

The Enchantment of Manali

Snow-can Rushdown*

ABSTRACT.

A long time ago in a place far, far away... snow was plentiful in the high countries, and glaciers were advancing worldwide. Snows were particularly heavy in the Himalaya, the great arc of mountains that formed the northern border of the empire of Akbar, son of Humayan. To Akbar, snow was more than an enchantment to provoke scientific discussions, snow was an essential part of hydrological and ecological Earth that gave life to agriculture in the *Panj āb* (the land of the 5 waters). Akbar was particularly concerned about the ever-increasing pressure of changing climate, as the Earth was then beginning to plunge headlong into the *Chhotti-Baraff-Ka-Samay* (Little Ice Age). Accordingly, Akbar asked his trusted scientist, the Mahārāja of Manali and the court of wise people of the *Snow and Avalanche Study Establishment* (SASE), to call together a meeting of scientists from around the world to discuss all things known about snow. This is the true story of the *International Symposium on Snow and Avalanches*, held in Manali, *Hindustan* (to be called *India* 4 centuries later).

If there is a knower of snows here, fetch him: There's a strange snow on the mountain side, her way of moving is like no mortal thing, but of a breath-like, powdery form, and she threatens to run down on a destructive path. [Mirza Ghalib, translated by D. MacAyeal]

Dharma is better than Artha, and Artha is better than Kama. Artha is naturally practised by the directors of scientific laboratories, for the livelihoods of scientists depend on it. Kama is practised by snow scientists, because they love their work. Dharma is achieved by those who devise shelters that protect people and traffic from avalanche danger. [Kama Sutra, translated by D. MacAyeal]

Scene 1: A traveller from far-away Europe, *Magnús*, arrives in Manali.

*Born in Mumbai, India, and author of 9 previous novels, including *Midnight's Flowlaw*.

31 In the day's last light, the shiny snowy mountain sides above the science-place called SASE looked like a sea of shimmery
 32 silver embedded with bright diamonds. There on the valley floor was the shimmery golden thread of the *Beas* River. This river
 33 was once called the *Hyphasis* by the ancient Greek legions who refused to cross it when *Alexander III* of Macedon extolled
 34 them to extend their conquest into Hindustan. This river also fed the *Sapta Sindhu*, the sacred 7 rivers, of the *Rigveda*.

35 The traveler rode in a bullock-cart marked with the banner-of-passage provided by the *Kṣatriya*, Colonel *Rajesh Seth*, who
 36 was the giver of boundless hospitality and ensurer of security in these lands. The traveller wore a colorful vest atop his *dhotis*
 37 that was bespeckled with the azure ink of leaky pens, and his lapel bore the blue color of a precious lapis lazuli pin lettered
 38 with 'IGS'. He claimed to be an emissary of an ancient learned society concerned with *Glac-i-ology* that was established in
 39 the land of Queen Elizabeth (Elizabeth? First or second? It does not matter for this story). This traveler to the science-place
 40 called SASE was *Magnús* of *Ice-i-stan*, descendant of the great *Magnús Khan*, and progenitor of the man called *Magnússon*
 41 who, 4 centuries later, would become the secretary general of the IGS.

42 The *Magnús* had come to Hindustan with two purposes, first, to attend the *durbār* of scientific wise people called by Akbar
 43 himself, and second, to deliver a magical secret so divine that it could only be heard by the *Rajput* of snow science, the
 44 *Mahārāja* of *Manali* himself.

45

46 **Scene 2: The Magnús is awestruck by the pagentry of the Mahārāja's court (SASE).**

47

48 The *Magnús* quickly found that the scientists of Hindustan were awe inspiring, because their stories were better, their papers
 49 more numerous and dramatic, their field work more energetic and precise, and, most of all, because they somehow managed
 50 to thrive in a land where every-day traffic on the streets was more chaotic than a raging avalanche.

51 The opening of the great gathering of snow scientists was made festive by a troupe of *Himachali* dancers who performed the
 52 *Kayang Mala*, the garland dance, to the deep-noted sounds of their long trumpets. The place of lectures, the *Diwan-i-Khas*,
 53 was scented by the petals of thousands of marigolds and was named after the rare mountain rose of Himalaya, the *Saichen*. A
 54 luscious feast was produced for the *Baraff Tootna* (ice breaker) in the hall of the Mahārāja's great military men. The food was
 55 plentiful and exquisite, including *Kashmiri Biryani* and *Rogan Josh* of intricate flavors and *Kheer* so sweet it would generate
 56 pleasant dreams for those whose travels brought them across many time zones. The food was enjoyed amidst the enchanting
 57 rhythms and poetic verses of Samunder Khan and his troupe of *Rajsthani* musicians who had travelled to Manali after being
 58 in the New World, where they had played many concerts in the *Diwan-i-Carnegie* of New York. [Insert a statement about the
 59 Thursday night music program.]

60 On the middle day of the great gathering, the Mahārāja of Manali commanded his efficient and trusted *Kṣatriya* Colonel,
 61 *Rajesh Seth*, to amass a large caravan capable of transporting the raucous mob of wise snow scientists, along with their *lackeys*
 62 (graduate students) and laptops, across the harsh mountain roadways to the distant snow-research palace called *Dunde Station*.
 63 This station was the special shrine where the inner workings of snow were discerned by snow-whisperers, and it was located at
 64 the base of the high and rugged *Rhotang Pass* that joined the Kulu Valley to the moon-scape of the Spiti and Ladhak valleys.
 65 Along the way, an engineering marvel was beheld by the caravan, as they stopped to inspect a tunnel over which terrible
 66 avalanches would pass, leaving future travellers unharmed. On reaching the *Dunde*, a great magical feat was performed, as
 67 an entire mountain-load of snow was compelled to avalanche down a chute festooned with instruments used to advise the
 68 Mahārāja on the conditions that influenced safe passage across the mountainous roads of his realm.

69

70 **Scene 3: The Magnús is amazed by the lectures given by the 9 jewels of snow science.**

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72 During the great meeting, the *Magnús* was impressed by the lectures of the *Navratnas*, the 9 Jewels, of snow science, who
73 were known far and wide as the greatest of all glaciologists:

74 The first *Navratna* to lecture in the *Diwan-i-Khas*, in the *Saichen* auditorium, was *Sivaprasad Gogineni*, an ice-whisperer
75 who lived as a humble man during the day, but at night flew in strange silver birds that had mighty eyes which shot
76 invisible rays downward so as to see beneath the surface of things by the ray's reflection. This first jewel of snow science
77 could count layers in snowcaps and find farmer's goats that had fallen to the bottoms of ice crevasses.

78 And then there was *M.R. Bhutiyani*, a cutter of stones from *Jaipur* who fashioned beautiful carpets out of dust and snow
79 that adorned the sides of mountains, and thereby changed their albedo to better alay the Mahārāja's concern about the
80 *Chhotti-Baraff-Ka-Samay* (Little Ice Age).

81 Several of the 9 jewels of snow science came from distant colonies of the new world and from city-states of Europe. These
82 included the wise *Boyar* from *Mockva*, *Sokratov*, who carried a scale so precise that he could tell which snow flakes were
83 reincarnations of droplets from a warm, tropical environment, and which had cycled from a brutish, heavy life in the far
84 North.

85 There was the indomitable diviner of the Swiss Alps, *Schneebeli*, and his enchantment was a fierce, but righteous, sword
86 that he called the *SnowMicroPen (SMP) penetrometer*. With this instrument, it was said, the 4th Jewel of snow science
87 could discern the most subtle, and secret-most *intentions* of a field of snow to the *Kama* of rapid downhill motion.

88 Lest the world be seen as only a precise, careful working with no room for natural intervention, the 5th Jewel was a man
89 of Scottish ilk, *McClung*, who boasted the crass workings of the *Rutchblock*—a method of snow-monument excavation that
90 was later to be tested and rejected by the artisans who built the *Taj*.

91 There was the 6th Jewel, but he did not count as precious, as he was the *Şahib Bay-Waqoof*, the central clown of foolishness,
92 *Mac-A-yeal* who hailed from the land of smelly onions (Chicago).

93 The 7th Jewel was the just governor and keeper of SASE's treasury, the great *R.N. Sarwade*. As the *Kama Sutra* advised,
94 *Artha* is best practiced by directors of laboratories, for they are most practiced at pulling together material and intellectual
95 resources to produce milestone scientific conferences.

96 There was the 8th Jewel, *Pant* who soared in gossamer *Aerostats* (magic balloons) festooned with cameras to amuse the
97 snow scientists by showing them what a hawk could see from high above the snows.

98 And finally, there was the 9th Jewel, a great organizer of caravans, a builder of campsites and maker of great merriment
99 and comfort, the chief of the Mahārāja's security, the *Kşatriya Colonel*, who had once lived a former life as a bull elephant,
100 but was now devoted to the capture of the *Şahib Bay-Waqoof*, who's elusiveness and sudden departures would otherwise
101 mean that IGS council meetings would be held without a proper clown (shudder to think!).

102 All of these Jewels of snow science were there, and all gave talks; however, the time eventually came for the Mahārāja to
103 ask the *Magnús* about the special secret.

104

105 **The Magnús reveals his secret.**

106

107 After many nights and many days feasting and partaking of the cool fragrances of valley vegetation surrounding the great
 108 science-place in Manali, the Mahārāja, became suspicious of the foreign traveller *Magnús*. Was he simply a herald that brought
 109 scientists together each year to hear each other's songs of merriment? Was he just a *hounder* of dues to those who's journal
 110 subscriptions had lapsed? Or was he a conjuror of great power who had enchantment beyond that of any of the great wise
 111 snow scientists gathered at SASE?

112

113 **The Mahārāja of Manali:** "Magnús, I am amused by your presence and by the efficiency which you have lent to my people
 114 in the organization of this great meeting. But, my patience grows thin, tell us your secret, your special secret so divine that
 115 no ears can hear it save my own, or I will sentence you to labors as a foreign-born (and thus incompetent) taxi driver in the
 116 crowded streets of Dehli!"

117

118 With a flourish of great politeness, the Magnús bowed low, almost tipping his *Himachali* chapeau from the top of his head,
 119 and he began to speak.

120

121 **Magnús:** "*Ṣaḥīb*, I have met a Brahmin named *Jürg Schweizer* from *Davos*, the beautiful city of the *League of 10 Jurisdictions*,
 122 who sees far into the future of IGS meetings. He has told me of things to come—to come 20 generations in the future, to come
 123 in April of 2009, to be precise.—Here is what I learned:

124

125 "In April of 2009, almost 400 years into the future, *Ṣaḥīb*, there shall be a **better** meeting of snow scientists, a meeting not of
 126 9 Jewels of snow science, but of more than 100 Jewels whose wisdom and research power will amuse and advise wise citizens
 127 from around the world. Open your ears, for I shall now tell you what the Brahmin, *Jürg*, said about this future *symposium*:"

128

129 **Impressions ISSA 2009.**

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1. Great hospitality. Many thanks for a wonderful experience.

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2. Ruggedness of the Himalayan range.

132

3. Challenge SASE is facing with avalanche and snow forecasting for these ranges.

133

Avalanche forecasting for this vast area will obviously rely on weather parameters as SASE is far away from the location
 134 where forecasts apply (i.e., office-based forecasting). We have seen excellent attempts to downscale output from meteorological
 135 models combined with remote sensing data to the local conditions where the decisions need to be made. Still, precipitation is
 136 the least accurate parameter. Then, even with advanced forecasting tools, the decisions need to be made by experienced local
 137 forecasters who know their conditions and their terrain.

138

4. We need observations for the models and for local decision making.

139

We have realised in the last couple years that the way we do our observations affects the results we get (Heisenberg has
 140 figured that out some time earlier). Still most our observations methods are destructive. However, we have seen great progress
 141 in the application of the radar technology. And, there are the first attempts to not only retrieve quantitative (binary) snow cover
 142 information, but also qualitative information on, e.g., the properties of the snow cover surface. A novel destructive measuring

143 method has been introduced about 10 years ago: the SnowMicroPen (SMP). It is very impressive how that instrument has
 144 found its application around the world for a variety of studies from the Himalayas to the poles.

145 5. Appreciation of the Microscale.

146 Many phenomena, including avalanche formation, have their roots at the microscale (and depend on the properties of ice).
 147 Combining computer tomography (μ CT) and numerical modelling techniques has significantly improved our understanding of
 148 snow metamorphism, heat transfer, etc. More of that! In avalanche formation we have a debate in the last 1-2 years: shear *vs.*
 149 collapse and we have seen two presentations that shed some light on that issue. It is quite clear that, due to the highly porous
 150 nature of snow, any failure will result in structural damage which will manifest itself as collapse. The collapse is a source of
 151 gravitational energy that might well be available for fracture propagation. So clearly it is shear and then collapse. Whereas in
 152 Europe and North America much research is devoted to the artificial triggering of avalanches, largely because the majority of
 153 avalanche fatalities are recreationists, natural release is probably more a concern in the Himalayas, and one contribution has
 154 considered triggering of snow avalanche by earthquakes.

155 6. The merging of of brilliance (e.g., model development) with passion (application) for the avalanche phenomena.

156 It is best when brilliance meets application/passion.

157 7. Inability to make precise prediction.

158 When forecasting large destructive avalanche we deal with rare extreme events, within the tails of the distribution. Conse-
 159 quently, forecasting becomes very difficult to say the least. There was one very interesting proposal: dynamic avalanche hazard
 160 map. But, an avalanche hazard map is an avalanche hazard map is an avalanche hazard map..., i.e., an avalanche hazard cannot
 161 change from one day to another. Avalanche hazard maps tell where not to build a house. But, providing local forecasters with
 162 real data specific to their problem, not just downscaling the regional danger, that is the intriguing feat.

163 To conclude, we are all keen to come back in particular to see the progress on the Rhotang tunnel project and see the
 164 planned avalanche defence structures at work. ”

165

166 **The Mahārāja of Manali:** (Upon regaining his consciousness, as if having been put to sleep by the soporific effects of
 167 the 9 lectures heard previously, the Mahārāja of Manali looked alarmed and cried out.) “This secret is wonderful! This news
 168 about the future ensures that the heavenly spheres shall be well ordered, that the Nine Schools of snow-flake geometry shall
 169 be remain intact, and shows that the Sixteen Predicaments of Avalanche Dynamics and the Eighteen Steps to Snow Crystal
 170 Metamorphosis, and the Fourty-two Unresolved Glaciological Issues will continue to be amusing puzzlements! To honor your
 171 secret, I shall conjure a magic spell that will so enchant the participants of the 2009 meeting (many years into the future),
 172 that they shall long for a return to the place that shall be called *India* well after the 2009 conference is complete! I Proclaim
 173 that there shall be many more meetings in India even after the 2009 meeting is nothing more than a poem in volume 54 of
 174 the *Annals of Glaciology!* ”

175

176 And with that, Mahārāja of Manali thanked his people for organizing such a great meeting, dismissed the wise people to
 177 begin their homeward travel, and allowed the *Magnús* safe passage to visit the *Fatepur Sikri* on his Bullock-cart (but that is
 178 another story, with another secret that shall be revealed after the next IGS meeting in India).

179

Fig. 1. The *Magnús* (background) sits at ease with the IGS President, Eric Brun, and with the conference *Şahib Bay-Waqoof* (official fool), Doug MacAyeal, overlooking the Beas River Valley above Manali.

Fig. 2. Himichali dancers perform at the conference banquet.

Fig. 3. A snow scientist embarks on the elephant caravan to the Dunde Snow Research Station.

Fig. 4. The great Colonel mandated the building of a road for the caravan of snow scientists.

Fig. 5. The elephant (Toyota) caravan proceeds to the Dunde Snow Research Station.

Fig. 6. The Mahārāja's military men provided comfort, security and good humor during the trip to Dunde.

Fig. 7. The Mahārāja's Colonel, a reincarnation of a bull elephant. Eric Brun, at right, a reincarnation of the Sun King of France. (Drink and cigar in foreground, owned by the *Şahib Bay-Waqoof*.)

Fig. 8. Snow scientists charming skeptics with musical lectures and salutations.