The use of quicklime for controlling *Acanthaster* must depend on the ability of coral polyps and other soft-bodied reef organisms to remove quicklime effectively from their bodies by mucus secretion or other mechanisms. I agree with North and Pearse that preliminary experiments need to be undertaken to determine the effects of quicklime on inhabitants of coral reefs. Quicklime may prove more serious to the ecosystem than the predacious *Acanthaster*.

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5. Experimentally, 313 and 940 kg per hectare have been used (*2*). I used 313 and 626 kg per hectare on *Mya* (five specimens at each concentration), and 447 and 895 kg per hectare on *C. frondosa* (12 specimens each). Particle size has also varied from powdered lime to coarse grades of particle diameter 0.5 to 5.0 cm (*2*). I used powdered reagent-grade lime.

2 February 1970

Initiation of the Breakdown to Turbulence

The review paper on clear air turbulence by Dutton and Panofsky (*1*) makes me wonder if I have been looking at another part of the same "elephant" (*2*). This part comprises the temporal course of winds, temperatures, and their vertical gradients as measured on towers, mostly in elevated layers near the ground, and especially during the hours following sunrise. On some fair mornings when the wind is not too strong, the transition to turbulence can be quite abrupt, as is seen in the record of wind-direction fluctuations. From the sequence of changes in gradients preceding these abrupt onsets, a process is hypothesized, termed "local shear destabilization," to explain the initiation of the breakdown to turbulence, in which relatively rapid enhancement of stability is a significant early event.

It might be useful to give more attention in studies of clear air turbulence to relative temporal sequences of flow parameters during internal frontogenesis. While the necessary measurements are difficult (but should be attempted) in the atmosphere at altitudes at which clear air turbulence occurs, they are not so difficult near the ground, where flow patterns can also be made visible at selected times and heights.

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Birth Control for Economic Development?

Enke (*1*) proposes one "economic-demographic method of assessing what reduced human fertility might contribute to increased economic development." His proposal is based on a function that relates national output (V) to employed workers (N), capital stock (K), and improving technology (t). This function, when applied to an imaginary nation called Developa with a population of 10 million and an income per head of $150 in 1970, yields two tables in which certain economic indices —the income per head, unemployment rate, savings from income and others— for the years 1985, 1989, and 2000 in situations of high fertility and low fertility are compared.

In the text certain assumptions are made; it is stated, "These various estimates are only suggestive. Their exact magnitudes are unimportant. What is significant is that combinations of alternative parameters indicate that declining fertility rates do contribute to economic welfare. . . . Twice as much labor and capital will not double output if there is a scarcity of equally useful land. . . . Conversely, a slowing rate of population growth accords more economic benefits than a slow growth rate. . . . Fewer children per family give each family member more potential consumption from the same family income. But actual consumption should rise less than the potential consumption. The difference is 'released' for investment."

From these statements and an economic-demographic model the author leapfrogs to a general conclusion that "Enough is known about the main parameters that a demographic-economic computer model can be used to assess the effects of declining fertility rates on various indices of economic welfare in a typical less-developed country." He finally concludes that "the benefit to cost ratio [of] 80 to 1" is possible when a birth-control program is adopted for a less-developed country, inducing the reader to believe that governments should encourage contraception.

It is misleading to take a somewhat simple function of economic indices of developed countries and apply it to underdeveloped countries with very low income, as if the indices and ratios could be used without any further consideration.

1) The function considers only employed workers (N); it is a well-known fact in underdeveloped countries that employed workers are a fraction of the total labor force and that the major part of the workers in rural areas are not included in labor-force statistics. This might be overlooked in a hypothetical model but leads to another gap in the economic consideration of per capita income. A large part of the family income in underdeveloped countries is obtained as food provided directly from the land and consumed by the family. Thus it is not registered as cash economy, and the more the country is underdeveloped, the more highly distorted are the statistics.

2) The distortion of economic statistics adopted in the model becomes clear when one considers that in South America there is no country with a $150 per capita income (the lowest is Bolivia with $165). If there were such a country, there would be no family savings; it is unbelievable that this low an income has any significance as a means for a person to feed, clothe, and shelter himself, if he had to pay for it. In other words, it is meaningless to speak of $150 per capita income or of $75 as a poverty index, and of saving income in such conditions.

3) Certain indices of development may only be obtained within a satisfactory population concentration. For instance, there is no return on investment on highways, communications systems, community electric systems, or services for water and sewage in a country where population density is below, say, five inhabitants per square kilometer and where no urban concentrations of a sufficient size allow economic concentration. Also, it is impossible to compare the trade of commodities representing economic activity

in such a country to the economic activity existing in developed countries.

Incidentally, my planning office has just finished a feasibility study for an area in the Amazon Basin where 500 families may be settled in 14,400 hectares (1 hectare = 10,000 square meters), with a loan of $16,000 (United States dollars) per family extending over a 10-year period. After 10 years each family will have paid the loan, earned $44,000, and will continue to earn $10,000 per year.

In consequence, one question remains open: Shall underdeveloped countries appeal to birth control, an issue greatly discussed in the United States (*2*), or shall they make every effort possible to increase the numerator of the income-per-head ratio, as they seek an internal market for their products, thus embarking in another kind of economic development? In economics, the benefit of the individual does not always mean the benefit of the community, and so a true answer may only be found by an accurate analysis of each area and not through hypothetical generalizations of economic-demographic models taken from developed areas.

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Origin of Glass Deposits in Lunar Craters

The mechanism of solar flash heating (*1*) for creating a glaze within small lunar craterlets in the Apollo 11 landing site is geologically unusual. A temperature rise in the shallow craterlets in question, if sufficient to have glazed their interiors by solar flash, would produce even greater thermal effects in larger and deeper lunar craters and fractures. Moreover, this effect should be latitude-dependent since the sun does not deviate much (1°35′) from the lunar equator. Perhaps proponents of "instant flash" would speculate that lava flow patterns and rounded central mountains in lunar calderas are melted by such flares. I have argued that over 95 percent of the major lunar surface features are purely volcanic and not in any way external in origin. Lava flow patterns in many lunar craters indicate intermittent internal activity. Examples are Tycho (*2*) and Copernicus. Moreover, there is no latitude dependence on melt phenomena in lunar craters. There are objections to the temperature increase in the craterlets causing internal glazing. In the first place, the temperature increase of about 100°K from center to rim by solar concentration of heat cited by Buhl *et al.* (*3*) refers to hemispherical craters of millimeter size. The craterlets discussed by Gold are much larger (20 cm to 1.5 m) and much shallower (< 20 degrees internal slope angle). Buhl *et al.* state (*3*, p. 5294) ". . . [lunar] craters larger than 1 mm in diameter are shallower . . . [than those less than 1 mm]." Diameter-depth ratios for lunar craters over a few millimeters in diameter and under about 3 m in diameter are far greater than 2. The diameter-depth ratio of the craterlet in which Surveyor 3 landed is greater than 15; and the one that Surveyor 5 landed in is greater than 45. Heat would not significantly concentrate in such shallow depressions. Can the suggestion of internal glazing be honored without data on the diameter-depth ratios of the craterlets in question? Glazing should be correlatable with this ratio as well as the latitude of the craterlet.

Let us assume that a 100°K temperature increase is achieved in the

Fig. 1 (top left). Volcanic bomb impact craterlets in the Batur caldera, Bali, Indonesia. Diameter of craterlet in foreground is 1.8 m. Fig. 2 (bottom left). Range curves for lunar ejecta. Fig. 3 (bottom right). Cooling rates of a 3-cm basalt sphere in air and vacuum.