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Allison Bolger
SIT Study Abroad

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Allison Bolger

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A Geologic Guide to the Gokyo Ri Trek: Its Hazards, Nepal's Hindrances

Abstract

The purpose of this Independent Research Project is to study the geology of the Gokyo Ri Trek and record it in the form of a publishable, trailside guidebook. This guidebook will not only enhance trekkers' academic experience with enjoyable, interesting facts about Gokyo's geology, but will also inform them of the natural hazards all around. From glacial lakes and high mountain peaks to precarious scree slopes and towering ice falls, the geology of Sagarmatha National Park offers more than just rocks and snow. With these natural, yet highly unpredictable wonders and the tourists they attract also comes the power to severely hinder, or possibly even improve, local livelihoods. A trailside guidebook to the Gokyo Ri Trek with an emphasis on geologic instabilities will offer trekkers a small glimpse at the natural hazards and developmental hindrances Nepalese people face on a day-to-day basis.

Introduction

Sagarmatha does not boast the most scenic views, nor is it the most technically demanding mountain to scale. Nevertheless, at 29,035 ft in elevation, it *is* the tallest mountain on the planet. Claiming such rights, it is inevitably a mecca for trekkers, high-altitude climbers, and adventure enthusiasts seeking its hype and beauty. Bursting river systems and gravity defying rock faces litter the landscape—Nepal truly is a geologic reverie; and the Himalaya are its crown jewel.

But with all of these spectacular landforms, the region still lacks a geologic guidebook to the Gokyo Ri Trek. Thus, I have created a day-by-day guide to the geologic formations trekkers will encounter during their trip, highlighting the prevailing “infrastructure” of Everest's natural landforms. This compact guidebook will serve as a comprehensible, enjoyable read—with photographs, process

descriptions, suggestions and all—to not only enhance trekkers’ experiences with a basic geologic background of the region, but also to inform people of the natural hazards all around them. From landslides and avalanches to glacial lake outburst floods, a geologic field guide will act as a much-needed informant of the dangers these Himalayan peaks pose. It will open trekkers’ eyes to the risks they are taking each step of the way; it will also enlighten trekkers of the risks their Sherpa guides and porters take each day—all in the name of “peak-bagging” and adventure.

My appeal for a trailside guidebook is not based on the notion that no other similar studies have been carried out. Undoubtedly, if one desires to know the maximum temperature for shear deformation in the hanging wall of the Tibetan Series and its implications for crustal shortening, then by all means, libraries of published geologic works can heed their call. Yet, it appears the standard Thamel-exploring, North Face-wearing, Everest-bound trekkers are not concerned with dip-slip faults or orthosilicates. But, once their plane lands in Lukla and trekkers hit the trail, they *are* curious to learn about the beautifully carved glacial valleys and meandering streams all around them. Most people do not realize that there are fossilized marine organisms (i.e. seashells) at the top of the planet’s highest peaks; but when they do, they want to know why. Likewise, Trekkers flock to Sagarmatha for the adventure and the thrills. Their curiosity will assuredly be peaked when the natural hazards and potential risks, be it avalanche, landslide, or GLOF, are underscored. That’s where this guidebook comes into play.

Literature Review

Past SIT student Brigit Anderson (2010) created a trailside geology guide of the Everest Base Camp Trek, which serves as an excellent source for trekkers with no knowledge of basic geology. It functions not only as a trailside guide, but also provides information on the geologic formation of Nepal, as well as a glossary with basic geo-terminology. While a solid guidebook for trekkers, the points of interest component and actual quantity of in-the-field “geo destinations” is lacking. A guidebook to the Gokyo Ri Trek will not only target a previously undocumented area, but will also focus on more “trailside stops” rather than terminology.

Glaciologist Michael Hambrey (2008) recently published his research on the “Sedimentological, geomorphological and dynamic context of debris-mantled glaciers” of Everest. This study focused on four avalanche-fed valley glaciers, namely Imja, Lhotse, Khumbu, and Chukkhung, and the hazardous potential of their respective moraine dams. Current research carried out by The Mountain Institute and The Centre for Integrated Mountain Development also reveals the invalidity of his proclamation that Imja Lake “morphologically fails to be an immediate threat.” In addition to describing trailside geology, this guidebook will be an up-to-date reference highlighting nearby natural hazards and will explain—in layman’s terms—the potential for catastrophe. ICIMOD’s recent studies, headed by team leader and glaciologist Pradeep Mool, support the call for further investigation, recognition and appreciation of these glacial lakes and the threats they pose to mountain villages.

Because this research project was more of a natural science endeavor, my field methods differed from your typical anthropological research instruments and procedures. The first portion of my study period will be devoted to acquiring geologic information in the field to serve as foundations for my guidebook. My research examined an array of geologic formations throughout the Everest region—a look at Nepal’s natural diversity, so to speak. Progressing from lower elevations alongside the Dudh Kosi River to higher mountainous regions near the Ngozumpa glacier and Gokyo’s five glacial lakes, this project served as a comprehensive guide to Everest’s extensive array of physical features and the natural hazards they pose. Information was attained via in the field photographic documentation, investigation, and (informed) examination of select landforms along the circuit.

The second leg of this project focused on a scholastic review of previous geologic studies and published papers. Methods included a visit to local libraries (Fulbright and ICIMOD) with pertinent documents and one visit to the Ministry of Geology in Kathmandu, all serving to validate and/or enhance my own observations of Nepal’s landforms. The nature of my ISP also required some loose interviews/PRA with local villagers, each offering their own expertise on prime geologic locations, routes to reach these areas of interest, and then the necessary follow up scientific research. Contact and email consultation with Robert Nelson, Professor of Geology at Colby College, significantly enhanced my findings. He lent his expertise in confirming or refuting my hypotheses and assisting in the identification of geologic features beyond my knowledge.

Methodology

Upon my arrival in the field, I learned to differentiate the plausible ideas outlined in my final proposal from the impractical. Taking a photograph of a rock, describing it and trying to pinpoint where it is on miles of trail is a somewhat ridiculous notion—I figured that much out pretty early on in the trek. And when trekkers are huffing and puffing up an ukaalo trail above 4,000 meters of elevation, even I—a geology student and ardent rock hound—can admit that the last thing one wants to be doing is searching out an especially nice specimen of gneiss. I knew if I didn't alter the structure of my guidebook it would simply be rendered useless.

Thus, I crafted the concept of an introductory portion to my fieldbook—with a section on historical geology and natural hazards, providing my reader with some foundational “tools” to identify the rocks they will come across en-route. Rather than find extremely specific “geology sites,” I attempted to pick out the most popular landforms and features trekkers will come across.

One afternoon while trekking from Machhermo to the Gokyo Lakes I struck up a conversation with the Sherpa guide for a group of French tourists. Initially discussing his recent travels to Mount Rainier and New Jersey, we suddenly morphed into much heavier topics. He spoke of the good and bad human impact, especially in the form of trekker tourism, has had on the region. Twenty-five years ago there were no lodges; if you wanted to trek to the Gokyo Lakes, a Sherpa guide, porters, food, tents and camping gear were required. Shockingly, such a long

packing list deterred many foreigners. But now, villages take care of the necessities—along with some amenities—allowing trekkers to flock the region.

On the plus side, villages like Dole and Machhermo have sprung up, providing job and livelihood opportunities for local Nepalese people. Unfortunately, trekker tourism has turned out to be a double-edged sword. With the influx of people, and thus, all of their waste, the lakes have become polluted, and deemed undrinkable due to all of the sewage. Just as we were about to part ways, he shrugged, and said, “its ok, you cannot appreciate the good without the bad.”

This certainly gave me a lot to think about on my walk to Second Lake. With all of the beauty Everest has to offer—the highest peaks on the planet, turquoise lakes in paradise, and not to mention, some of the youngest and most dynamic geology on the planet—hazards and misfortune still exist. There is both good and bad to trekking and high altitude mountain climbing—even through breath-taking country; because sooner or later somebody is going to pay the price.

The outcome of my research project is a geologic guide to Gokyo Ri and the Gokyo Lakes Trek with an emphasis on natural hazards. This research demonstrates why it’s so important to understand the local geology of a region and its implications. The Himalaya are not just rocks and ice, but ominous and extremely unpredictable natural threats with the power to severely hinder, or possibly even improve, lives. Climate change is a very tangible issue deleteriously altering the livelihoods of mountain villagers. Ideally, this finished product will, after some tweaks are made and funding found, be transformed into a publishable

guide, distributed at publishing houses in Kathmandu or at teahouses up near Everest. Alternately, I may publish the guide as an “e-book” for kindles—granting access back in the States.

Conclusion

Maps and published papers concerning Everest’s bedrock geology, structural features, and geomorphology do exist, but they are sparse and too in depth for the average trekker, guide or native Nepalese villager (educated in English) to understand without extensive further collegiate-level education. My guidebook to the Gokyo Ri Trek not only informs trekkers of the local geology, but also provides them with alternative excursions to sites of geologic interest around Naamche Bazaar and Gokyo during “rest” days.

On a larger scale, foreigners will be provided with a small glimpse of the natural hazards and developmental hindrances local Nepalese people face on a day-to-day basis. Landslides and heavy rainfall erode nutrient-rich soil, imperative for agriculture in high elevation villages, isolated from food trade routes. Ideally, when trekkers return to their comfortable lives, they will have a greater understanding and appreciation of the causes hindering “development” in Nepal.

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