Prepared for the
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Figure 1.—Index map showing location of east Mangala Valles area in relation to Mangala Valles, Amazonis Planitia lowland, Terra Sirenum highland (shaded), principal grabens (heavy lines), and impact craters (circular outlines with ticks); upper member of the Medusae Fossae Formation (unit Amu) described on sheet 1.

Figure 2.—Viking high-resolution (48 m/pixel) photomosaic of central part of east Mangala Valles area; color processing by Alfred McEwen. North at top.

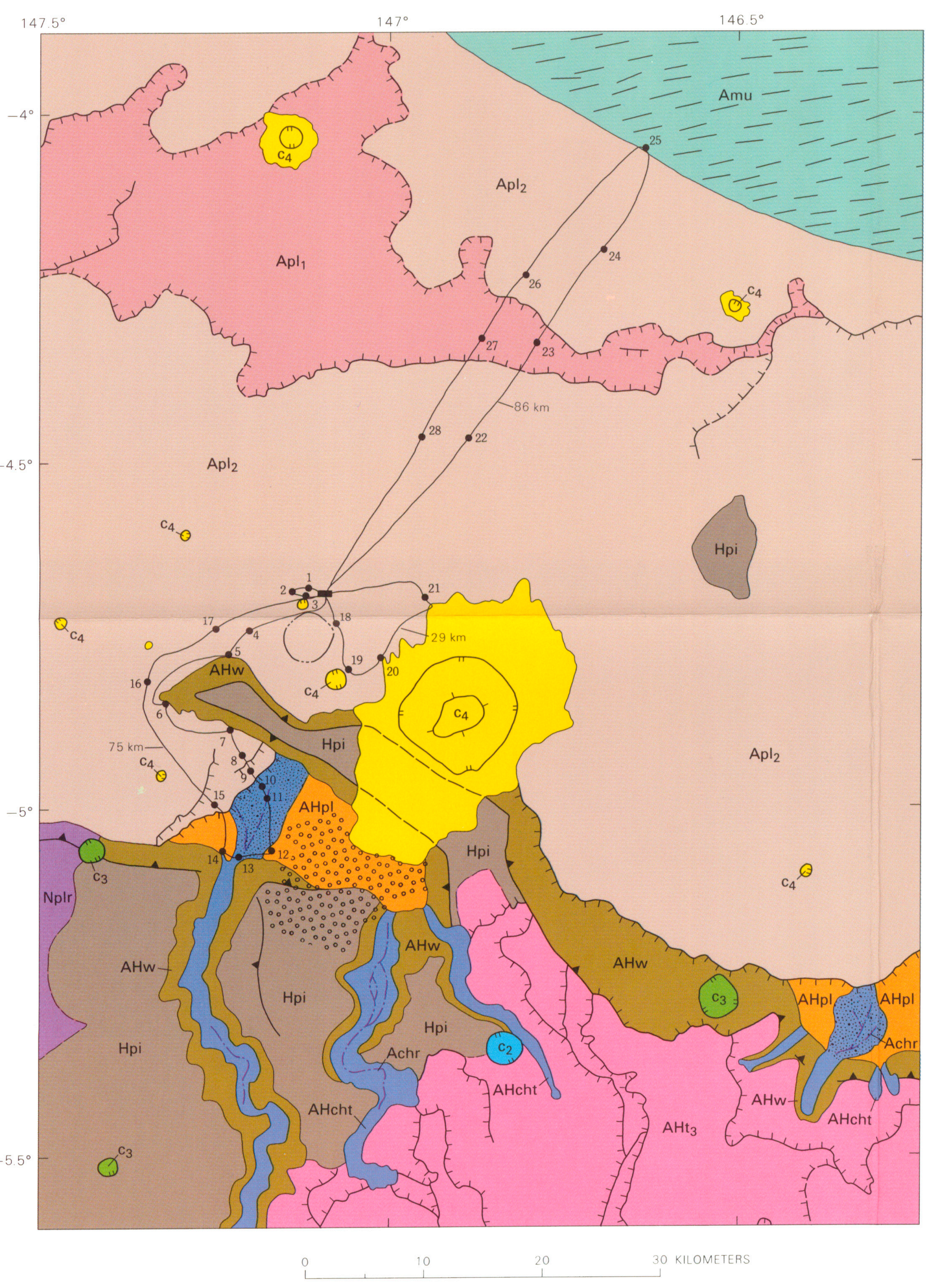

Figure 3.—Proposed traverse for sample-return vehicle, shown on area from central part of geologic map (sheet 1, which includes explanation of geologic symbols); all craters larger than 1 km across are shown. Map area is same as that of figure 2. Rectangle indicates landing site; numbers are those of sample stations (table 1).

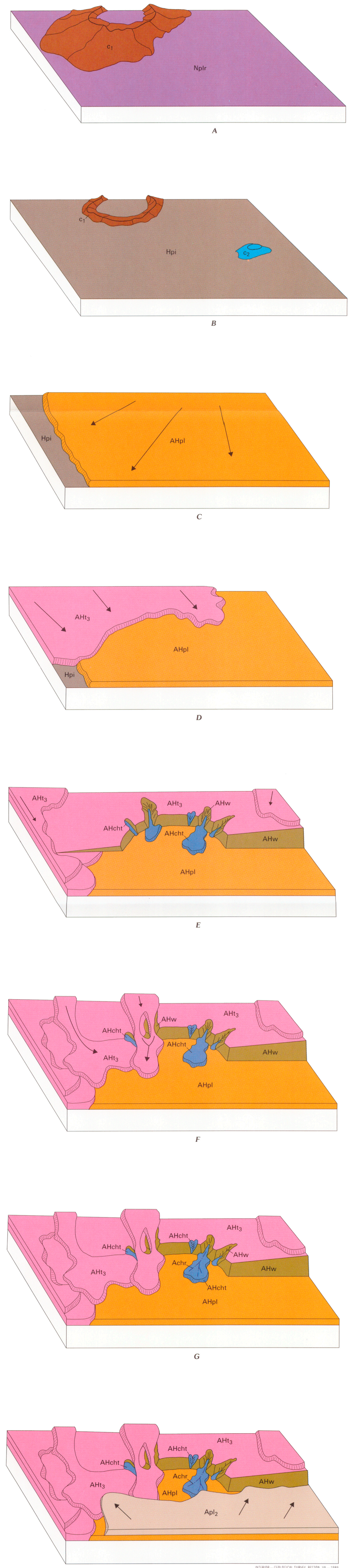

Figure 4.—Generalized block diagrams interpreting sequence of events in Isara Valles area (lat 5° to 5.5° S., long 145.8° to 146.5°). View south. Front sides of blocks about 40 km long; hachures on flow units denote differences in elevation. Map units described on sheet 1, but diagrams correspond only approximately to area shown on sheet 1. *A*, Noachian ridged plateau material (unit Nplr) and hypothetical superposed impact crater (unit c_1). *B*, Hesperian intercrater plains material (unit Hpi) mantling Noachian units; hypothetical impact crater (unit c_2) superposed. *C*, Old lobate plains material (unit AHpl) of probable basaltic composition flowing northeast across intercrater plains. *D*, Basaltic Tharsis Montes Formation material (unit AHt_3) flowing northwest across older units. *E*, Formation of highland-lowland boundary scarp, theater-headed channels, and their channel-floor material (unit AHcht); scarp and canyon walls covered by wall material (unit AHw). *F*, Younger flows of Tharsis Montes Formation locally covering theater-headed channels and boundary scarp. *G*, Ribbon channel cutting fan at mouth of east channel of Isara Valles; deposition of floor material of ribbon channel (unit Achr). *H*, Young lobate plains material (unit Apl_2) of probable basaltic composition flowing south across parts of older units.

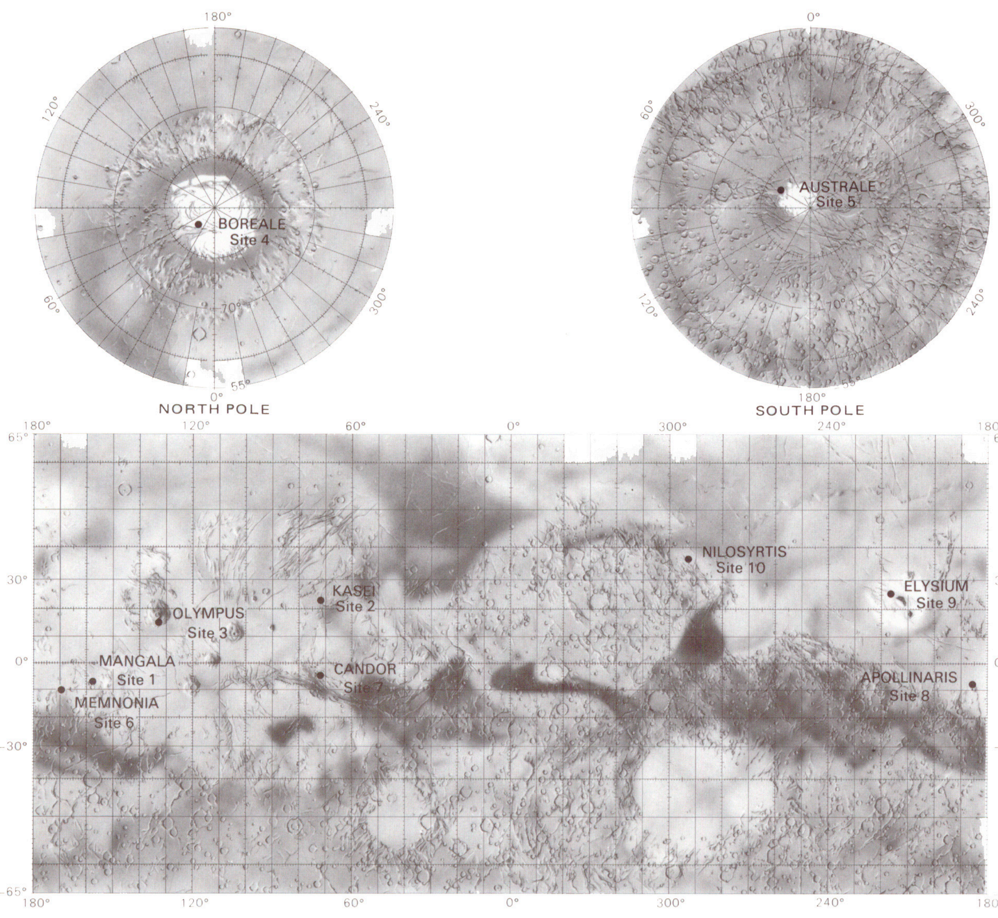

Figure 5.—Planned science study areas on Mars that include candidate landing sites for future sample-return missions.

Table 1.—*Materials to be sampled at stations of proposed landing-site traverse (fig. 3). Map units identified on sheet 1.*

Station number	Map symbol	Description
1	Apl_2	Young basaltic flows
2	Apl_2	Young basaltic flows
3	Apl_2	Young basaltic flows and possible crater material
4	Apl_2	Young basaltic flows
5	AHw	Talus
6	AHw	Talus
7	AHw	Talus
8	Apl_2	Young basaltic flows
9	Apl_2	Young basaltic flows that cover ribbon channel
10	AHcht	Fan material from theater-headed channel
11	Achr	Ribbon-channel deposits
12	AHpl	Older basaltic flow overlain by fan material from theater-headed channel
13	Achr	Ribbon-channel deposits
14	AHpl	Older basaltic flow overlain by fan material from theater-headed channel
15	Apl_2	Young basaltic deposit overlying channel materials
16	Apl_2	Young basaltic flows
17	Apl_2	Young basaltic flows
18	Apl_2	Young basaltic flows overlying crater material
19	Apl_2	Young basaltic flows and possible crater ejecta
20	c_4	Ejecta from large young crater; ejecta may include older units
21	Apl_2	Young basaltic flows
22	Apl_2	Young basaltic flows
23	Apl_1	Basaltic flows of intermediate age
24	Apl_2	Young basaltic flows with possible thin cover of windblown, pyroclastic material
25	Amu	Possible young ignimbrite material
26	Apl_2	Young basaltic flows with possible thin cover of windblown, pyroclastic material
27	Apl_1	Basaltic flows of intermediate age
28	Apl_2	Young basaltic flows

SUMMARY

The scientific legacy of the Mariner and Viking missions to Mars has been enormous. It has enabled us to understand the general characteristics of Mars' surface better than those of any other planet—well enough not only to map its geology in considerable detail but also to plan intelligently for future spacecraft landings. For example, the acquisition of high-resolution, contiguous images by Viking Orbiters of several areas on Mars has facilitated the selection of science study areas that contain candidate landing sites for sample returns.

The scientific information contained in returned samples will confirm or negate our current hypotheses for the origin and composition of geologic materials and the nature of surface features on the planet. From laboratory analyses of the samples, we can determine absolute ages, chemical and mineral compositions, and physical characteristics of rock and surface materials. If we obtain sufficient core samples, we may be able to estimate the quantity of permafrost on Mars.

Candidate landing sites must contain a diversity of geologic units, spanning a wide age range, that are in close enough proximity to be sampled by a vehicle of limited mobility. If a site also has unique geologic features, its potential value is greater.

The east Mangala Valles area (sheet 1; fig. 1, sheet 2) includes such a site (figs. 2, 3, sheet 2). The variety of materials that can be sampled during a proposed traverse (fig. 3, table 1, sheet 2) includes basalt flows of different ages, possible young ignimbrite material, and crater ejecta; the availability of impact-derived debris along the traverse will increase the probability of sampling older materials. The traverse also approaches a salient of the highland-lowland boundary scarp, a planetwide feature whose origin can only be hypothesized on the basis of available data; samples of talus from the scarp may illuminate its origin.

In addition to these features, the area contains several small channels whose ages have been determined relative to geologic units that are cut by or that overlie the channels. The geologic map (sheet 1) shows evidence of channeling episodes of three distinct ages. The block diagrams (fig. 4, sheet 2) interpret two such episodes and other events in the long and complex history of the area. Since their discovery, the Martian channels have been a curiosity to researchers; sampling of channel materials along the traverse will help determine hydrologic evolution on Mars and may explain how the process was constrained by other events in Martian history. Furthermore, materials of the channel floors and mouths are areas of major sedimentation that are more likely than other materials to yield samples containing evidence of past life.

Like the candidate landing site in the east Mangala Valles area, the other sites in the planned science study areas (fig. 5) maximize the probability of selecting samples that will answer the widest diversity of fundamental questions within reasonable mission constraints.

DOCUMENTATION FOR A CANDIDATE LANDING SITE IN THE AREA
GEOLOGIC MAPS OF SCIENCE STUDY SITE 1A, EAST MANGALA VALLES, MARS

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