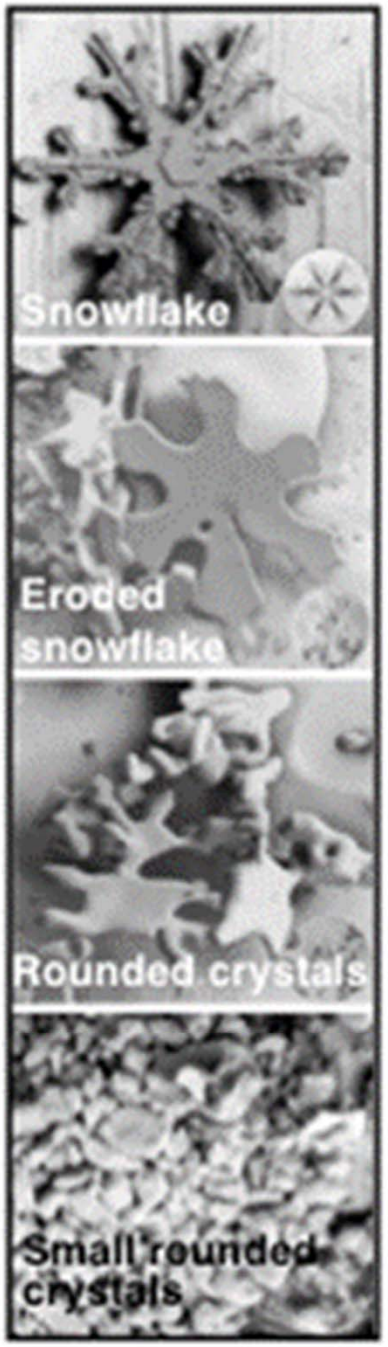
Equi-Temperature

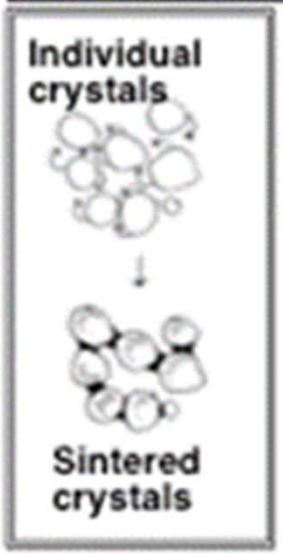
Equi-temperature Metamorphosis



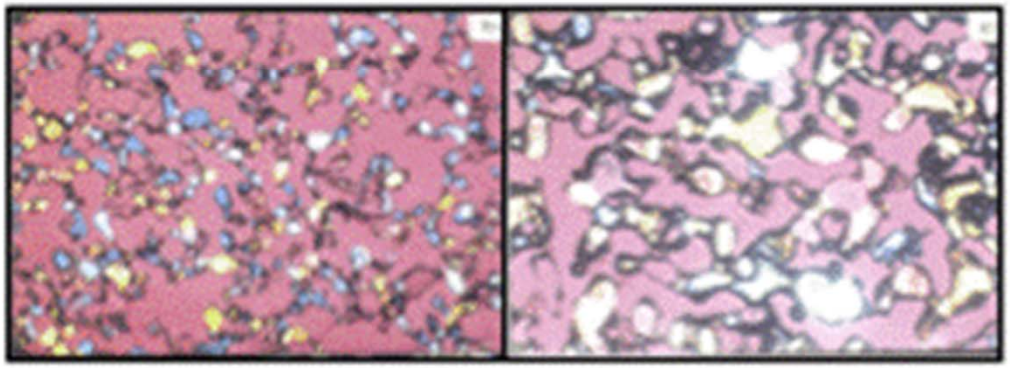
Snowflakes and eroded snowflakes





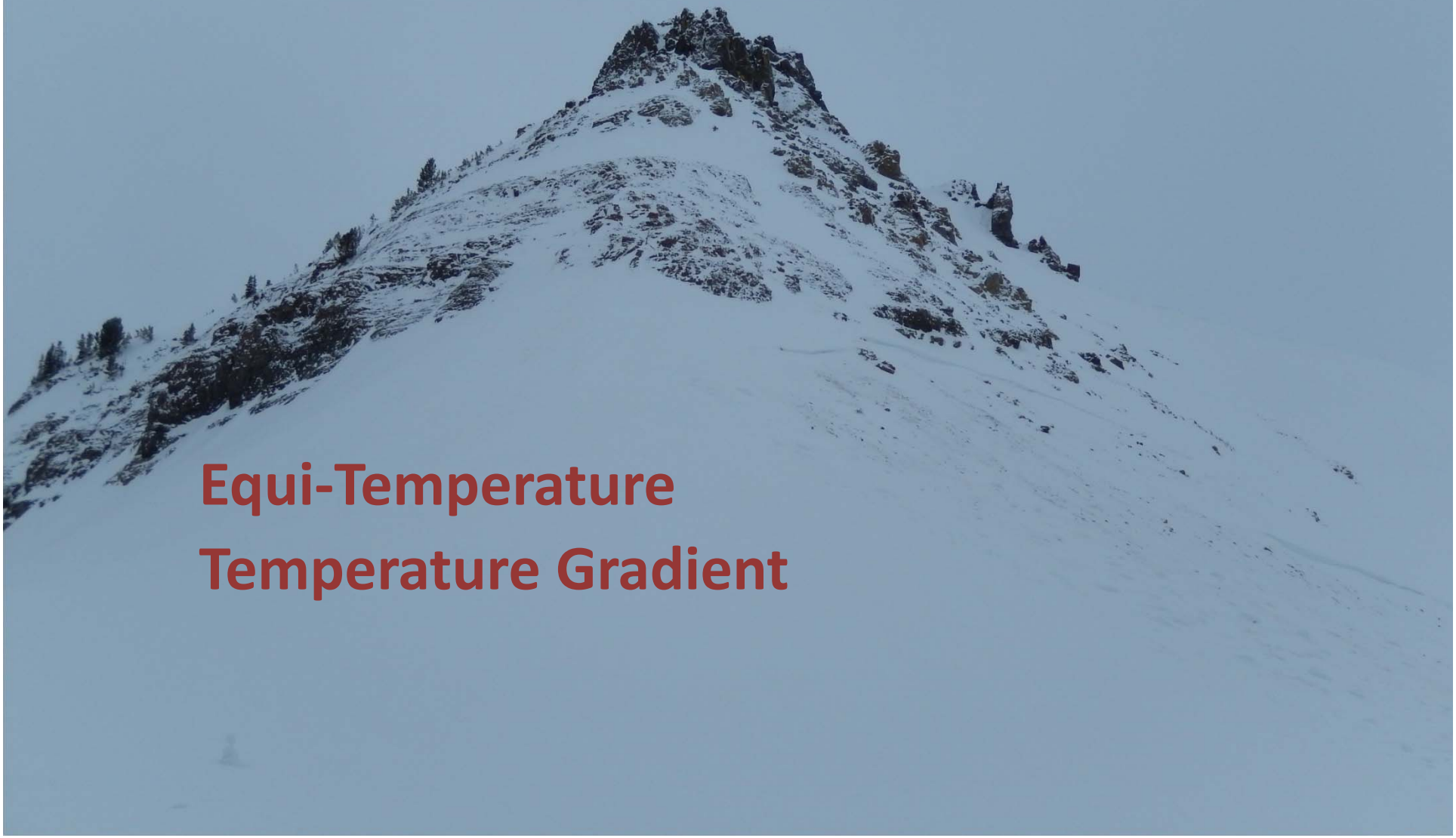


(Destructive Metamorphism)



Small rounded crystals *Well-rounded crystals*

Metamamorphism

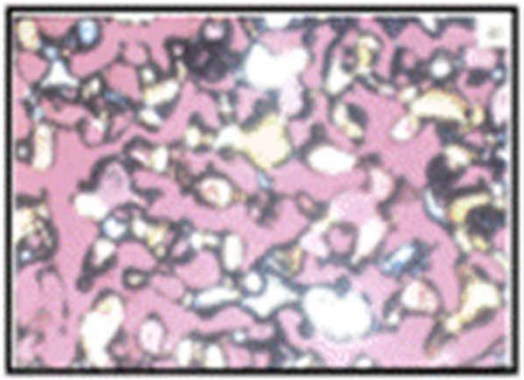


Equi-Temperature

Temperature Gradient

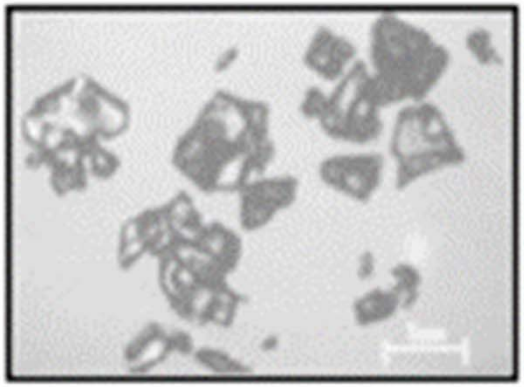
Temperature Gradient Metamorphism

(Constructive Metamorphsim)



Well-rounded crystals

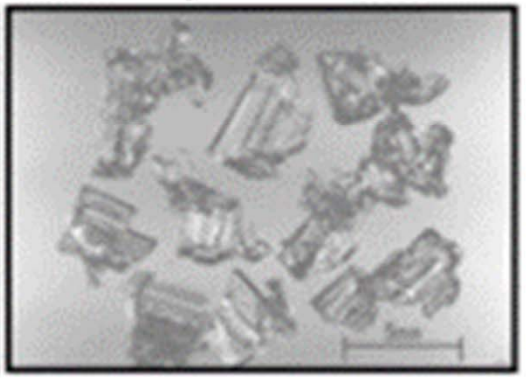
Rounded crystals with developing facets



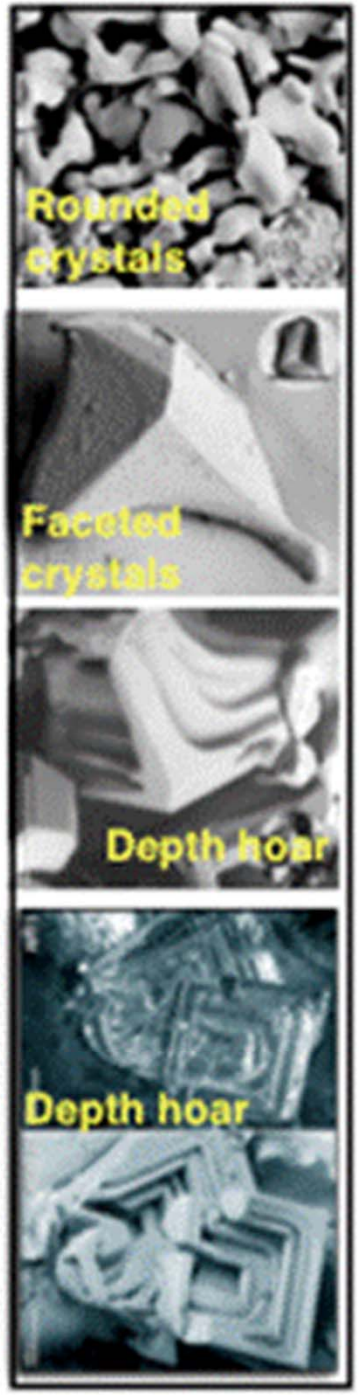
Solid faceted crystals

Depth hoar

Large depth hoar



Cup-shaped, striated crystals (depth hoar)



Metamamorphism

Equi-Temperature

Temperature Gradient

Melt Freeze

Pressure

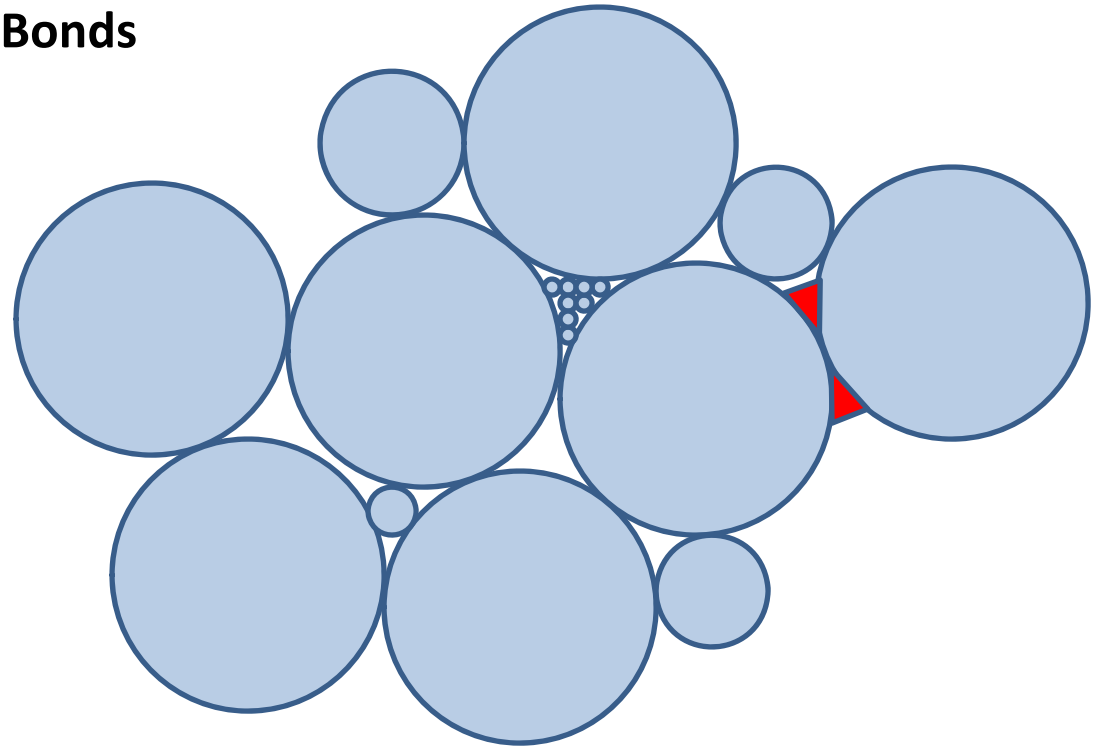
Test Course Consistency is #1!

Want to build courses that are homogeneous across a certain area, as well as from day to day, if possible.


Keep the Snow Clean

Bonding

Road Mix with Bonds



Increase Density

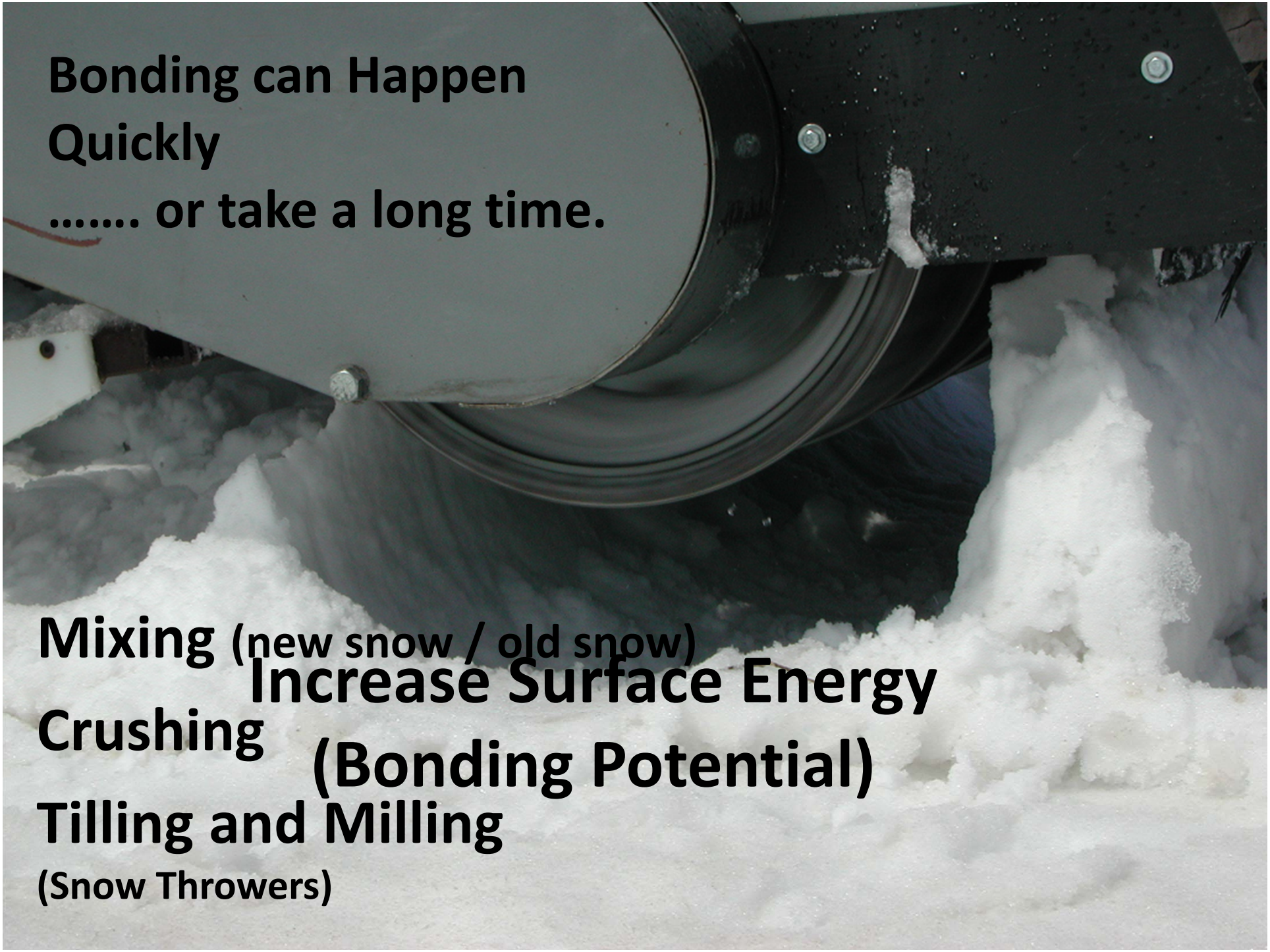
Increase Surface Energy

Increase Temperature (to a point)

Inject Water

Particulate (Dirt, Dust, Exhaust = Albedo and Lack of Bond)


Compaction
(Increase Density)
Tracks
Plate
Jump Up and Down!
Deep Snow
Roller
Shallow Snow
Wheels (Roller or Vehicle)
Vibration


Bonding can Happen Quickly
……. or take a long time.
Mixing (new snow / old snow)
Crushing
Tilling and Milling
(Snow Throwers)
Increase Surface Energy
(Bonding Potential)


THERE'S ONLY ONE JEEP!

Basic Properties

Depth

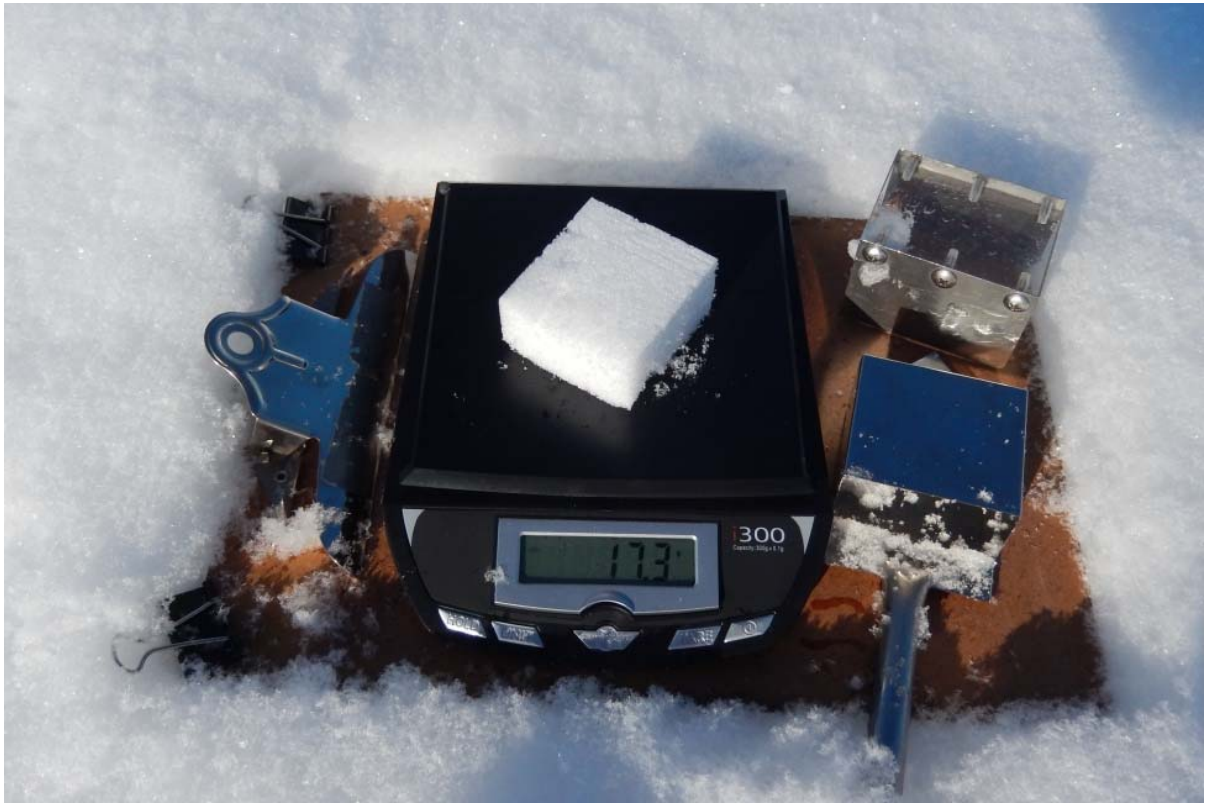
Layering / Lenses

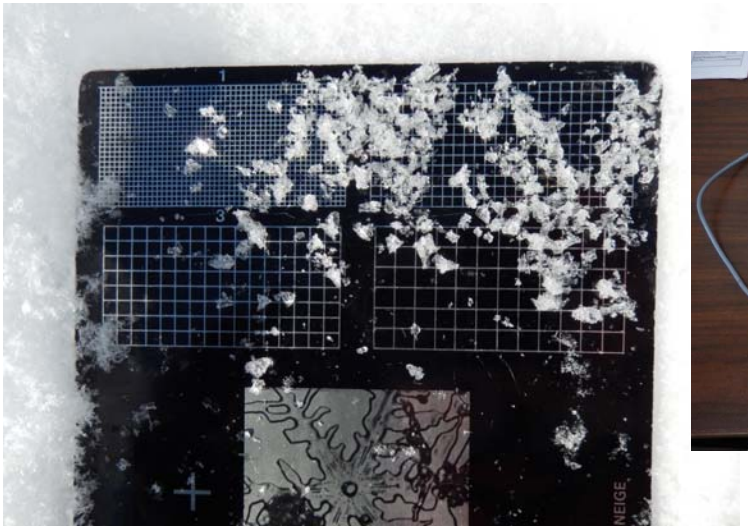
Temperature

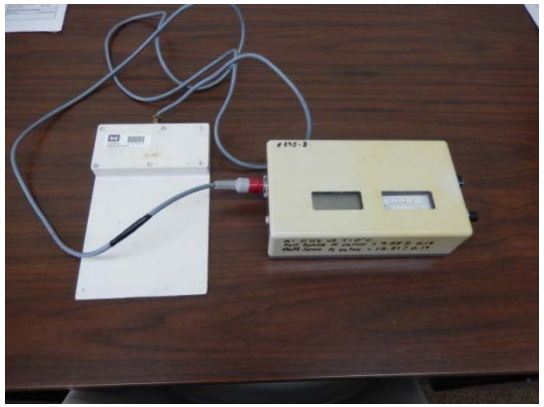
Density

Free Water Content (dry to slush)

Crystal Structure


300
173



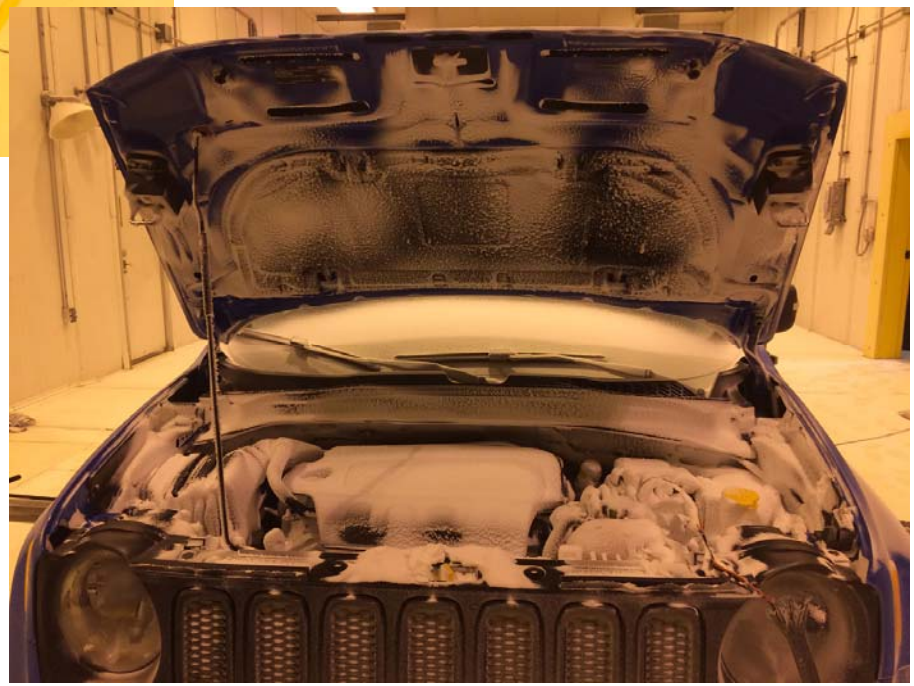


Strength Measurements

Shear and Compression

Snow Around the World

Cape Evans, Antarctica



Lab vs the “Real World”

Ice Testing

Friction

Roughness

Strength

Weather Effects

Cloud Cover

Air Temperature

Wind

Humidity

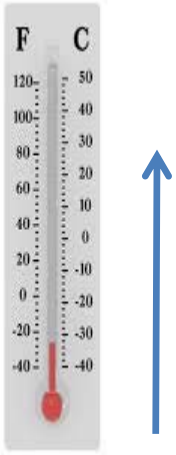
Solar

Snow Temperature

Ground Temperature

Dew Point

Snow and Ice Melting



Energy to raise the temperature of ice 1° F is 0.51 BTU/lb.

Let's say we want to make 100 gallons of cold water in the field. First we would want to raise the temperature of the snow to just below 32° F. If the density of the snow is 0.25 we would need about 54 ft^3 of snow (about 850 lb).

If the snow is 0° F, it would take about 14,000 BTU to accomplish the 32° change in temp.

Once the snow is brought to near the melting point, it takes a larger input of energy to move from solid to liquid (latent heat of fusion). This amount of energy is about 144 BTU/lb or about 122,400 BTU for the above example. This makes a total of about 136,400 BTU to make 100 gallons of water. At an efficiency of 0.9, this becomes about 150,000 BTU. This equates to 1.3 gallons of jet fuel or 1.8 gallons of propane.


Yup, I'm a snow
Geek, and…..

I still say – Jump Up and Down!!

Questions????