

Figure 1. This close-up view reveals differentially eroded, tan-colored consolidated sediment (a) surrounded by darker toned individual rocks and sediment (b) to the north. Bedforms can be seen in the thin veneer of sediment (c) that are not obvious in the digital terrain model on sheet 1.

DISCUSSION

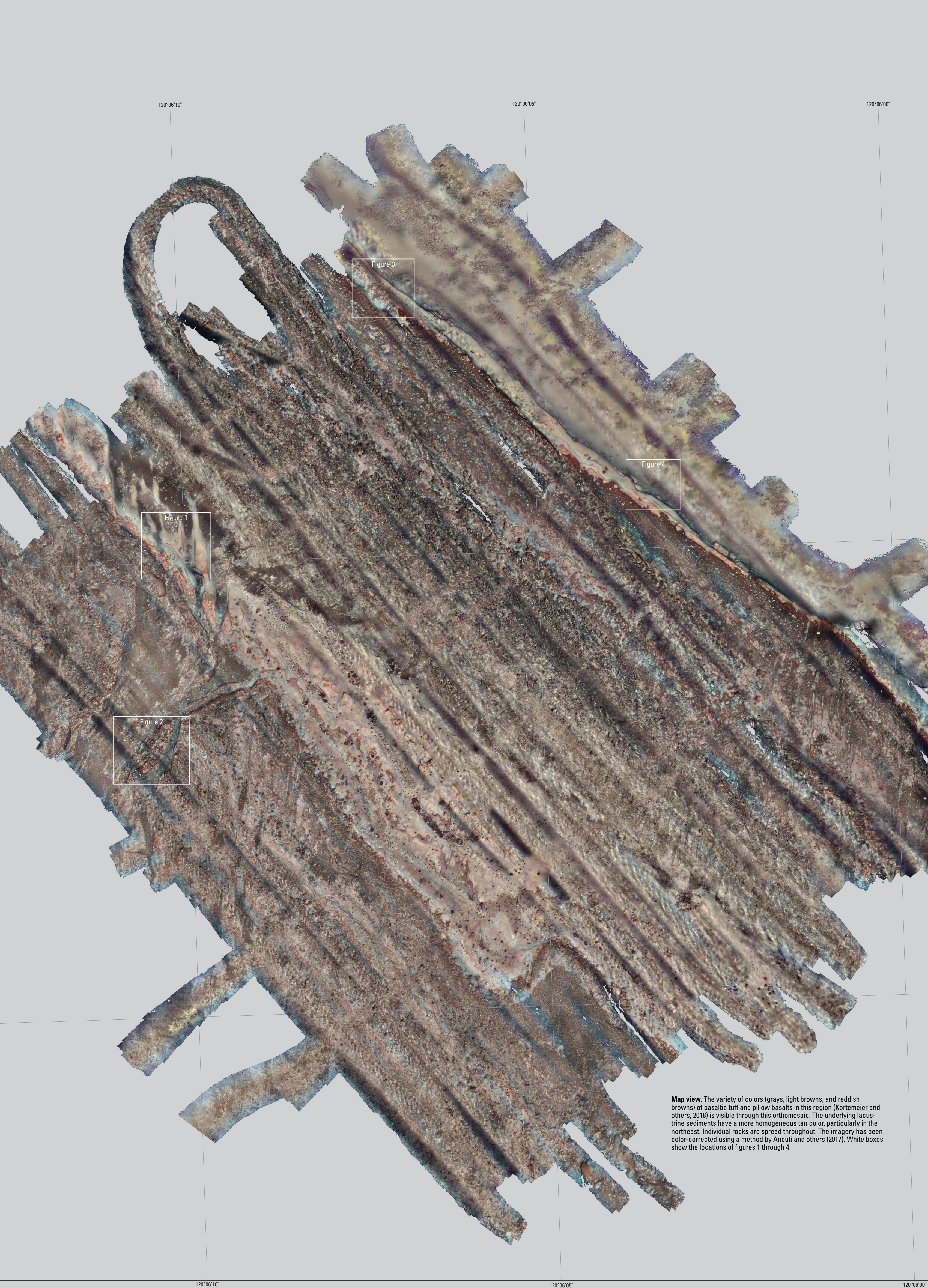
This two-sheet publication displays a high-resolution colored shaded-relief bathymetric map (sheet 1) and orthomosaic (this sheet) of part of the Lake Tahoe floor in California generated from a U.S. Geological Survey towed surface vehicle with multiple downward-looking underwater cameras. The system is named the Structure-from-Motion Quantitative Underwater Imaging Device with Five Cameras (SQUID-5) (U.S. Geological Survey, 2022). The cameras were synchronized with each other and with a survey-grade Global Navigation Satellite System. A total of 42,939 photographs were collected with nearly complete overlapping coverage of an area approximately 250 meters x 250 meters (m) (Hatcher and others, 2021). A digital terrain model and orthomosaic were generated from the overlapping photographs using Structure-from-Motion photogrammetry techniques. The raw imagery is available online in the data release by Hatcher and others (2021), and the processed digital terrain model and orthomosaic are available in the data release by Warrick and others (2021). Gaps are present in the bathymetry data owing to data-collection or -processing artifacts. These two sheets display the very fine details of the lake floor mapped using SQUID-5. The orthomosaic shown here has a spatial resolution of 5 millimeters.

REFERENCES CITED

- Anouti, C.O., Anouti, C., De Vlieshouwer, C., and Bekasert, P., 2017, Color balance and fusion for underwater image enhancement: IEEE Transactions on image processing, 27(1), 379–393.
- Dartnell, P., and Gardner, J., 1999, Sea-floor images and data from multibeam surveys in San Francisco Bay, Southern California, Hawaii, the Gulf of Mexico, and Lake Tahoe, California–Nevada: U.S. Geological Survey Digital Data Series DDS-55, 1 CD-ROM. [Also available at <https://doi.org/10.3133/d555>.]
- Hatcher, G.A., Warrick, J.A., Kranenburg, C.J., Dal Ferro, P., 2021, Overlapping lakebed images and associated GNSS locations acquired near Dollar Point, Lake Tahoe, CA, March 2021: U.S. Geological Survey data release, <https://doi.org/10.5066/P9V44ZYS>.
- Warrick, J.A., Hatcher, G.A., and Kranenburg, C.J., 2021, Point clouds, bathymetric maps, and orthomosaic generated from overlapping lakebed images acquired with the SQUID-5 system near Dollar Point, Lake Tahoe, CA, March 2021: U.S. Geological Survey data release, <https://doi.org/10.5066/P9934161>.
- Kortemeier, W., Calvert, A., Moore, J.G., and Schweickert, R., 2018, Pleistocene volcanism and shifting shorelines at Lake Tahoe, California: Geosphere, v. 14, no. 2, p. 812–834, <https://doi.org/10.1130/G50155.1>.
- U.S. Geological Survey, 2022, SQUID-5 camera system: U.S. Geological Survey web page, accessed October 27, 2022, at <https://www.usgs.gov/centers/pemsc/science/squid-5-camera-system>.



Figure 2. The orthomosaic in this region shows individual, gray-colored rocks (d) in the deeper gully whereas the rougher, pitted rock (e) tends to have a reddish-brown color. This difference in color indicates the two rock types are composed of different materials and may have originated at different sources.



Map view. The variety of colors (grays, light browns, and reddish browns) of basaltic tuff and pillow basalts in this region (Kortemeier and others, 2018) is visible through this orthomosaic. The underlying lacustrine sediments have a more homogeneous tan color, particularly in the northeast. Individual rocks are spread throughout. The imagery has been color-corrected using a method by Anouti and others (2017). White boxes show the locations of figures 1 through 4.

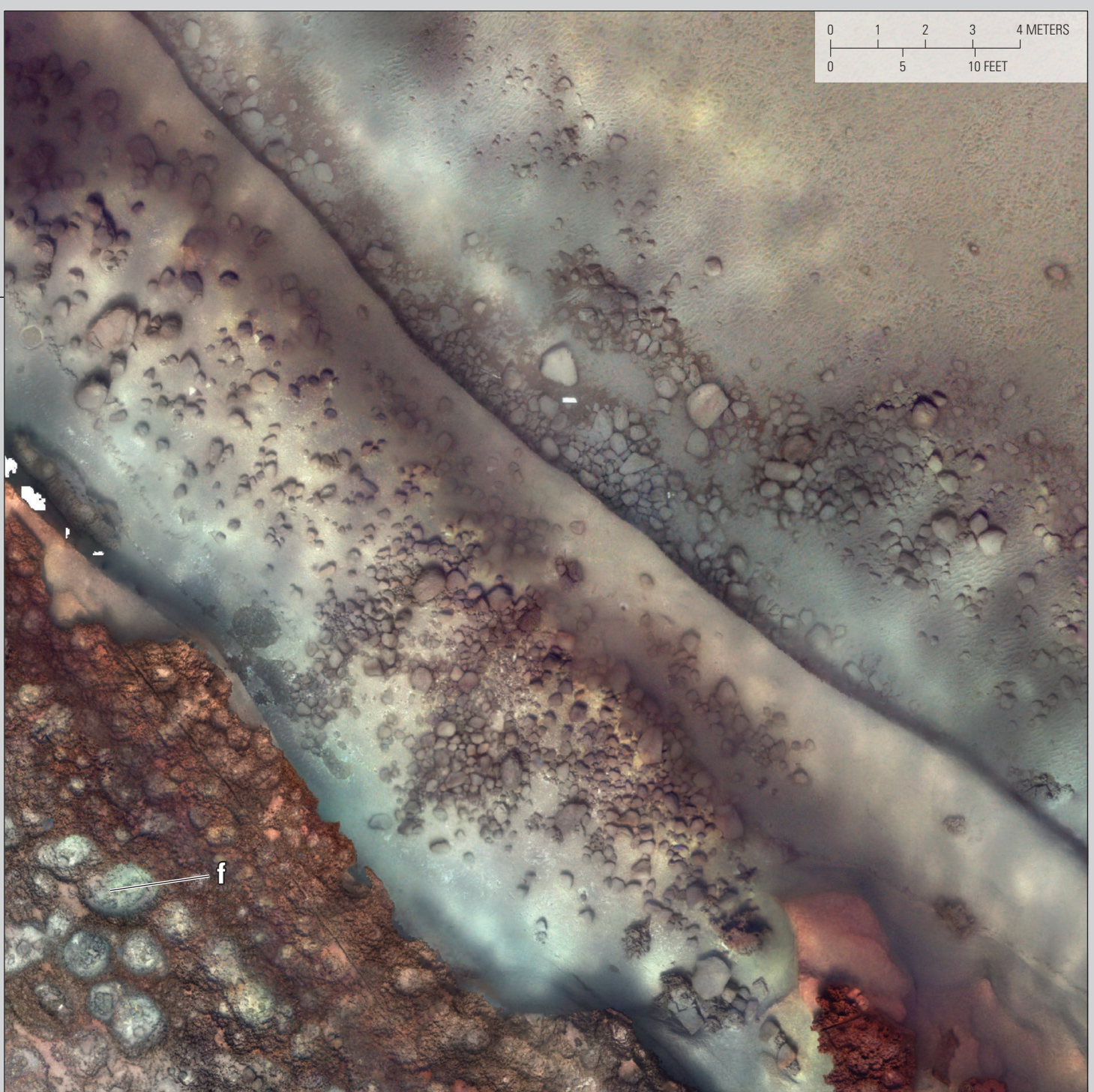


Figure 3. The rough rock reef of the raised platform in the southwest (see sheet 1 for elevation differences) is reddish-brown whereas the small depressions in the rock (f) have grayish tones. Individual rocks can clearly be seen on the middle ledge and at greater depths in the northeast possibly composed of underlying lacustrine sediment (Kortemeier and others, 2018).

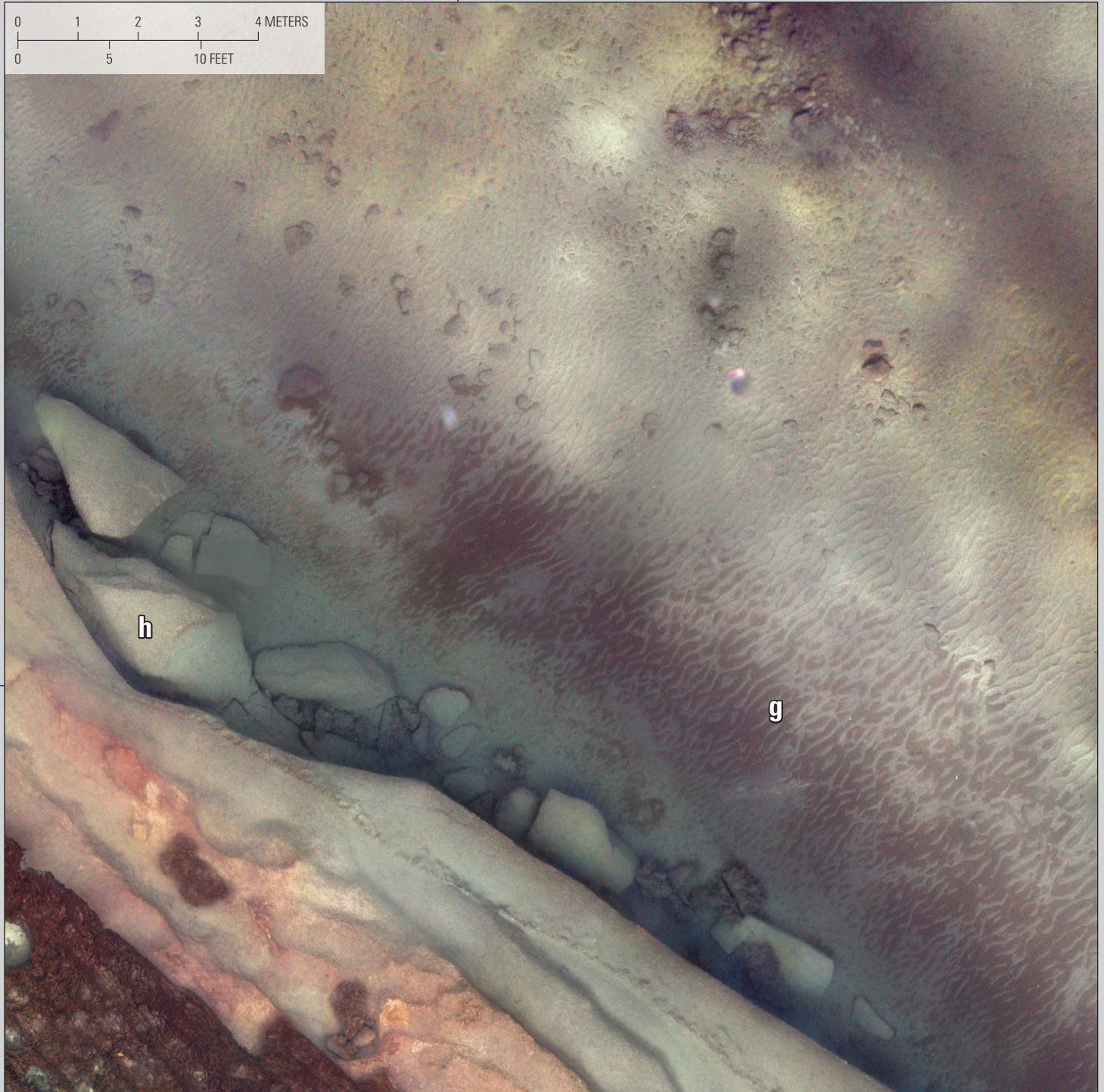
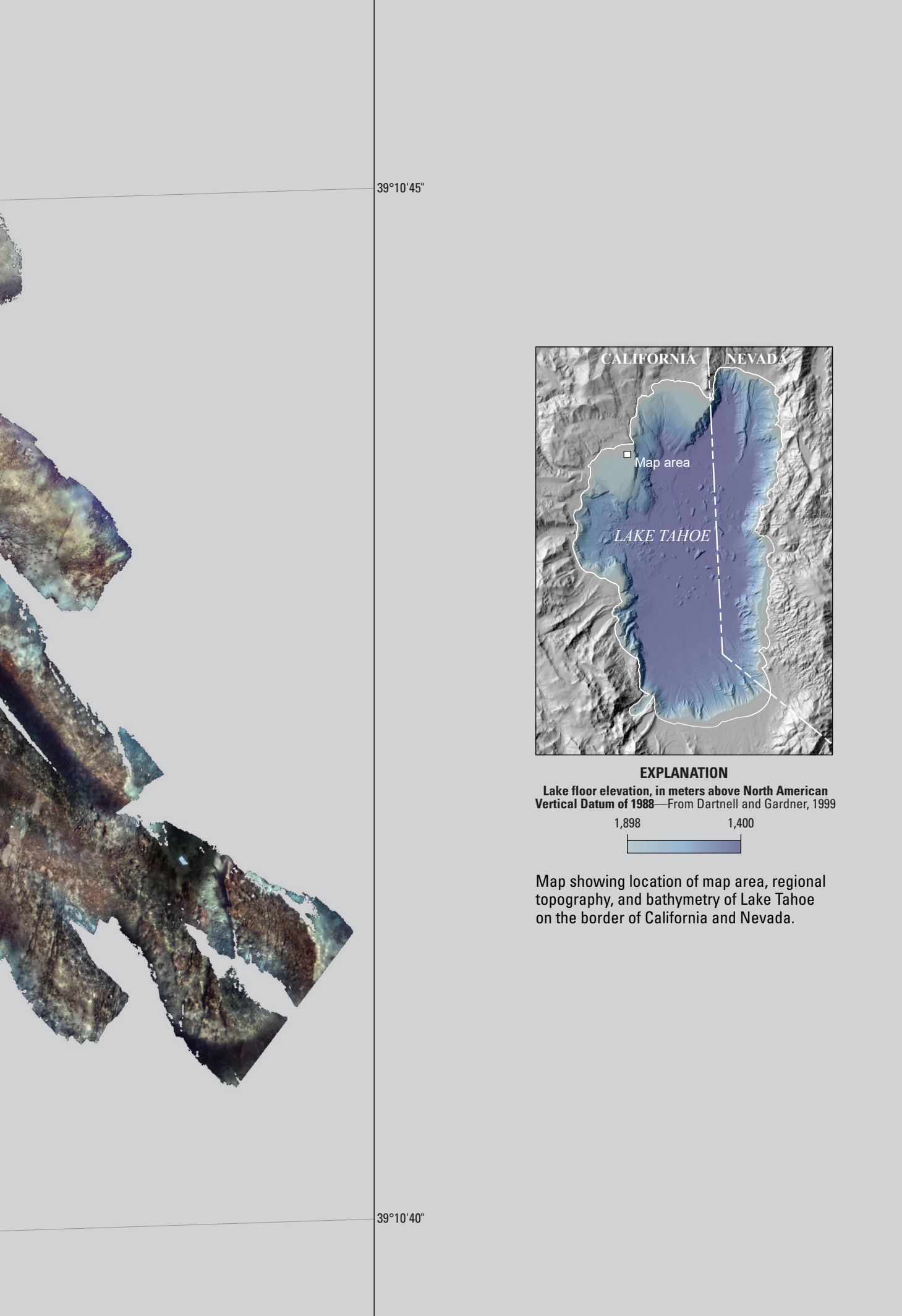


Figure 4. The raised rock platform in the southwest corner of this view has a deep red color. Similar colored sediment within the bottom (g) indicates this sediment has eroded from the rock. The homogeneous sandy tone of the larger eroded blocks (h) indicates the ledge is composed of consolidated sediment.

Colored Shaded-Relief Bathymetric Map and Orthomosaic from Structure-from-Motion Quantitative Underwater Imaging Device with Five Cameras of the Lake Tahoe Floor, California

By
Gerald A. Hatcher, Jonathan A. Warrick, and Peter Dartnell
2022

Any use of trade, product, or firm names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government.

This map or plate also is offered in an online, digital version. Users should be aware that, because of differences in rendering processes and pixel resolution, some slight distortion of scale may occur when viewing the online version on a computer screen or when printing it on an electronic device, even when it is viewed or printed at its intended publication scale.

Digital files available at <https://doi.org/10.3133/sim3501>.

Suggested Citation: Hatcher, G.A., Warrick, J.A., and Dartnell, P., 2022, Colored shaded-relief bathymetric map and orthomosaic from structure-from-motion quantitative underwater imaging device with five cameras of the Lake Tahoe floor, California: U.S. Geological Survey Scientific Investigations Map 3501, 2 sheets, scale 1:700, <https://doi.org/10.3133/sim3501>.

Associated data for this publication: Warrick, J.A., Hatcher, G.A., and Kranenburg, C.J., 2021, Point clouds, bathymetric map, and orthomosaic generated from overlapping lakebed images acquired with the SQUID-5 system near Dollar Point, Lake Tahoe, CA, March 2021: U.S. Geological Survey data release, <https://doi.org/10.5066/P9934161>.

Hatcher, G.A., Warrick, J.A., Kranenburg, C.J., and Dal Ferro, P., 2021, Overlapping lakebed images and associated GNSS locations acquired near Dollar Point, Lake Tahoe, CA, March 2021: U.S. Geological Survey data release, <https://doi.org/10.5066/P9V44ZYS>.

ISSN 2291-1324 (online)
<https://doi.org/10.3133/sim3501>