Snow Travel, Avalanche Awareness, and Crevasse Rescue

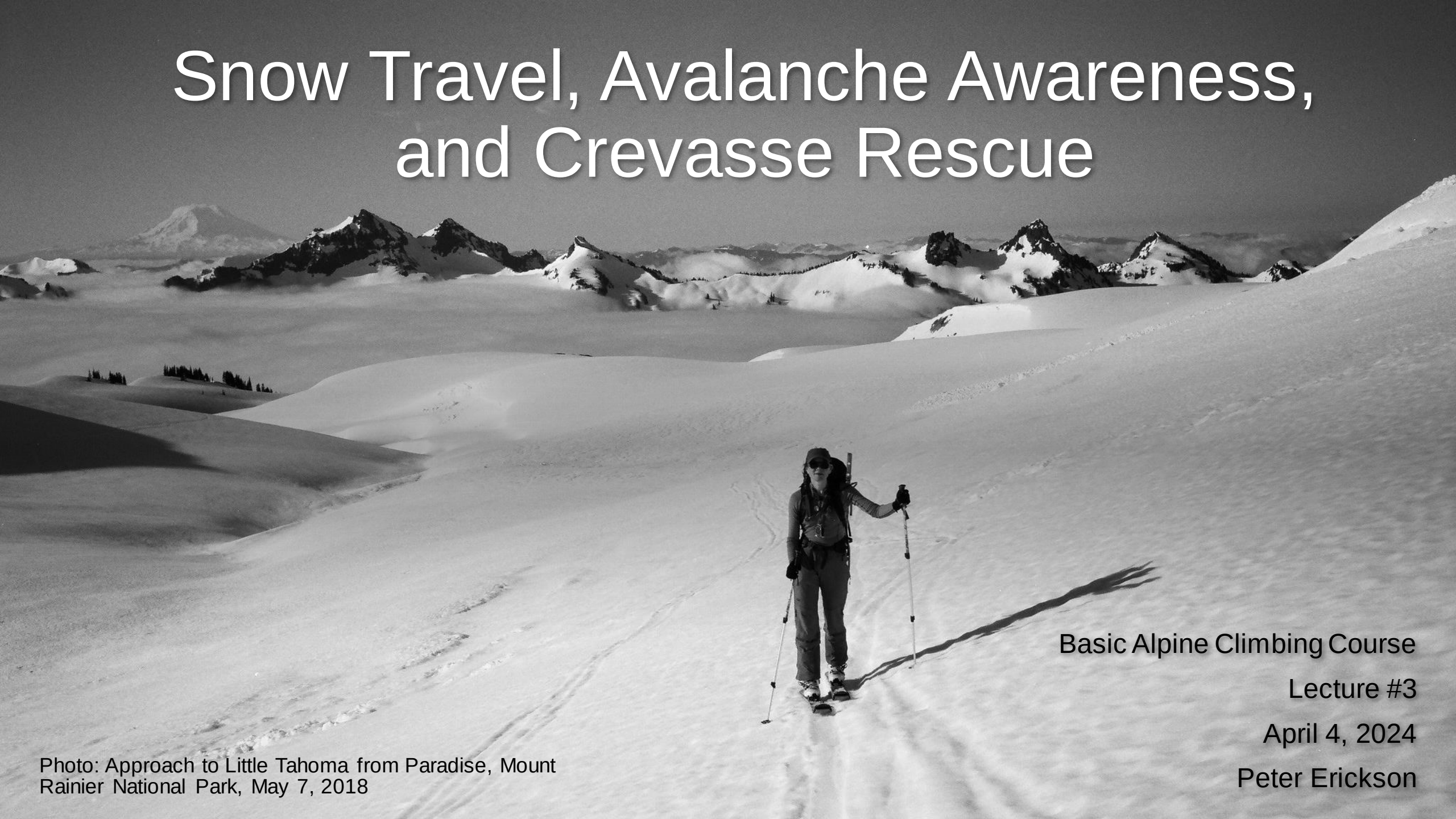


Photo: Approach to Little Tahoma from Paradise, Mount Rainier National Park, May 7, 2018

Basic Alpine Climbing Course

Lecture #3

April 4, 2024

Peter Erickson

Why do you [want to] climb snow?

Photo: Eldorado Peak, April 23, 2018

Outline – (it’s all about traveling safely)

- **Traveling on snow** – terrain, hazards, techniques, equipment
- **Snow anchors, belays –** when risk increases
- **Crevasse rescue –** made simple (ha)
- **Avalanches** – managing risk
- **Snow camping**

Traveling on snow

Samples of terrain and snow conditions you will encounter on basic climbs

Photo: Sahale Peak, July 19, 2016
(Photo by Michael Toyama)

Photo: Quien Sabe Glacier, June 30, 2013
(Sahale Peak is behind us; Sharkfin Tower is off-screen in upper right)

Photo: Whitehorse Mountain, May 20, 2014

Photo: South Early Winter Spire: May 30, 2016

Photo: Mount Rainier, June 21, 2015

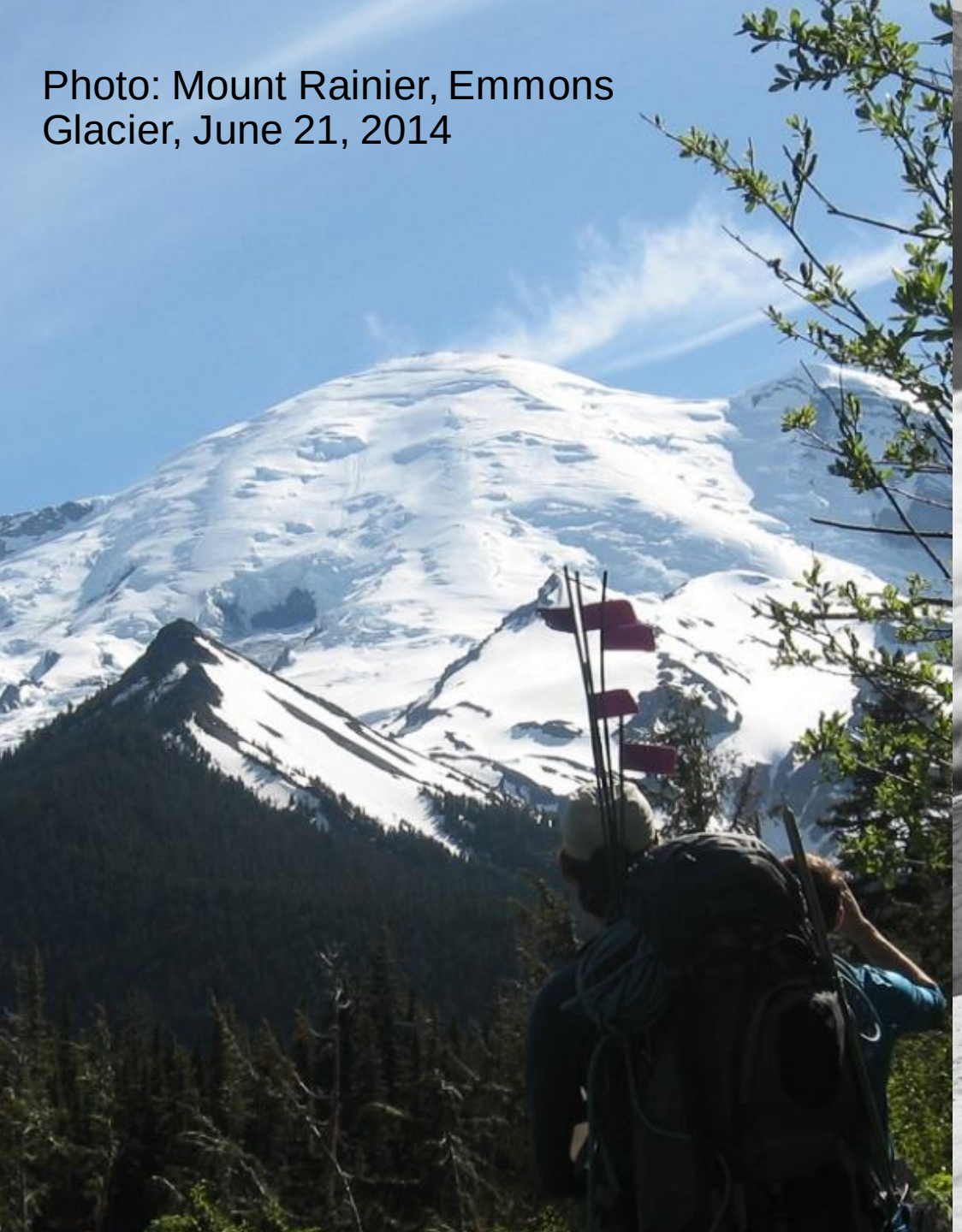


Photo: Mount Rainier, Emmons Glacier, June 21, 2014

Photo: Sloan Peak, July 24, 2016


Photo: Returning from Black Peak, May 24, 2020
(Cutthroat Peak and Whistler Mountain shown)

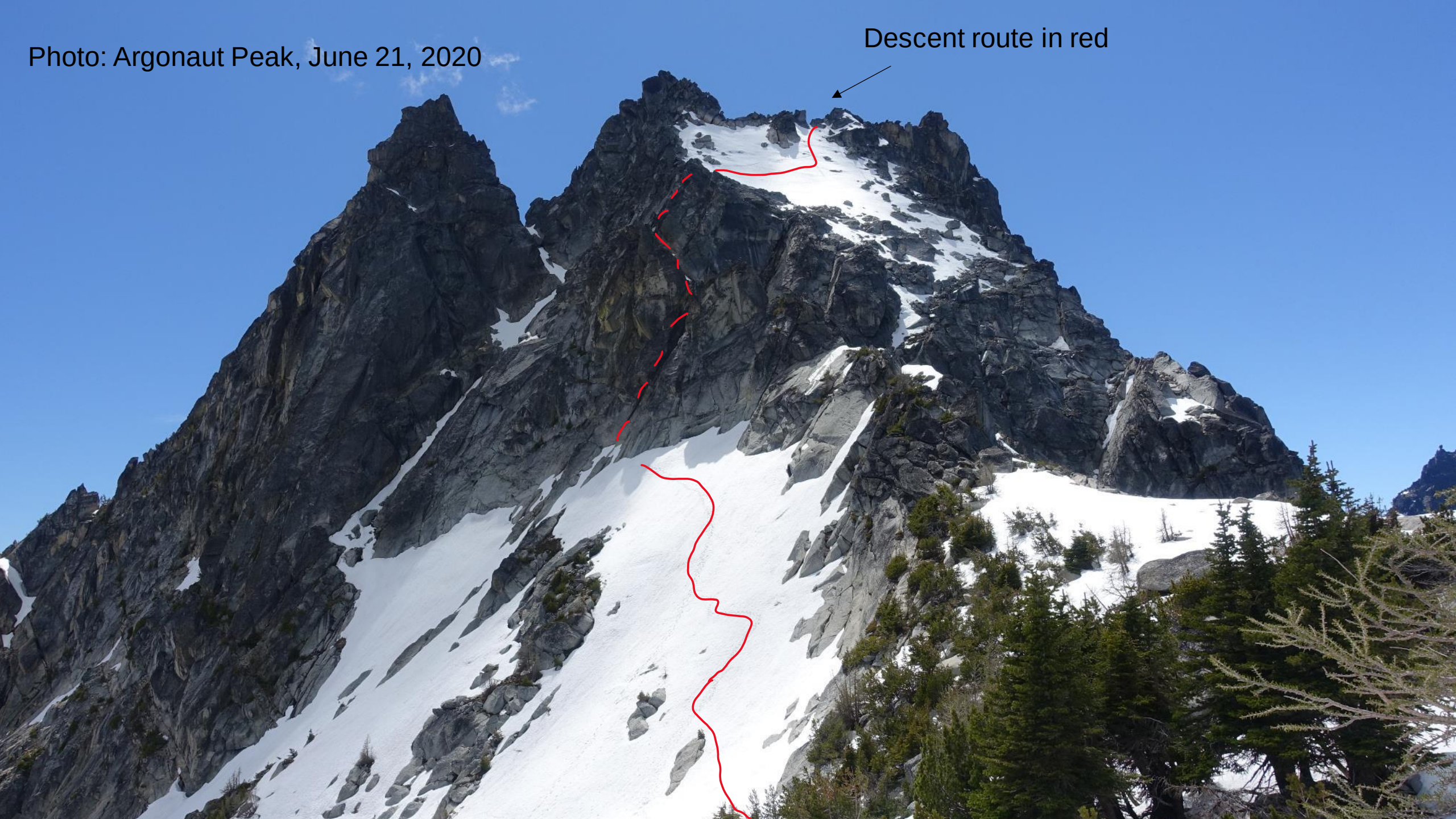


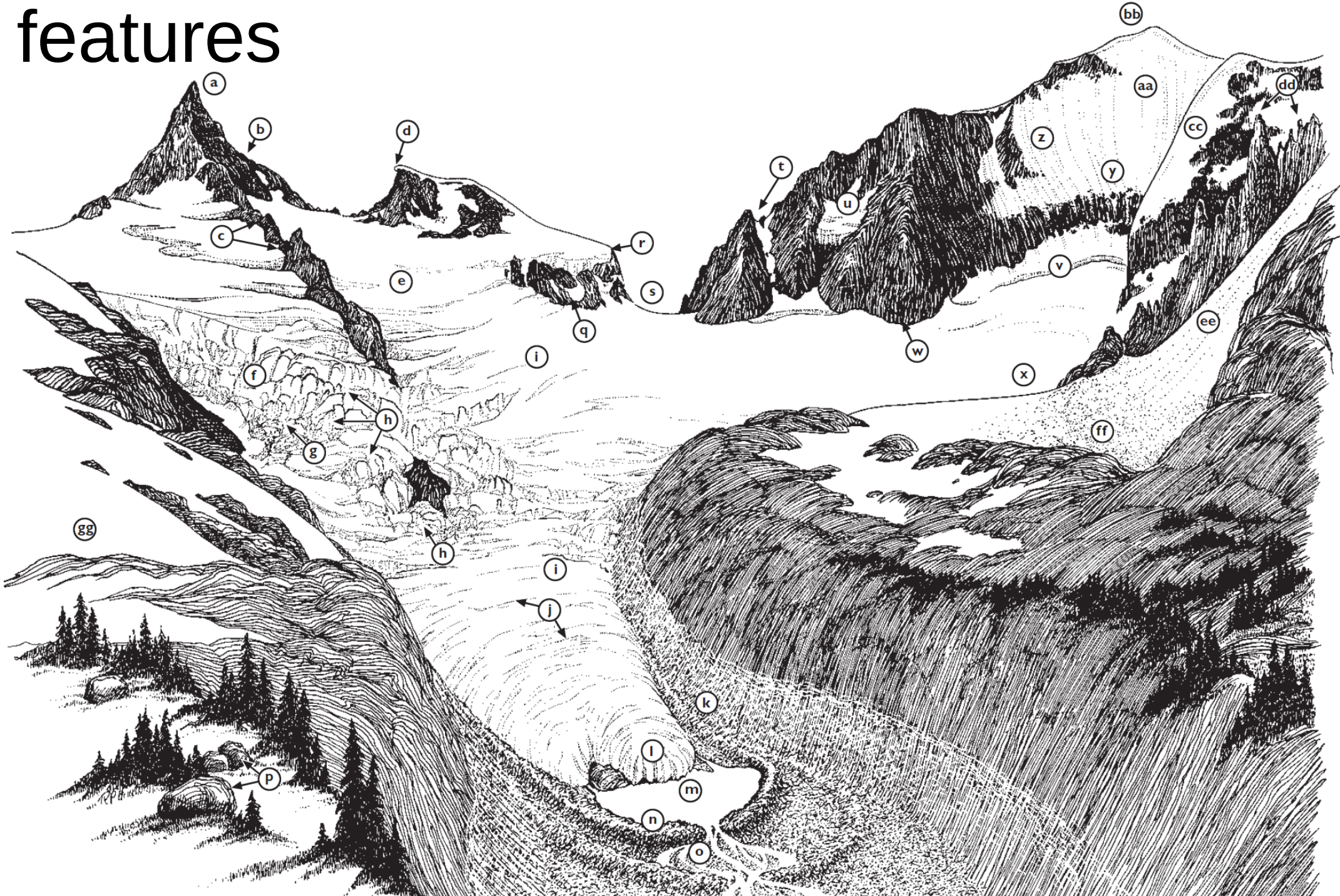
Photo: Argonaut Peak, June 21, 2020
Descent route in red

What kind of hazards did you notice?

- Dangerous **runout** / exposure
- Crevasses
- Snow conditions – poor traction / sharp ice / crampon balling?
- Snowbridges?
- Sun / UV (glacier glasses / sunscreen mandatory)
- Weather?
- What else?

Terrain features

a. Horn or aiguille
b. Ridge
c. Rock arête
d. Cornice
e. Glacier basin
f. Seracs
g. Fallen seracs
h. Icefall
i. Glacier
j. Crevasses
k. Lateral moraine
l. Snout
m. Moraine lake
n. Terminal moraine
o. Glacial runoff
p. Erratic blocks
q. Rock band
r. Shoulder
s. Col
t. Couloir or gully
u. Hanging glacier
v. Bergschrund
w. Buttress
x. Cirque or bowl
y. Headwall
z. Flutings
aa. Ice wall
bb. Summit
cc. Ice arête
dd. Towers or gendarmes
ee. Avalanche chute
ff. Avalanche debris
gg. Snowfield



“Discussion”

- What new terms / features did you learn?
- Why is it useful or important to have precise, shared terminology?
- Any other observations?
- Note all the dangerous runout situations

Snow travel – techniques and equipment

- Assessing runout and consequence
- How not to fall
  - Walking in balance
  - Wear crampons
  - Self “belay”
- How to move efficiently (not just for snow)
  - Flotation (snowshoes…)
  - Rest step
  - Plunge step
  - Clothing systems (& packing systems)
  - Food and drink systems

How not to fall: Walking in balance

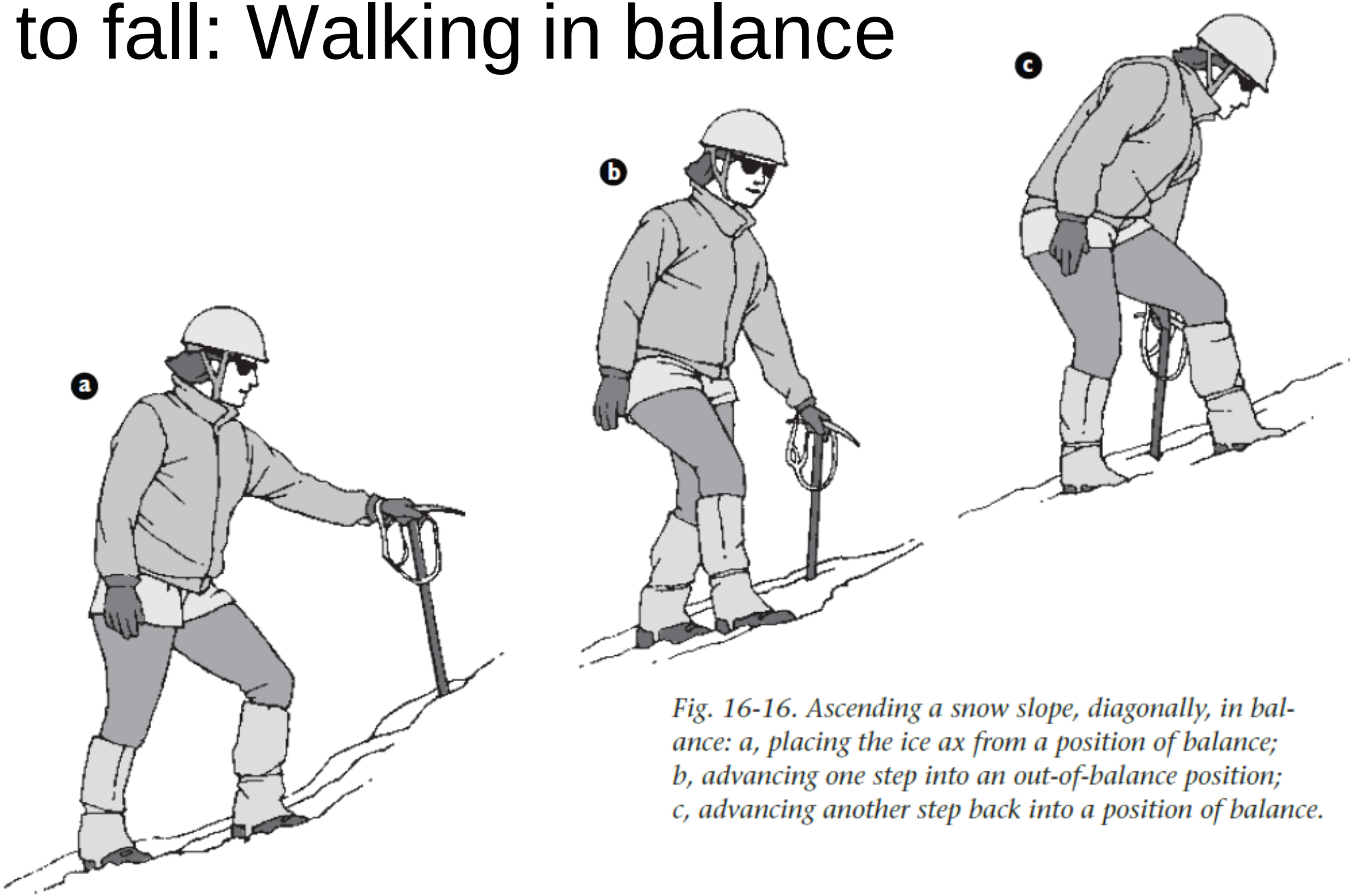
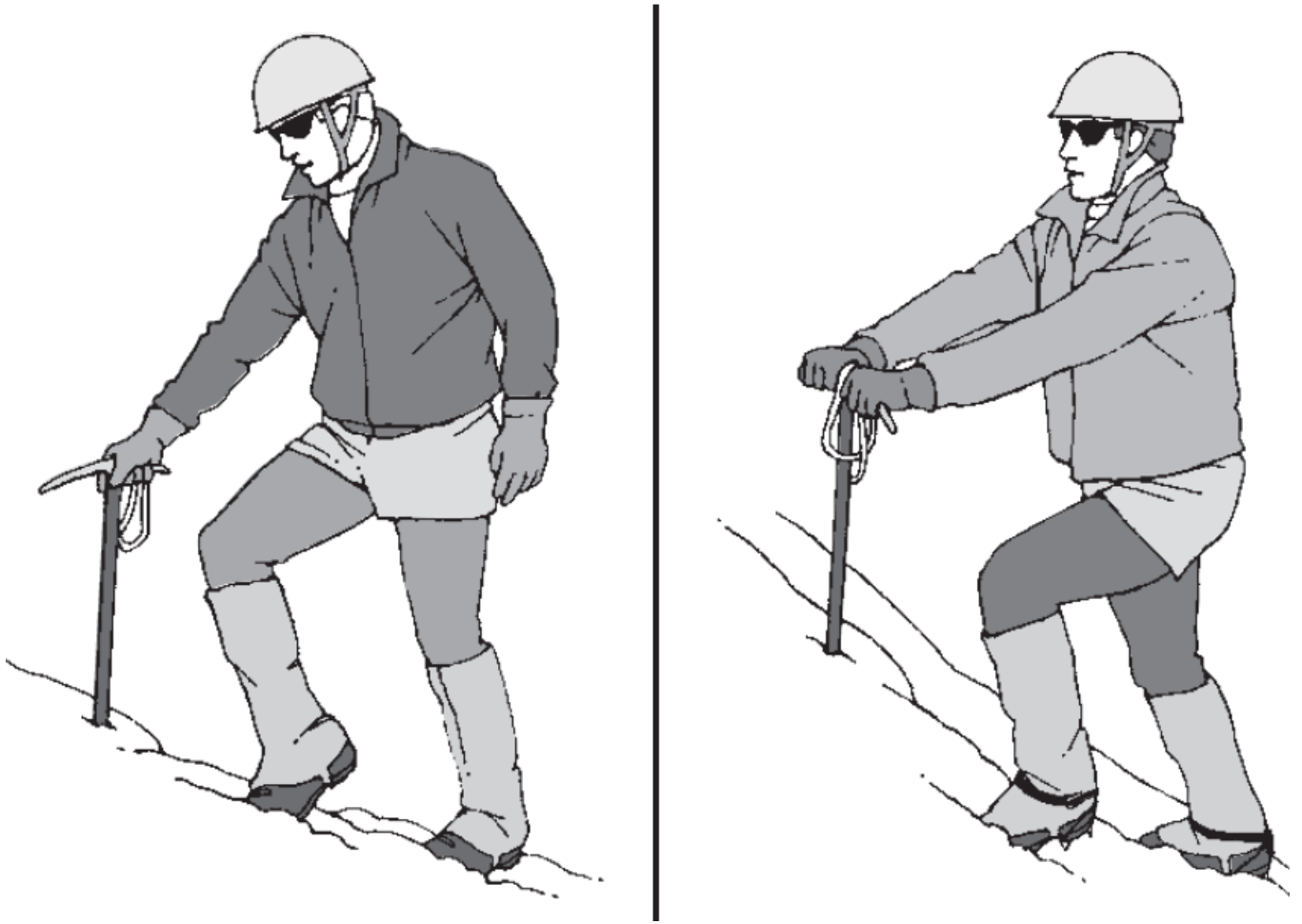
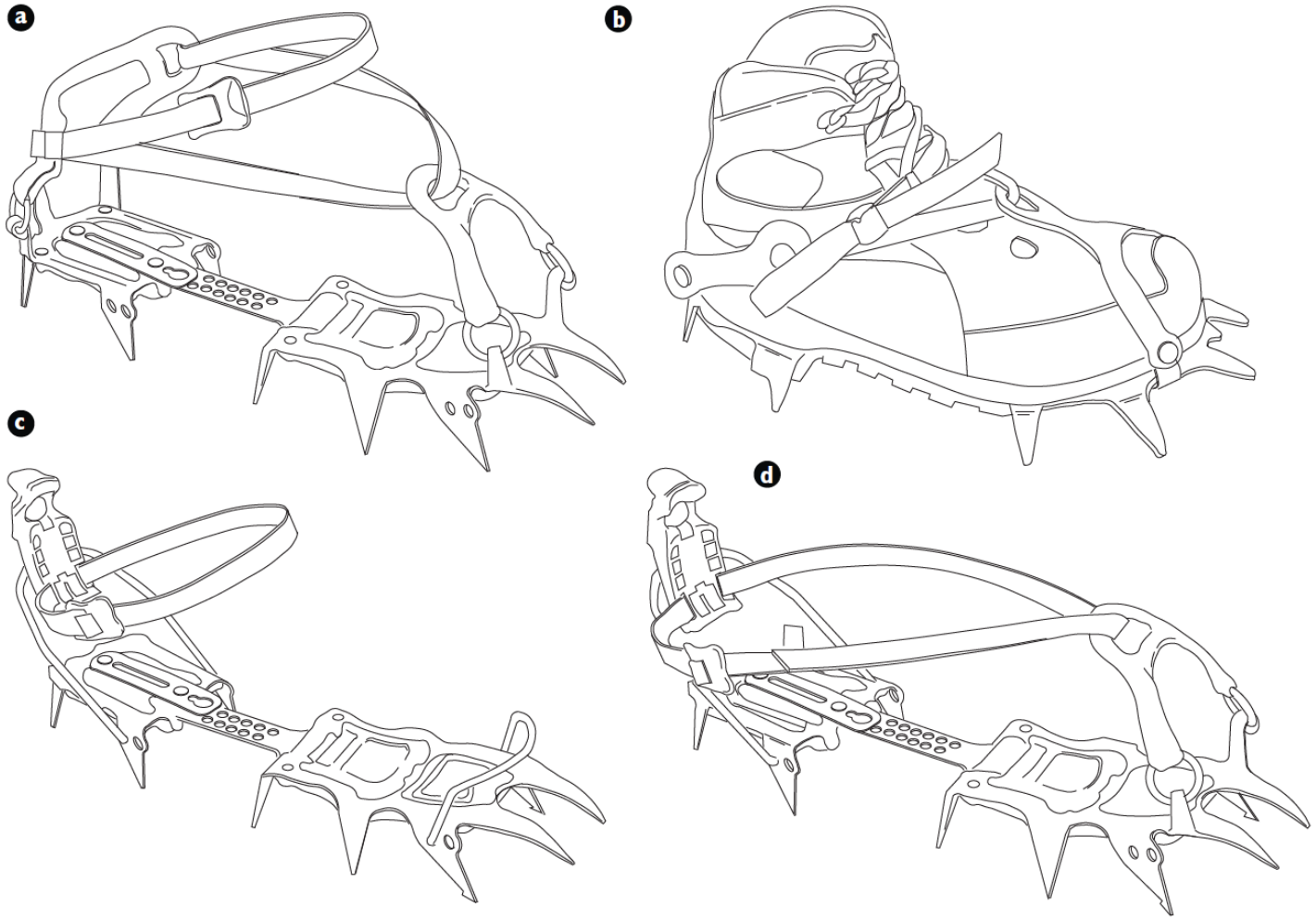


Fig. 16-16. Ascending a snow slope, diagonally, in balance: a, placing the ice ax from a position of balance; b, advancing one step into an out-of-balance position; c, advancing another step back into a position of balance.

Photo: Silver Peak, Jan 3, 2015



How not to fall: wear crampons!



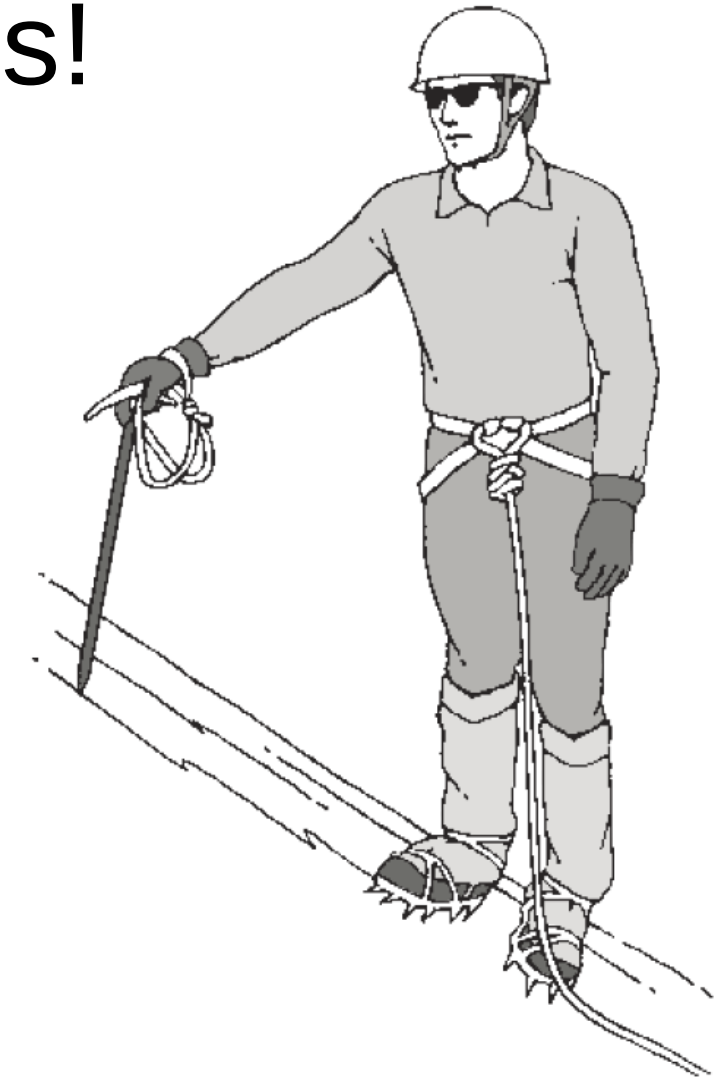
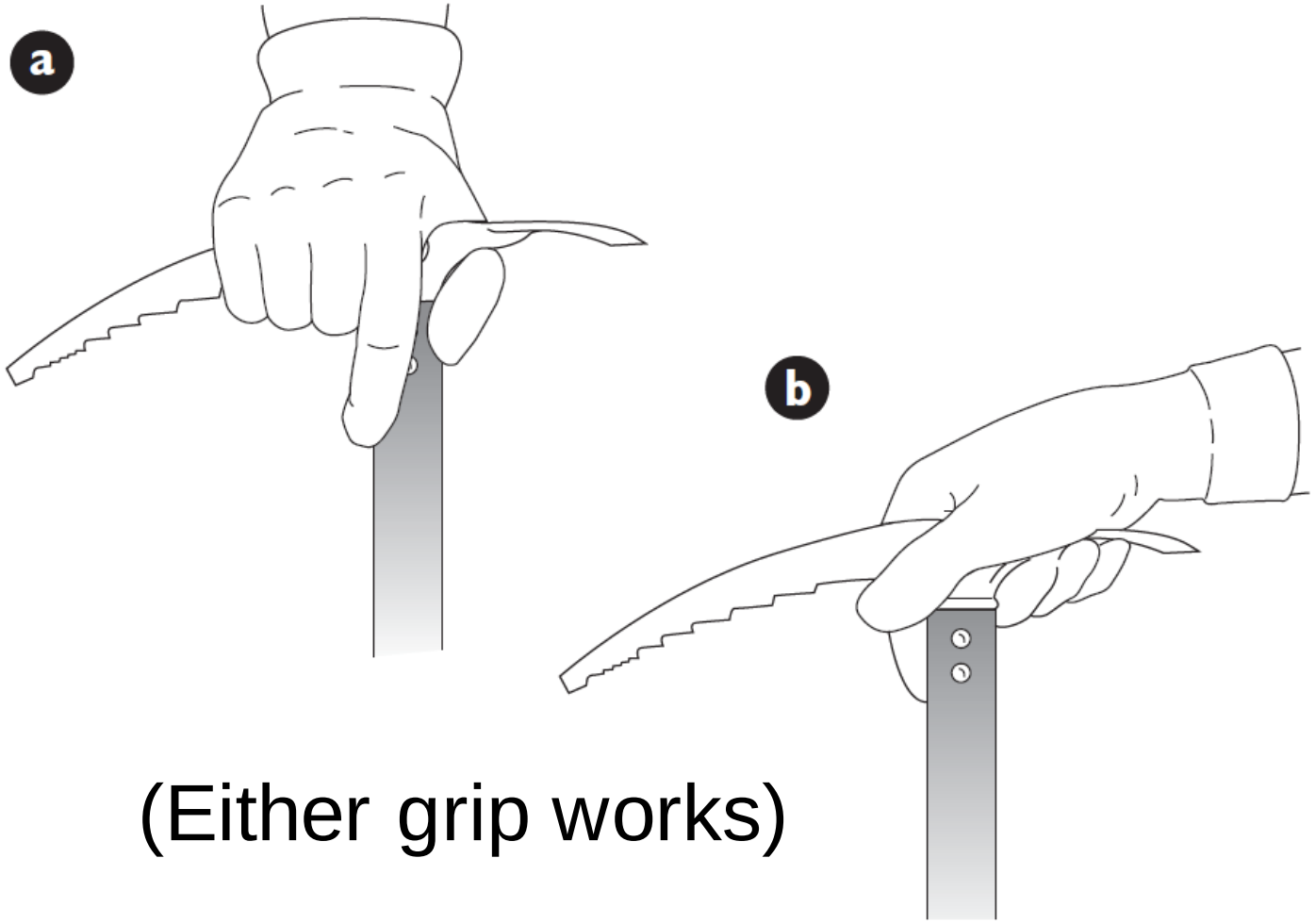


Fig. 18-13. French technique on a moderate slope, flat-footing in a diagonal ascent combined with ice ax in cane position.

How not to fall: Self-belay

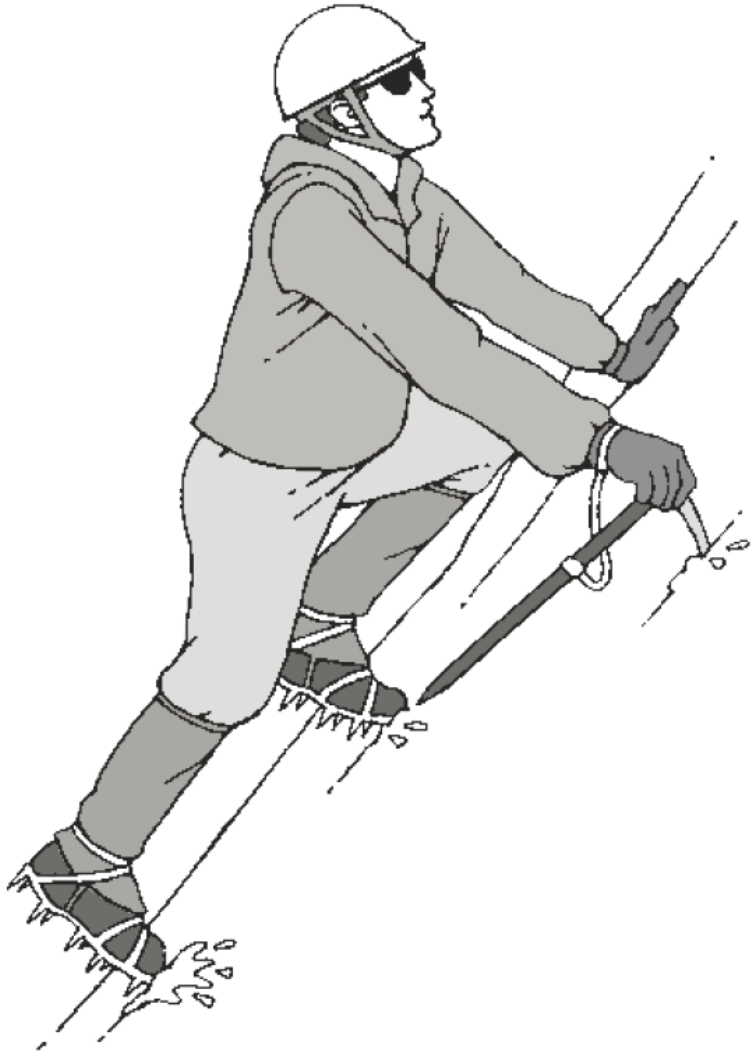


(Either grip works)

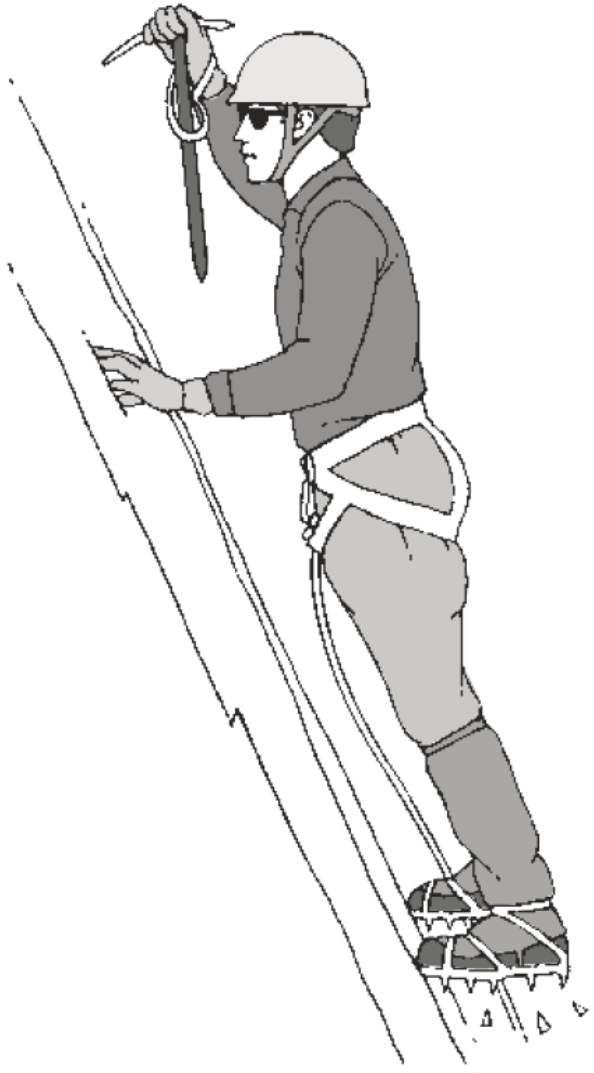
Fig. 16-15. Grasping an ice ax: a, self-arrest grip; b, self-belay grip.

Fig. 16-23. Facing in (backing down): place ax low on the slope and don't lean in toward the slope.

Low Dagger



High Dagger



Other ice axe considerations

- When to use it? (e.g., likelihood and consequence of fall)
- Leashed or un-leashed
- Length
- Shaft / pick shape and details (more advanced topic)
- Always wear gloves

Other crampon considerations

- Too sharp (out of box) can be a hazard
- Gaiters help limit snagging too (if snugly fitted)…
- Fit them to boots ahead of time (double check!)
- Requires careful / attentive walking
- Aluminum v. steel (steel more versatile, preferred for first pair)
- Avoiding a fall with crampons is way better than counting on stopping a fall with self-arrest

How to move efficiently:

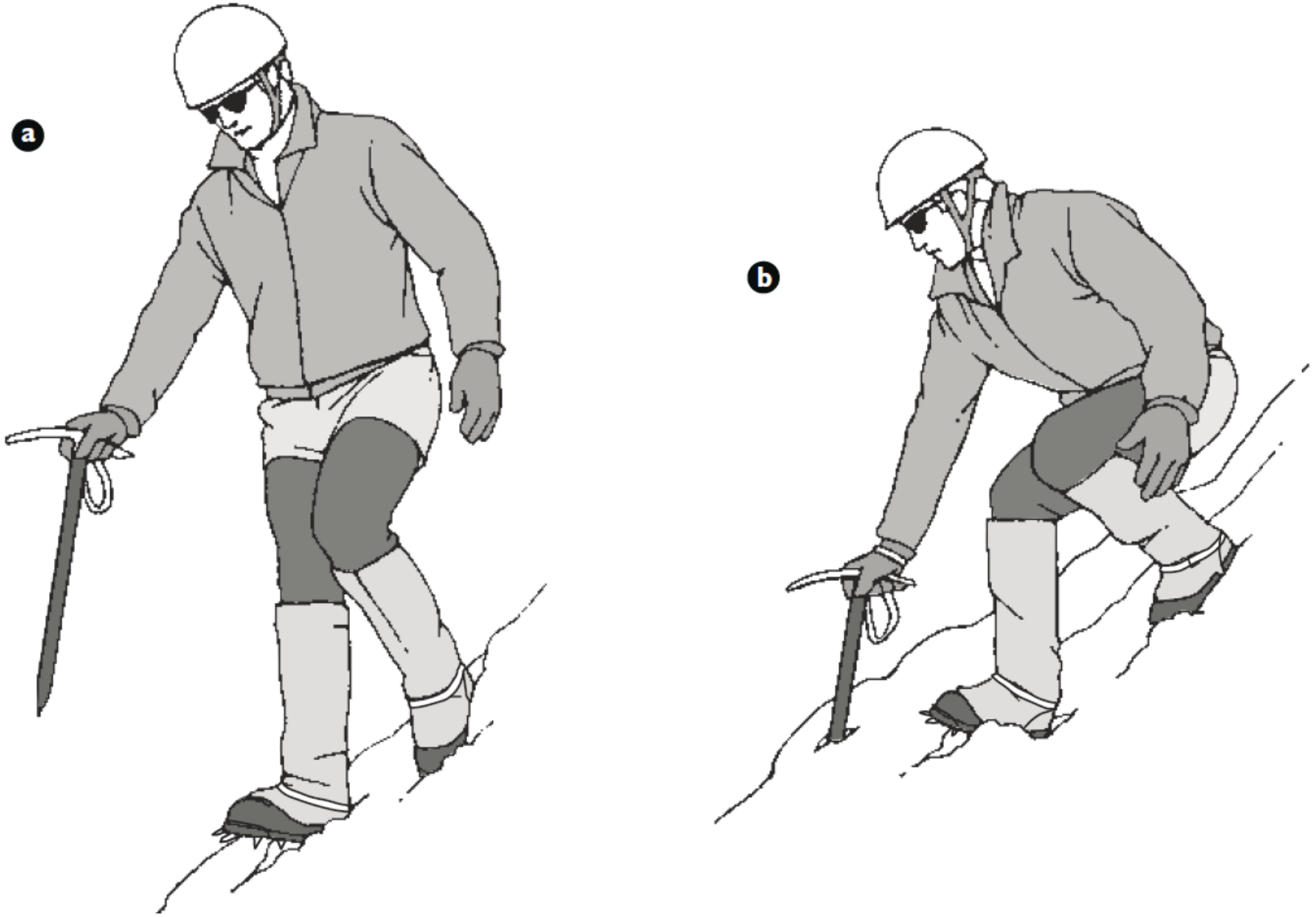
- Soft snow (esp. Winter / early Spring): **Flotation** (snowshoes…, or skis)
- Hard snow (Late spring through autumn:) **Crampons**

Photo: Mazama Ridge, snow overnight, March 2015

How to move efficiently (kicking steps)

- Lead step-kicker should consider fitness and height of team
- How high each step?
- Straight up or traversing?
- Take turns in lead to spread step-kicking effort
- Reinforce steps as you go (2nd, 3rd person, etc.)
- Pacing important to maintain efficient cardio

How to move efficiently (going down): plunge step (“nose over toes”)



How to move efficiently (going down): can you glissade safely?

Fig. 16-24. Glissades: a, sitting; b, standing;

How to move efficiently: other considerations

- Clothing and packing systems
  - Layers that can be added and subtracted
  - Start out cold (seriously – sweat is your enemy)
- Food and hydration
  - Keep eating; keep quick calories in your pocket
  - Keep drinking; hydration tube very helpful
- Clear, open communication (creates shared expectations)
  - Planned rest breaks (e.g. 5 minutes every hour) can help

Last resort: self-arrest (may not work)

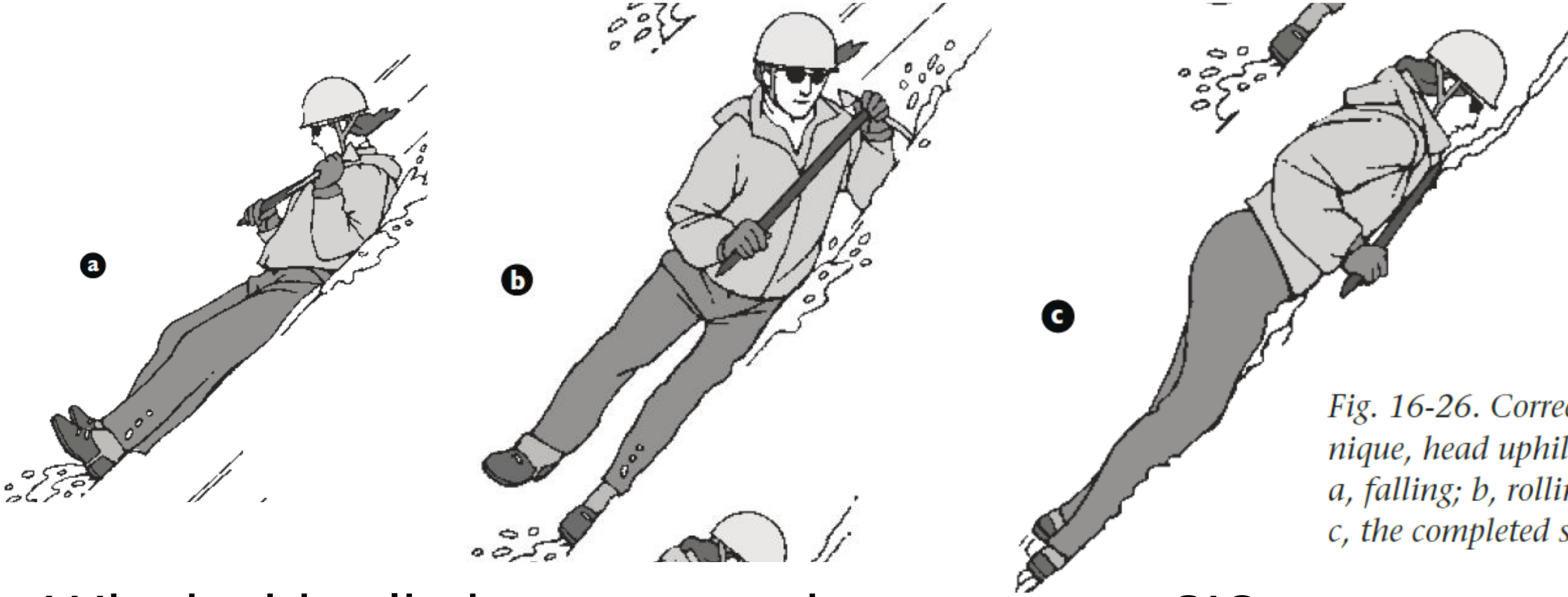


Fig. 16-26. Corre
nique, head uphil
a, falling; b, rollin
c, the completed s

Q: Why is this climber not wearing crampons?!?

How to move safely (here, quickly!!!)

Photo: Mount Rainier, Disappointment Cleaver, June 21, 2015

Exercise – what gear to bring?

- You will be climbing Mt. Cruiser in Olympic National Park
  - In mid-July, over two or three days, depending on how long it takes
  - The approach is long: 7.5 miles one way from the trailhead to Flapjack lakes
  - Forecast: daytime highs in the 80s, night-time lows in the 50s; partly cloudy overnight, clearing by morning
  - Handout has route description and map
- In your breakout groups, imagine you are at the trailhead (**no cell coverage**, e.g. no googling past trip reports): **discuss pros and cons of bringing crampons and ice axe**
  - And, if and when you would use them, will you also put on harnesses / use the rope? (Which you are already planning on bringing because Cruiser is a rock climb)

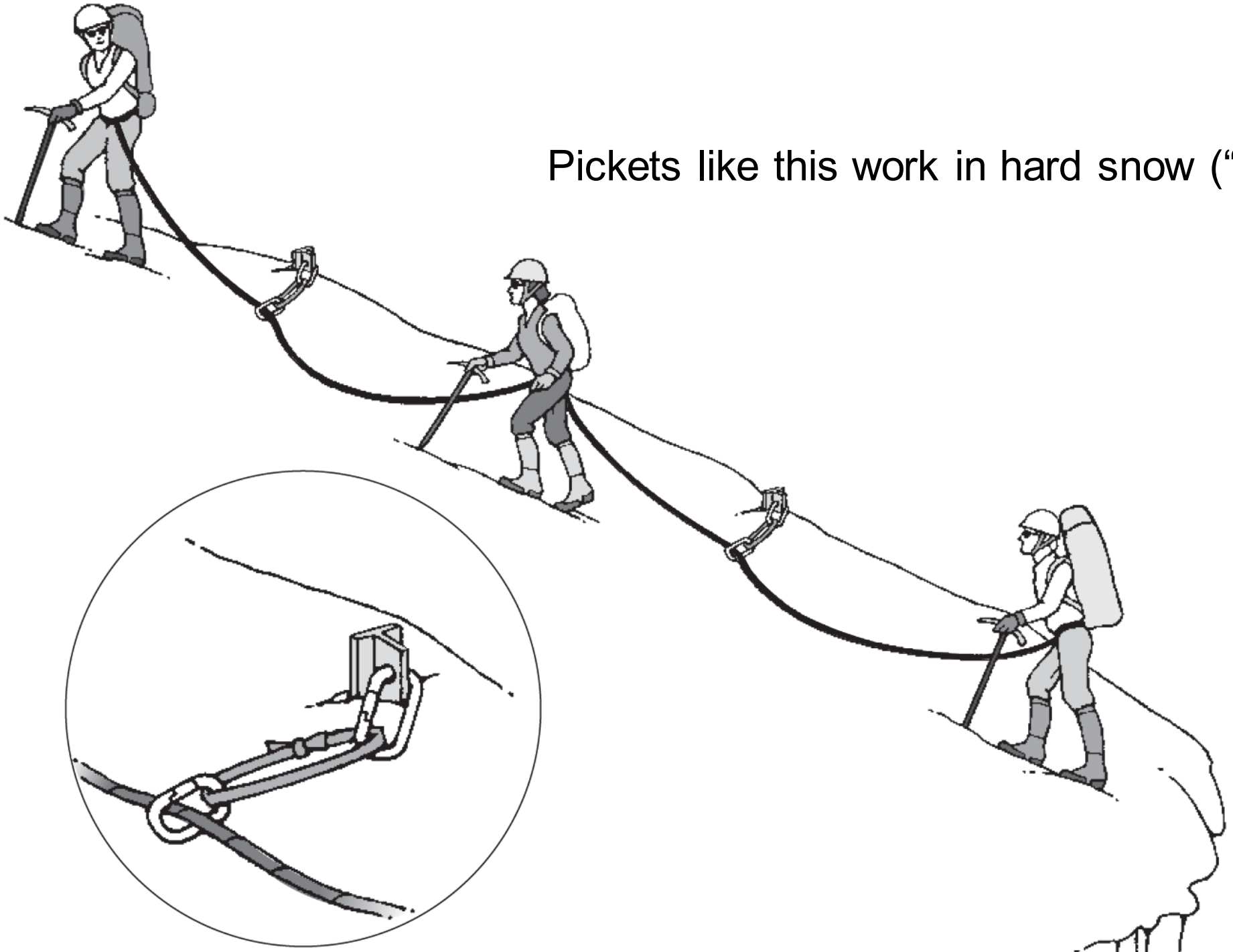
Photo: Mt. Cruiser, July 12, 2014

Snow anchors and belays

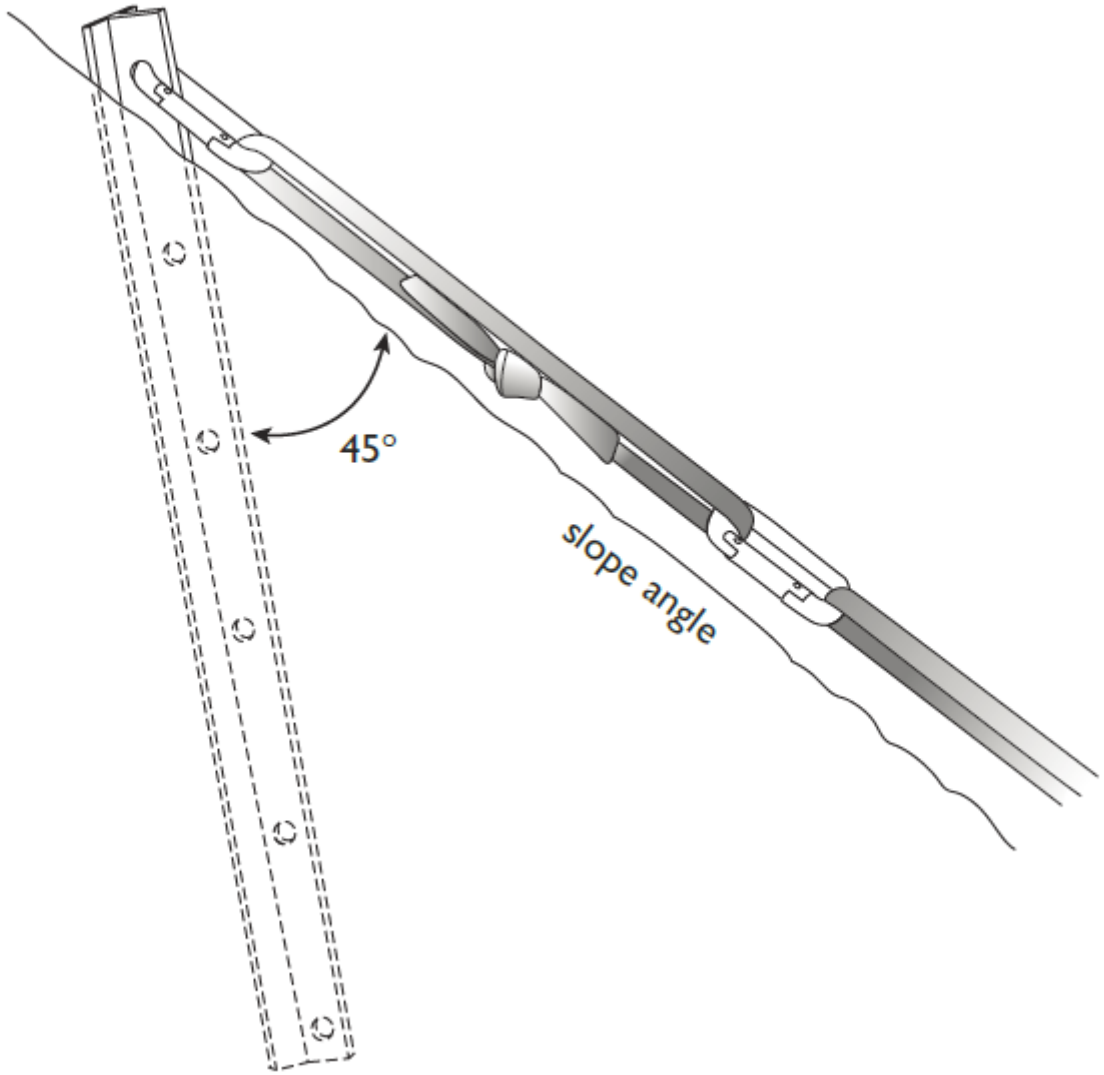
When the risk of a fall increases in likelihood or consequence

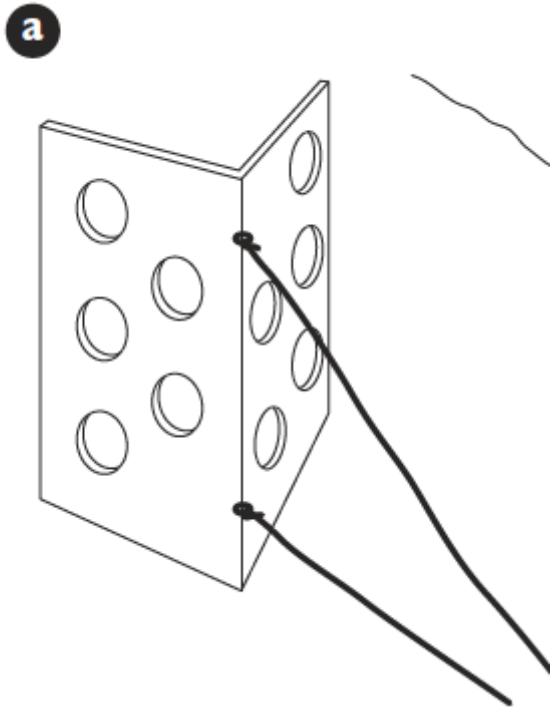
Photo: Mount Rainier, Disappointment Cleaver, June 21, 2015

Pickets like this work in hard snow (“neve”) only



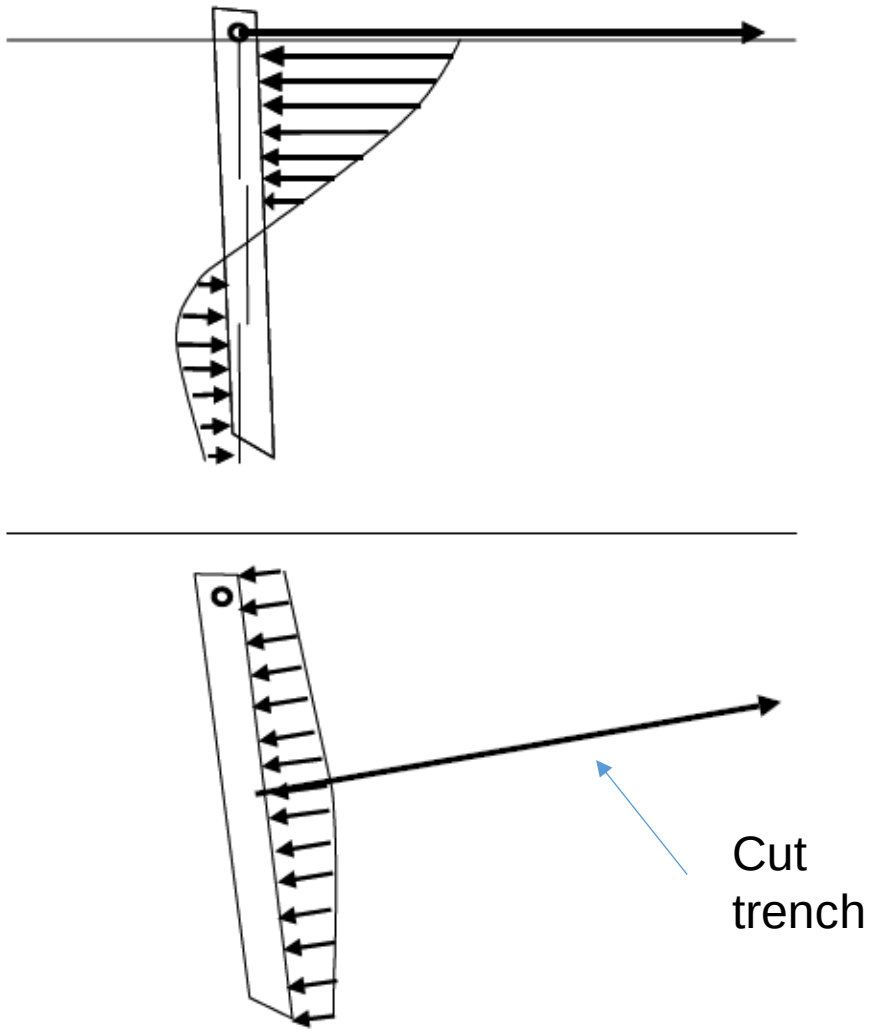
Pickets (common) & flukes (less so)





Pickets: Vertical, mid-clip usually best

- Snow has strong compressive strength, weak shear strength
- Vertical orientation easier to get a large area of compression
- Mid-clip best if feasible
- Exception when t-slot picket better: weak, dry snow that cannot be compressed



Belaying & rappelling in snow

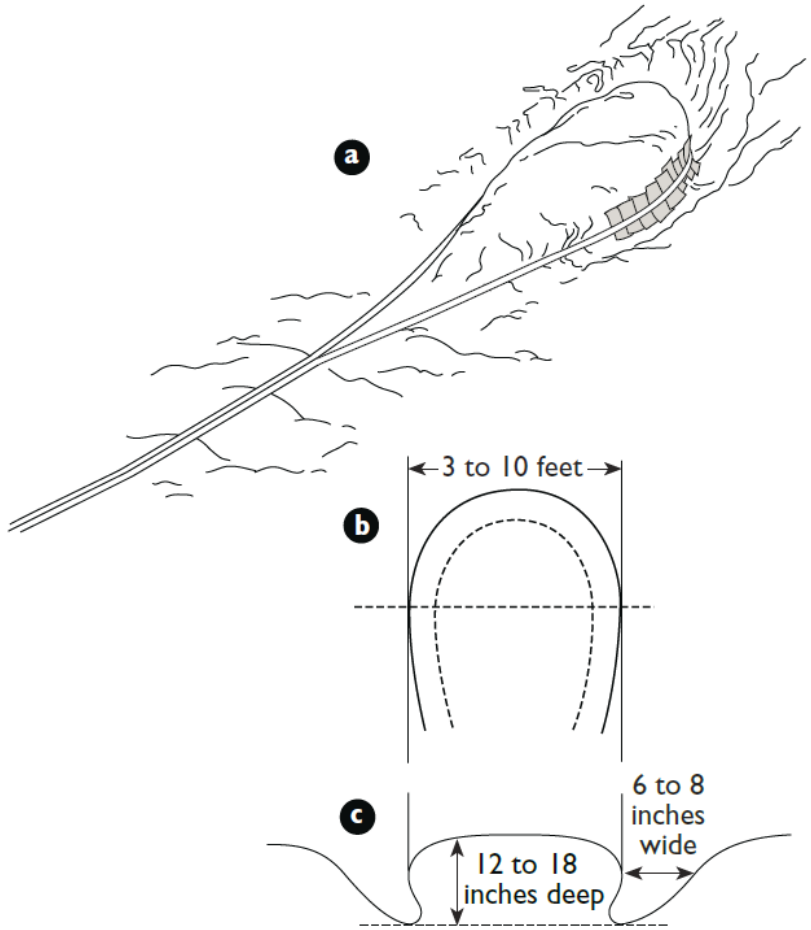


Fig. 16-35. Snow bollard: a, in a rappel setup; b, viewed from above; c, cross section.

Fig. 16-39. Sitting hip belay.

Photo:
Mount Rainier, Emmons Glacier, June 21, 2014

Consider a belay?

Photo: Eldorado Peak, June 25, 2015

“Discussion”: Should you rope up on steep snow if you aren’t placing pickets or other protection?

Photo: Mount Shuksan (approaching summit pyramid), June 5, 2016
(photo by Stephen Sugiyama)

Intro to Crevasse Rescue

(See separate slides from Deling Ren)

Managing risk from Avalanches

Confirmation bias can be deadly

- “Well, they crossed it safely just an hour ago”
- “So-and-so has been here before”
- “I haven’t heard of any recent avalanches”
- “I don’t see any avalanches”
- Are these relevant observations?

You can’t learn all about avalanche safety in one evening

- But you can learn:
  - Terrain selection, e.g. avalanche angles.
  - Critical communication practice:
    - Agree to travel as a team, speak up
    - Challenge assumptions
    - Respect anyone’s veto
  - Resources:
    - Northwest Avalanche Center (NWAC)
    - AIARE..(classes)
    - Mapping tools that shade slope angles
  - Some things to avoid

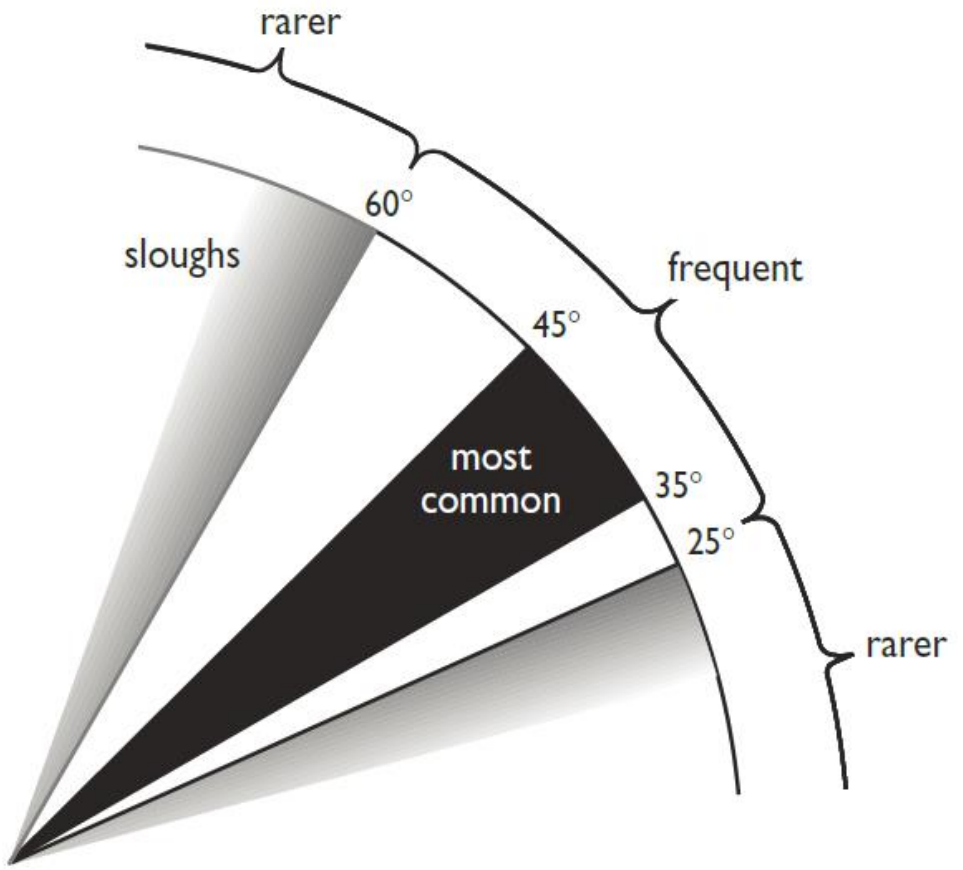


Fig. 16-42. Frequency of avalanches on slopes of various angles.

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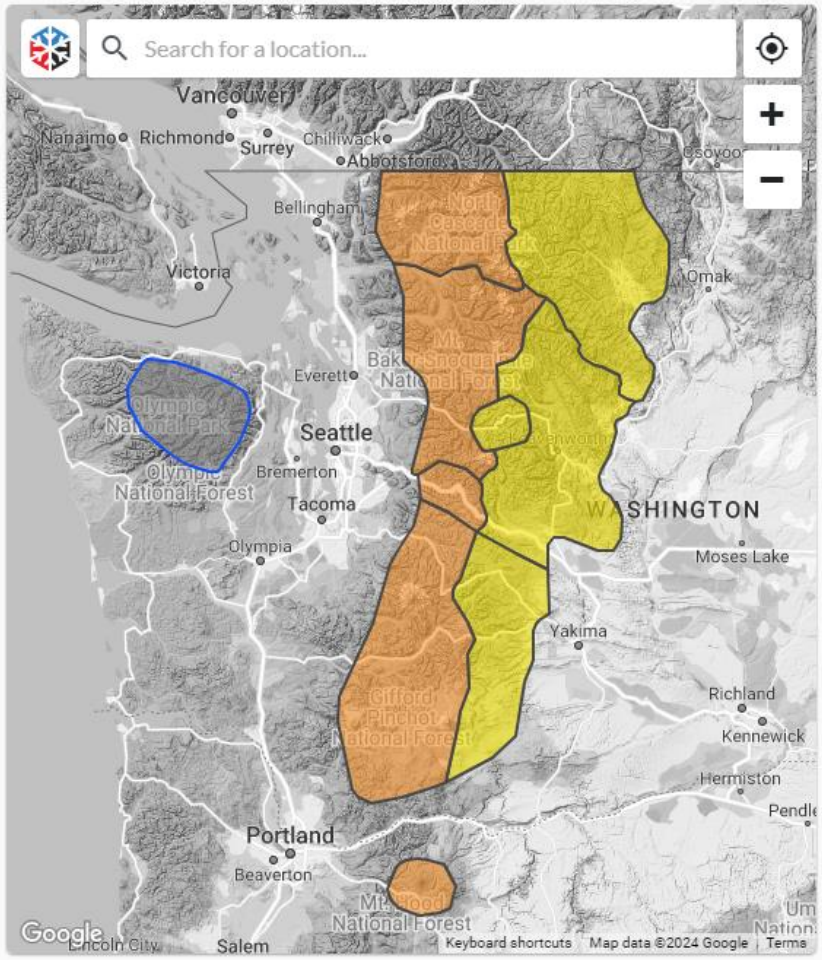
Avalanche Forecast By Zone



Avalanche Danger Scale

General Info	1 - Low	2 - Mod	3 - Cons	4 - High	5 - Extr

Get Involved

Become a Member

Become a Volunteer

News

Spring Forecast Schedule Begins Sunday, March 10th (Daylight Savings)

- Avalanche Forecasts issued daily at 6:30pm.
  - 7:30am for non-warning updates (new this season)
- Mountain Weather Forecasts: issued twice daily (7:00am, 2:30pm)
- Support your local community by submitting an observation.
- We built an app! You can download here: Apple or Android
- Community Resources for Grief Support: American Avalanche Association (A3): Resilience Project, American Alpine Club: Climbing Grief Fund, Survivors of Outdoor Adventures and Recovery (SOAR)

Recent Blogs

In Memory of Matt Primomo

- **Forecast for April 4 (2022):**
- Monday's avalanche danger isn't worth overthinking. Very strong and gusty winds, heavy precipitation, and fluctuating snow levels check all the boxes to create very dangerous avalanche conditions at mid and upper elevations. While you will likely be able to trigger a slide on any slope that isn't scoured down to the old crust, they will be much deeper and more deadly in areas where the wind piles the snow deeper. We even expect several rounds of natural avalanches due to prolonged windy conditions and continued snowfall. For that reason, avoid traveling in areas where avalanches can start, run, and stop.
- At lower elevations, it will take a bit before enough snow accumulates to begin to build an avalanche issue. However, with such strong wind speeds, this will likely occur in openings where the snow can drift into deeper slabs. Even in the trees, watch for textured surfaces and firmer drifts to identify steep slopes you want to avoid.

AVALANCHE DANGER

	Monday, April 4, 2022	Tuesday, April 5, 2022
Upper Elevations 6500-5500ft	4 - High	3 - Considerable
Middle Elevations 5500-4000ft	4 - High	3 - Considerable
Lower Elevations 4000-2500ft	3 - Considerable	3 - Considerable

Elevation Band Descriptions

DANGER SCALE

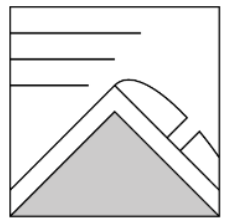
1 - Low | 2 - Moderate | 3 - Considerable | 4 - High | 5 - Extreme

+ Danger Scale

AVALANCHE PROBLEMS (1)

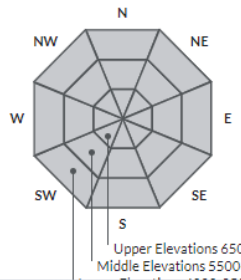
PROBLEM #1: WIND SLAB

PROBLEM TYPE



Wind Slab

ASPECT/ELEVATION



LIKELIHOOD

Certain
Very Likely
Likely
Possible
Unlikely

SIZE

Historic (D4-5)
Very Large (D3)
Large (D2)
Small (D1)

Top

Things to avoid:

Cornices…

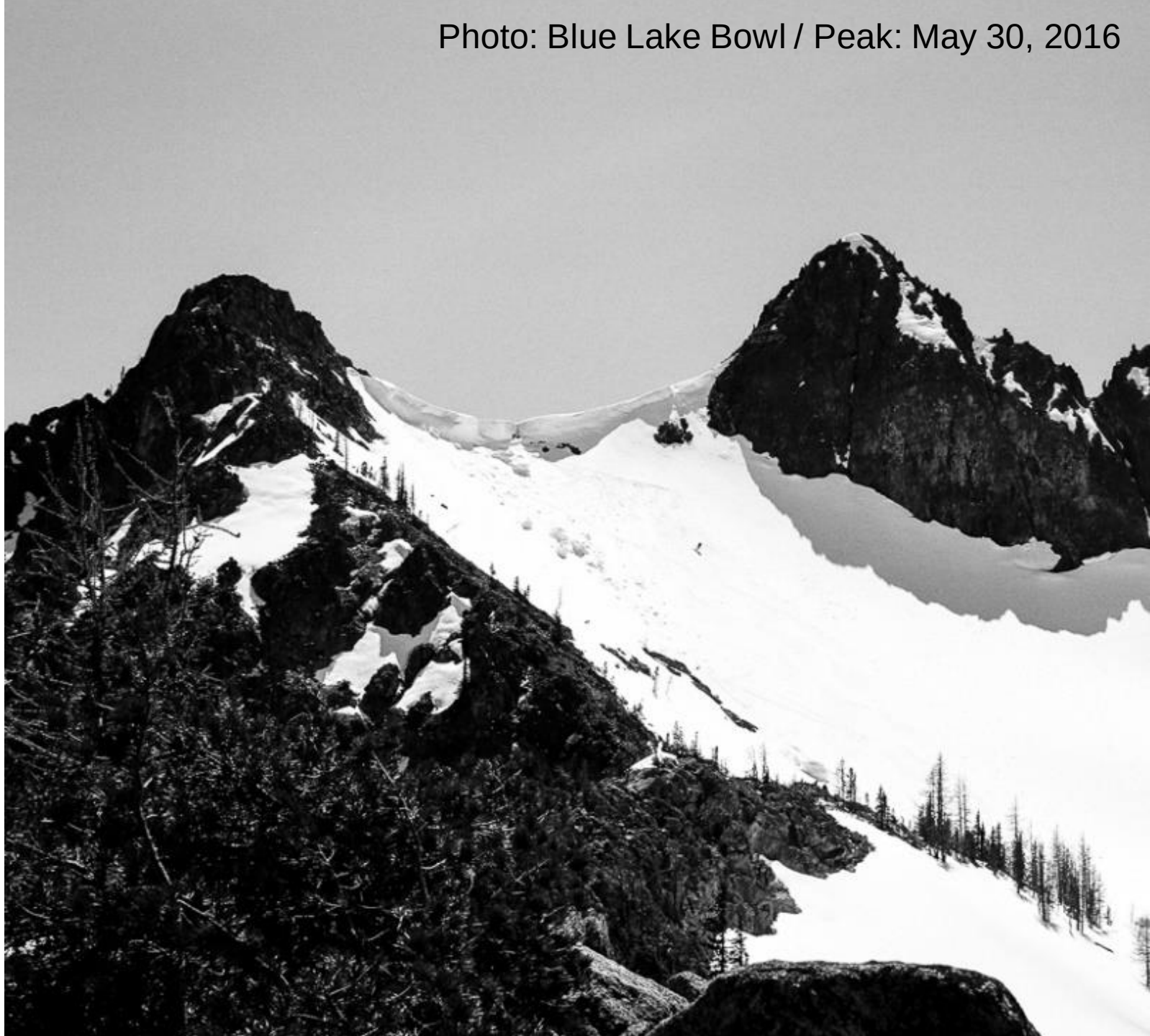


Photo: Blue Lake Bowl / Peak: May 30, 2016

Things to avoid: pinwheels / roller balls

Other avalanche considerations

- Slope / solar aspect matters a lot
- Avoid terrain “traps” / cliffs below possible avalanches
- Beware “whoompfing”, shooting cracks
- Beware rapidly warming temps, especially in spring
- Favor ridgelines in your travel (not bowls)
- If anybody isn’t “feeling it”, trust your instincts, “the mountain will always be there”

Snow camping

Different than summer camping

Snow camping –different than summer camping

- Obvious
  - Cold
  - Stuff is heavier
- Less Obvious
  - Snow can be a nice surface to camp on
  - Tents more difficult to set up
  - Site selection may be more critical
  - Wind may blow your tent away

Photo: Mount Baker, May, 2012

Shelter selection for camping on snow

- Considerations include weight, comfort, protection, ease
- Need some sort of snow anchors
- Evaluate trade-offs in selecting shelter for each situation

	Weight	Comfort	Protection	Ease
Tarp	~1 lb	Low-Med	Low-Med	Low
Bivy	1-2 lbs	Low-Med	Low-Med	High
3-season tent	2-4 lbs	Med	Med	Med
Pyramid	2 lbs	Med-High	High	Med
4-season tent	5-7 lbs	High	High	Med

Photo: Tarp shelter, Camp Sherman, Mount Rainier, June 21, 2014

Photo: Snow kitchen,
Mazama Ridge, snow overnight, March 2015

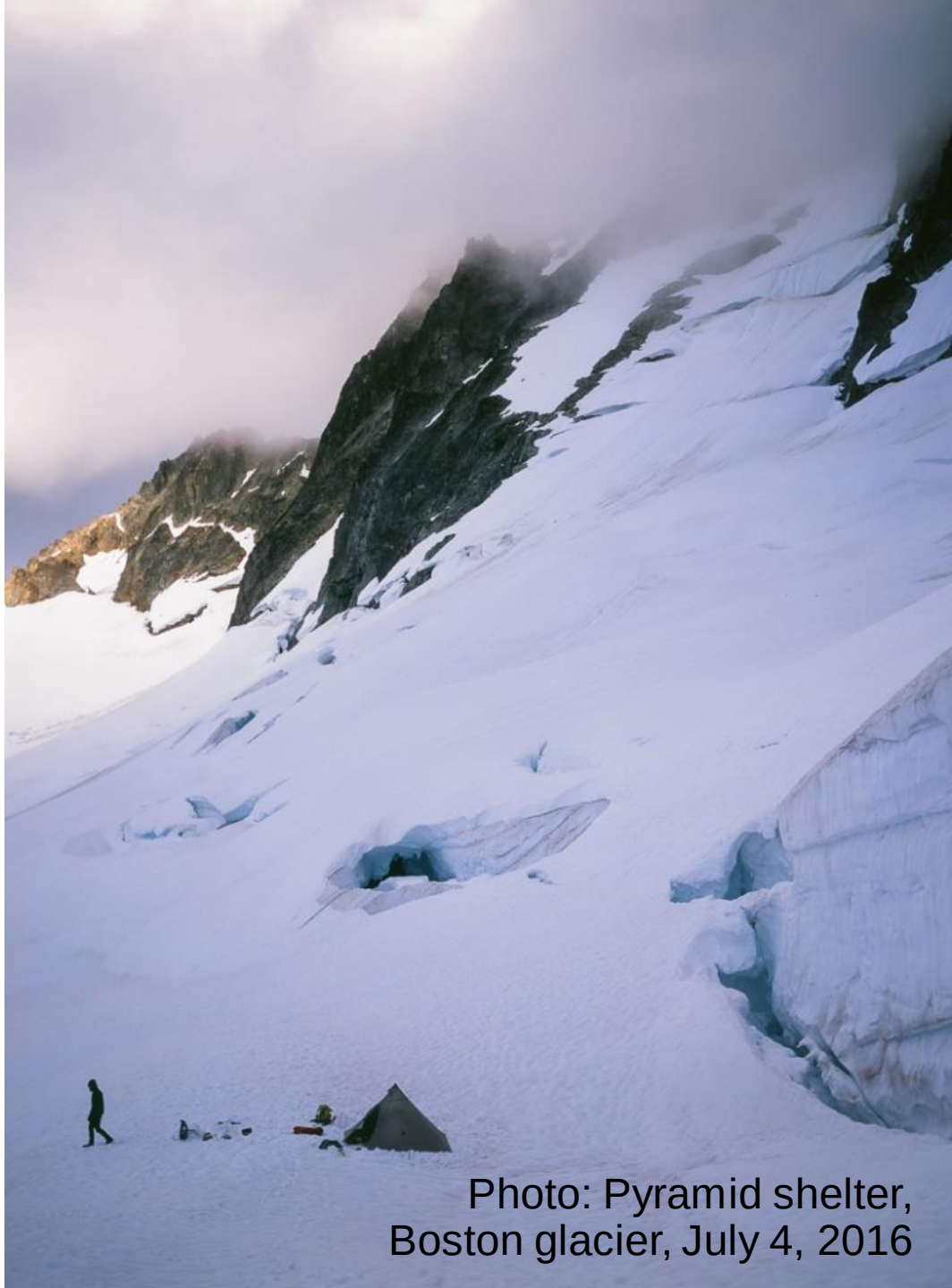


Photo: Pyramid shelter,
Boston glacier, July 4, 2016


Photo: 4-Season tent
Headlight Basin, below Ingalls Peak, May 15, 2020
Ingalls Peak, South Ridge (5.4)

Snow and winter camping site selection

- Seek
  - Wind protection
  - Snow deep enough to dig out “built-in” features?
  - Flat platform (or can make flat)
  - Secure anchoring
- Avoid
  - Avalanche terrain or runout
  - Low spots (slush?)

Photo: Decker Glacier, Spearhead Traverse BC
April 2017

Other winter camping considerations

- Sleeping bag: ~15 degree usually suffices for three-season bag for Cascades
- Sleeping pad: need R-value 5 for snow
  - Often means two pads, e.g. closed cell foam + inflatable
  - Or… inflatable R-value 5+ pad (expensive, e.g. Therm-a-Rest X-therm)
- Clothing system
  - Base layer, windbreaker, puffy, & shell may be all you need
  - Can add and subtract each successive layer without needing to remove the prior one
- Extra fuel & time to melt water for snow
- Dedicated bathroom area and pack-it-in-pack-it-out

Be safe, have fun, learn something, and maybe get to the summit!

Photo: Eldorado Peak, June 25, 2015

Thank you

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