ined: waste heat from nearby installations, warm return air from other underground workings, geothermal heat from rock at depth, or the heat contained in large bodies of water in lakes and rivers (even beneath ice-cappings in winter). In deep mining, as at Kolar (in India), or on the Witwatersrand, or in Northern Australia, heat removal from the air-stream is necessary. For this evaporative cooling is used or, alternatively, the air is passed over chilled coil systems. Although we read of the rare case in mining that calls for humidification of an air stream, de-humidification is frequently more desirable. The ultimate and eventual limitation in modern mining is depth, in which the problems of heat, largely through geothermal gradients, can be very serious. Combined cooling and de-humidification processes have become necessary to provide desirable environmental conditions in some mines. Avoidance of humidification is attempted by resorting to dry drilling and a reduction in the use of water wherever possible, but such practice in turn gives rise to other problems.

Quality control of the environmental atmosphere has not received as much attention in metal-mining as it has in collieries, but a greater awareness is evident nowadays amongst metalliferous mining engineers responsible for mine air-conditioning. The use of electrical analogue computers offers a rapid means of simultaneous control of a number of factors. Much remains to be done in the study of turbulent resistance to flow in mine air streams and in the development of methods of ventilation network analysis.

Acclimatisation is a factor in environments which claims our attention in the industry under certain conditions. The extreme heat at extreme depths of mining give rise to problems of heat tolerance of the individual and, with them, those of acclimatisation. The adjustment of miners to extremes of environmental heat may be prolonged and, even when acclimatized, gradual lowering of the overheated body to normal temperatures is important. Acclimatisation is also necessary in the case of high altitude locations; for example, in the Andes at elevations of 14,000-16,000 feet, where it takes the form of adjustment to oxygen deficiency and avoidance of over-exertion. Acclimatisation is a personal adjustment in the approach to, and withdrawal from, these unusual environmental conditions.

Dusts and Radiations.

The hazards associated with dusts and radiations are amongst the most serious of all those with which the mining engineer must contend but, like ventilation, have been receiving increased attention in recent years, particularly since the insidious effects of radiations have been dramatically demonstrated in the uranium mines of this continent and elsewhere. Although much work has been done on this important subject, much still remains to be learned concerning dusts and radiations.

The dust hazards derive from combinations of particle size range, freshness (or surface reactivity), composition, and the susceptibility of the individual exposed thereto. Dust particles of pathological (or combustible) consequences are predominantly below 10 microns in size; that is, less than .0004 inch. Particles larger than 10 microns are unlikely to remain in airborne suspension in air streams of even moderate velocity. The hazardous dusts characteristically have a mean particle size in the range of 0.5 to 3 microns, and generally the chemical reactivity of the minerallic material increases with decreasing particle size. Dusts below 10 microns, having no significant weight or inertia, tend to remain suspended somewhat indefinitely in an atmospheric environment. On the other hand, we know so little about actual dust particle behavior, particularly of the fibrous types such as asbestos—fine tube-like structures of almost constant diameter (0.5 micron) but of varying lengths. Do they tend towards preferential concentration, wafting about in the atmosphere and settling under "hindered" conditions? How do we assess atmospheric concentrations of such dusts with accuracy? Since dust particles may be electrically charged, can they, or do they, attract to their surfaces coatings of even finer, more fissile dusts in parasitic fashion? Is this the reason for the intense activity of some essentially silicious dusts (as on the Rand and elsewhere) where pneumoconiotic symptoms appear to have been accelerated by some agency, perhaps extremely fine radio-active coatings? These are questions that still remain to be settled.

There are a number of categories into which dusts can be classified: (a) pulmonary dusts, which are harmful to the respiratory system (such as silica, silicates, beryllium ores, iron ores, and cassiteritic ores);