

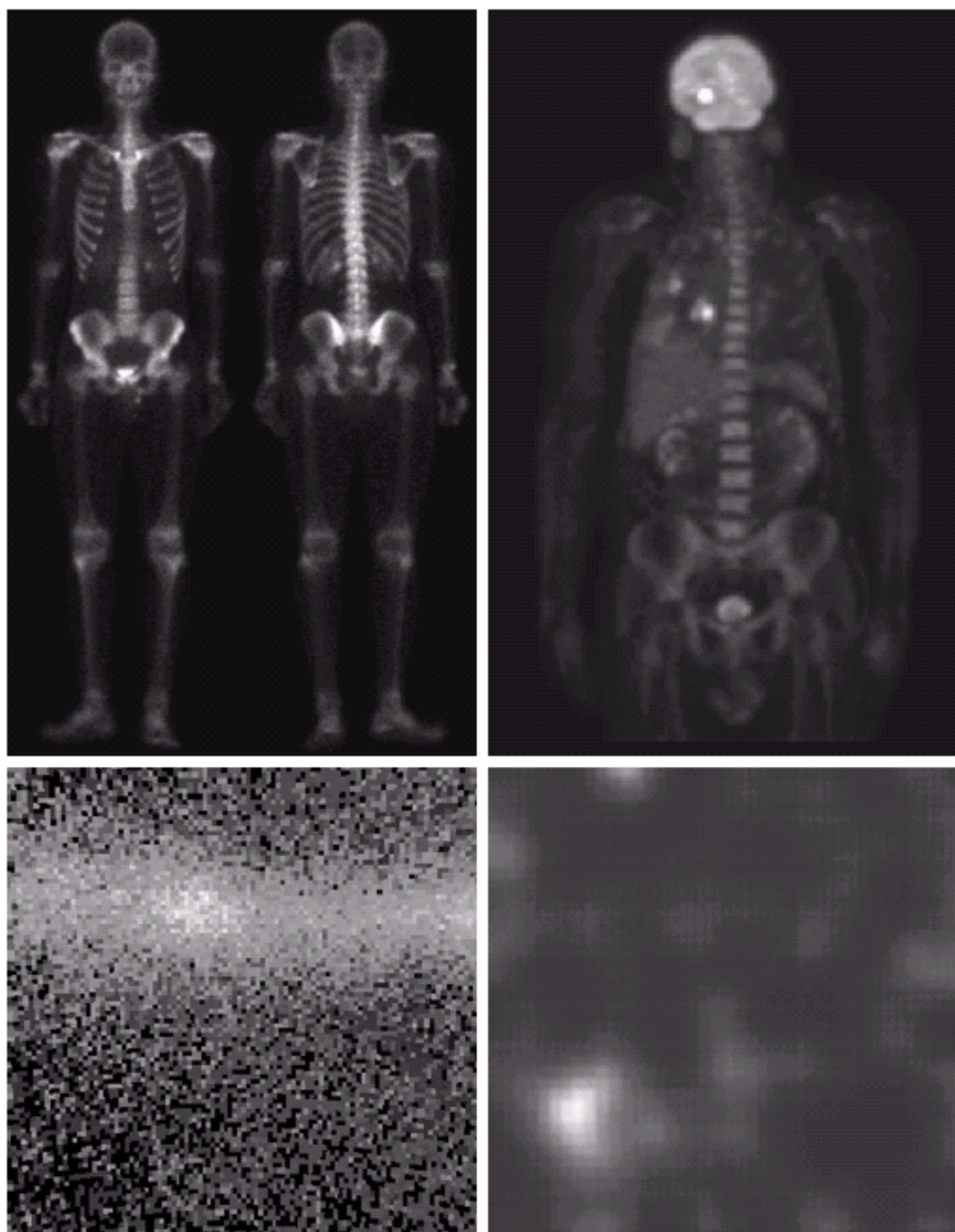
Gamma-Ray Imaging

a b
c d

FIGURE 1.6

Examples of gamma-ray imaging. (a) Bone scan. (b) PET image. (c) Cygnus Loop. (d) Gamma radiation (bright spot) from a reactor valve.

(Images courtesy of (a) G.E. Medical Systems, (b) Dr. Michael E. Casey, CTI PET Systems, (c) NASA, (d) Professors Zhong He and David K. Wehe, University of Michigan.)



IR Imaging (Performance)

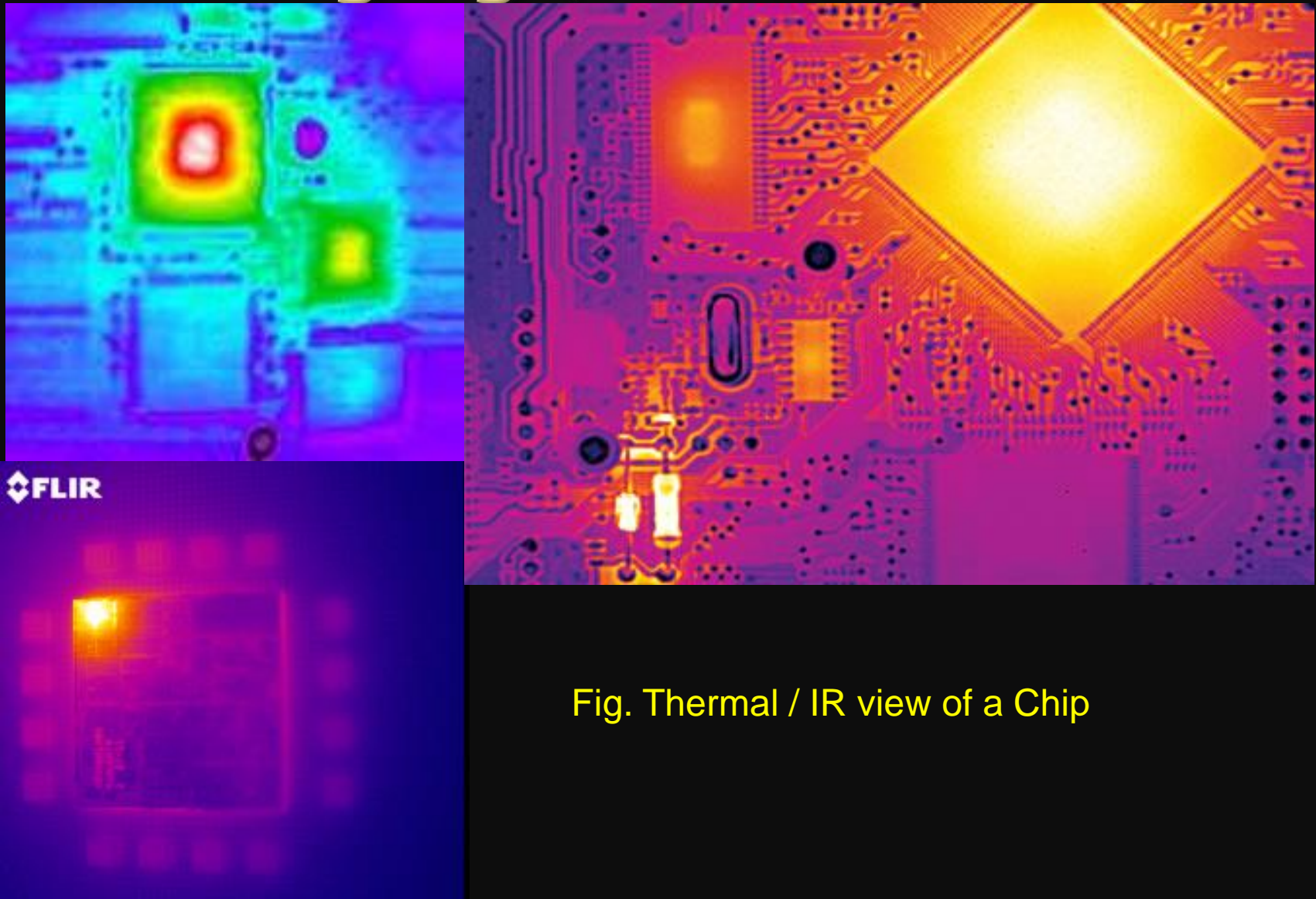


Fig. Thermal / IR view of a Chip

IR Imaging (Natural Calamity)



Fig. IR satellite view of Augustine volcano

IR Imaging (Night Vision)



Fig. Night vision system used by soldiers

IR Imaging (Weather)

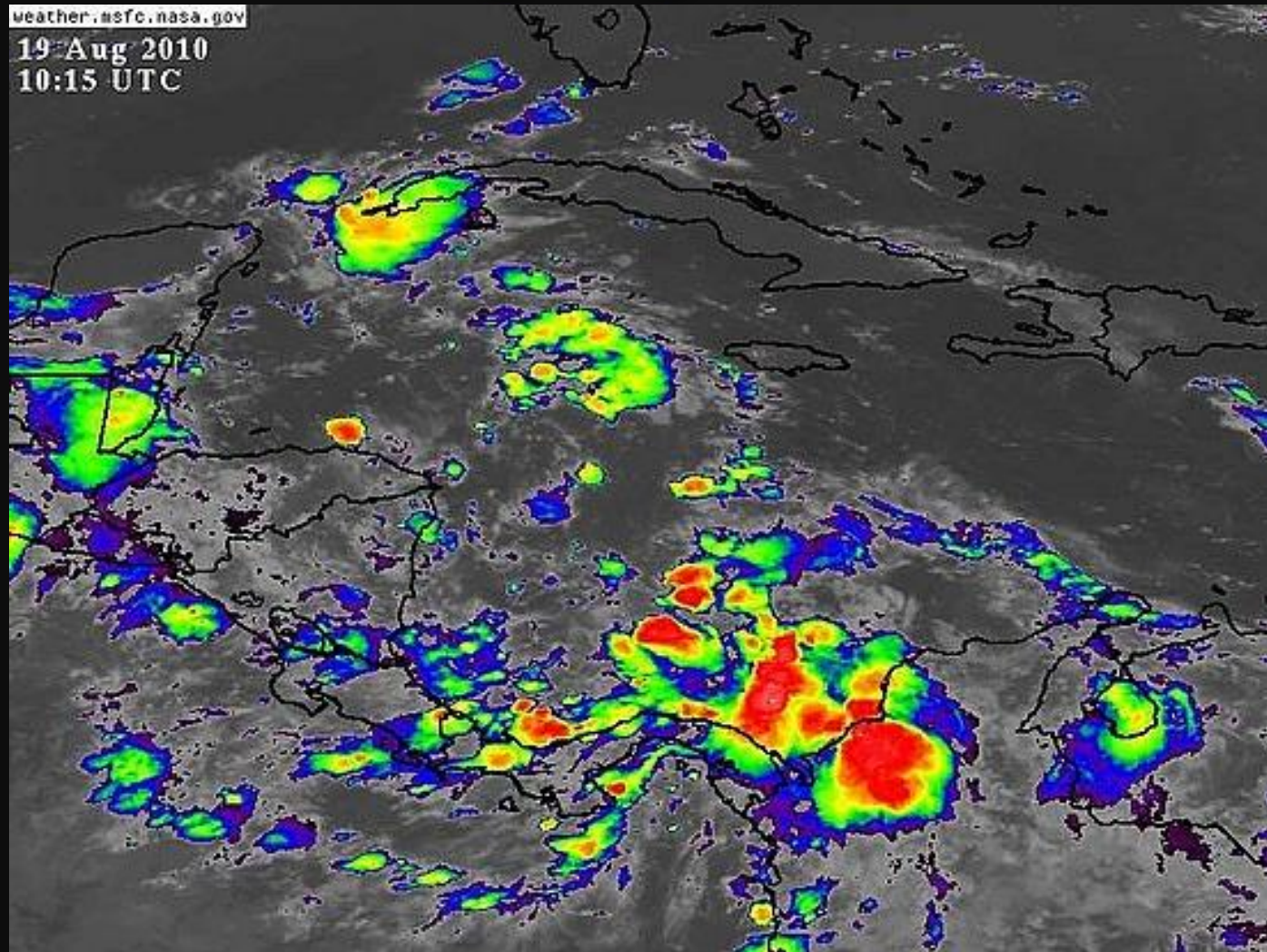


Fig. IR Satellite Imagery

IR Imaging (Astronomy)



Fig. Nebula NGC 1514 01 in Visible (left) and Infrared (right)

Ultrasound imaging (Medical)

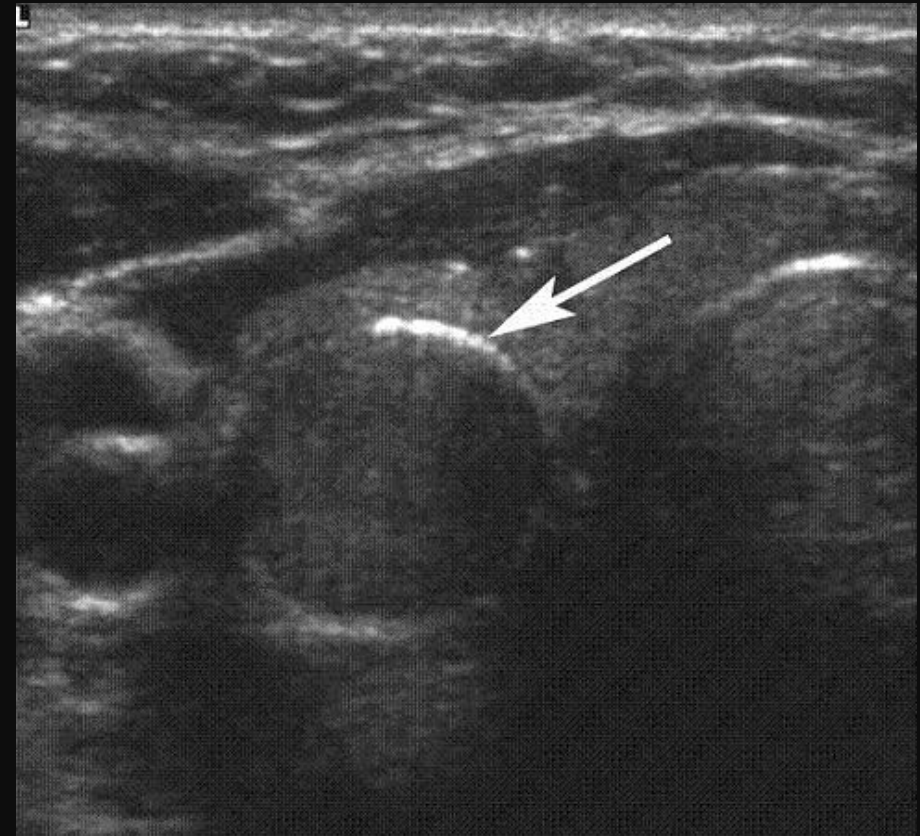


Fig. Fetus and Thyroid using ultrasound

Seismic imaging (Earthquake)

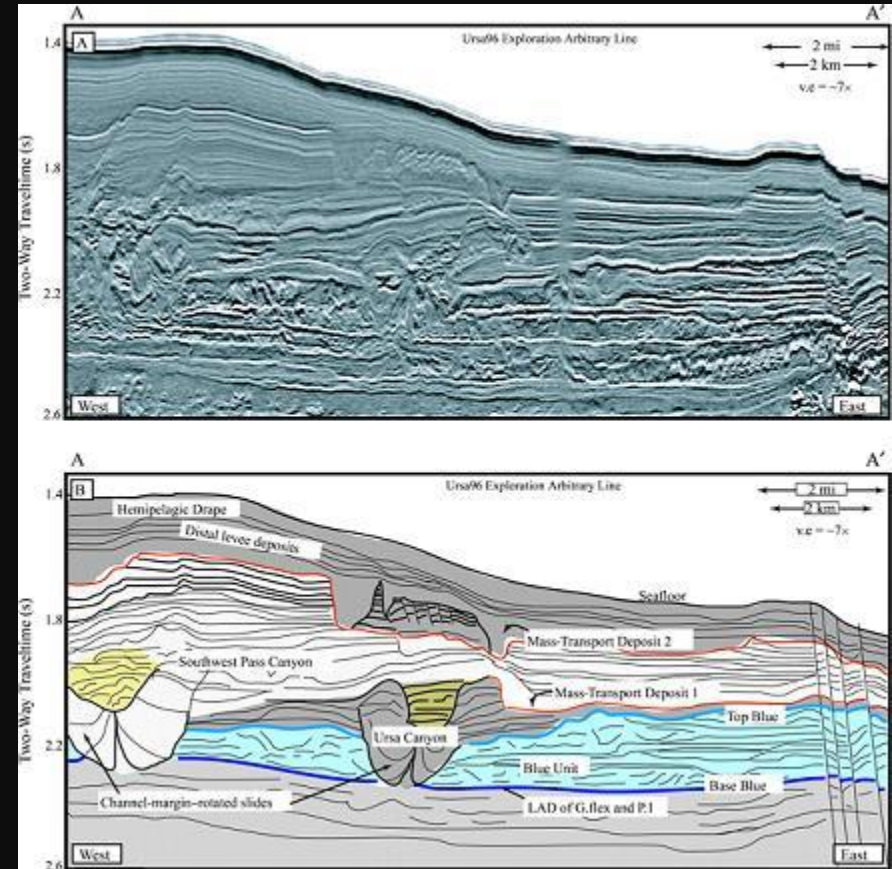
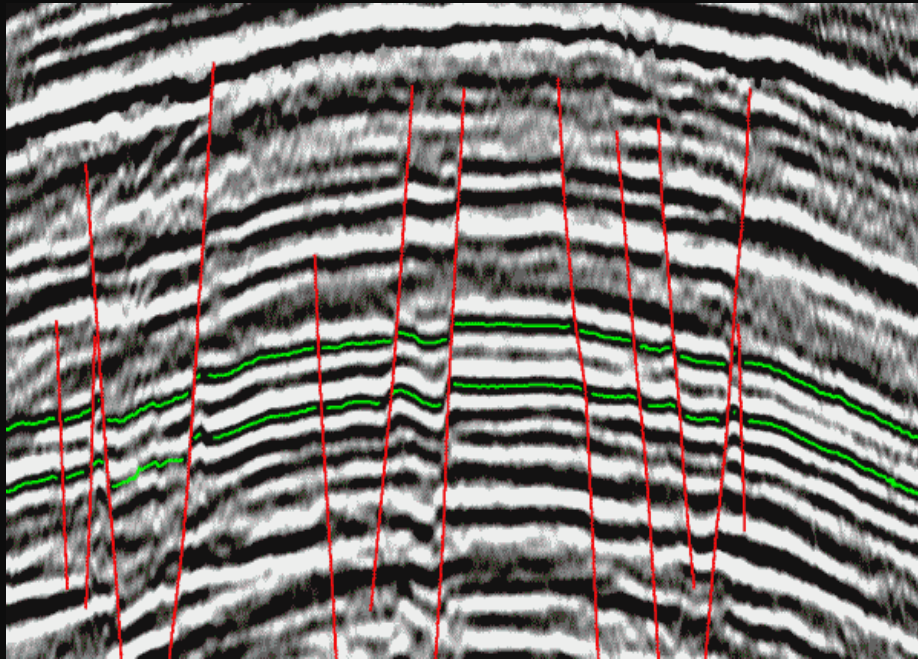
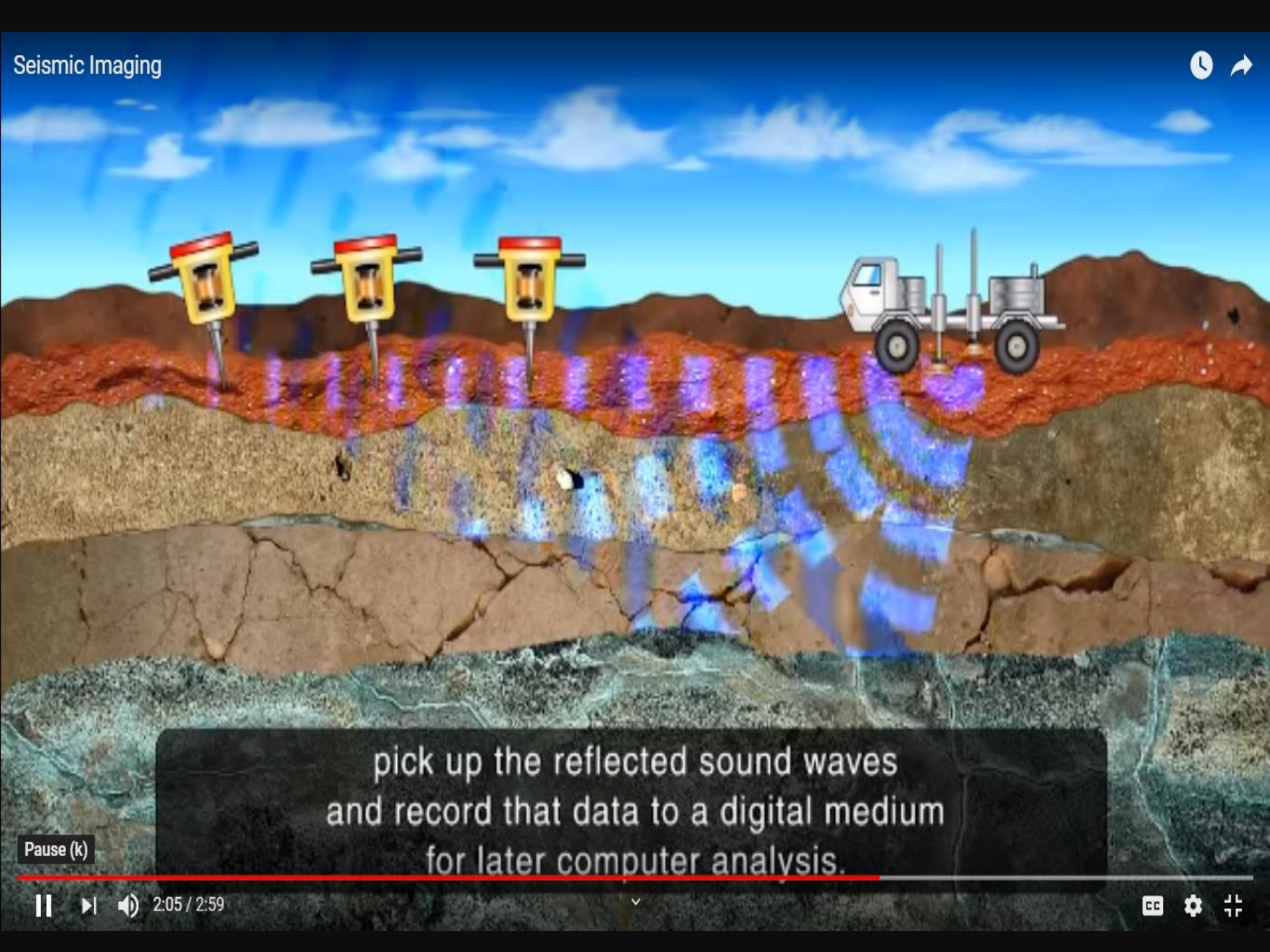


Fig. Detecting Earthquakes and its cause using cross sectional view



and then recording how long a reflected sound wave took to be received by a microphone.



Pause (k)

pick up the reflected sound waves
and record that data to a digital medium
for later computer analysis.

UV imaging (Ozone)

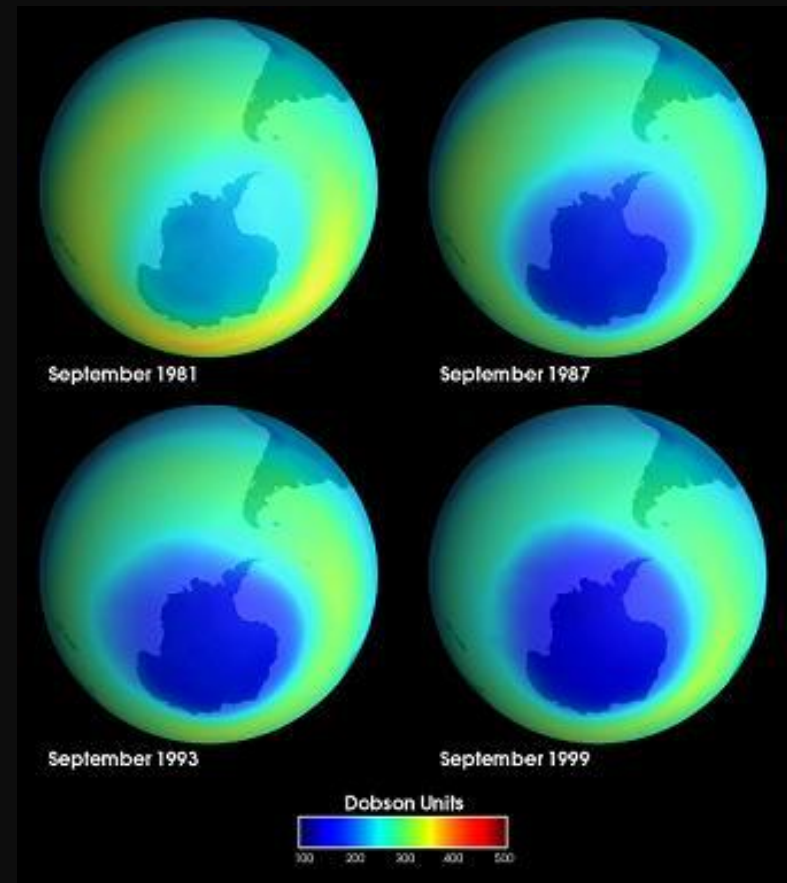
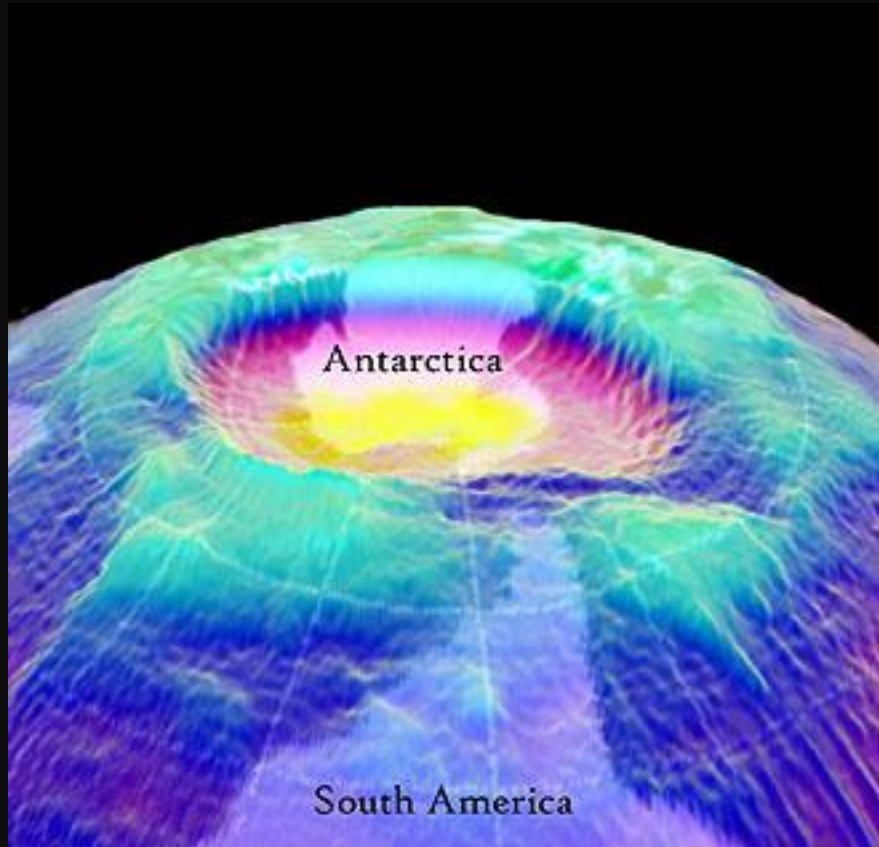


Fig. Detect ozone layer damage

UV imaging (Sun spots)

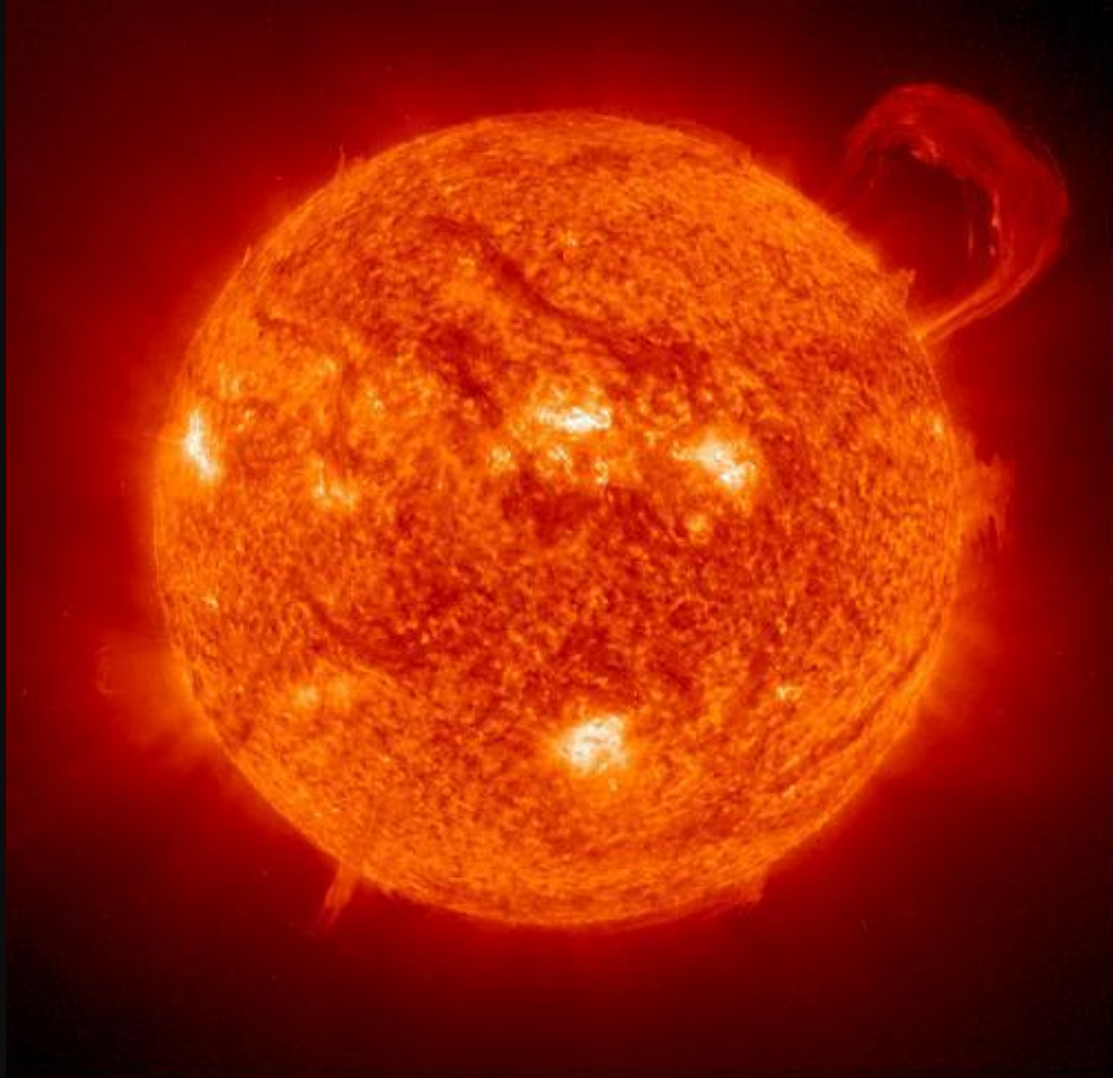


Fig. Identify sun spots

X-Ray imaging (Medical)



X-ray of normal cervical spine



X-ray of normal C-spine, side view

Fig. X ray of neck

X-Ray imaging (Medical)



Fig. X ray of head

X-Ray imaging (Circuits)

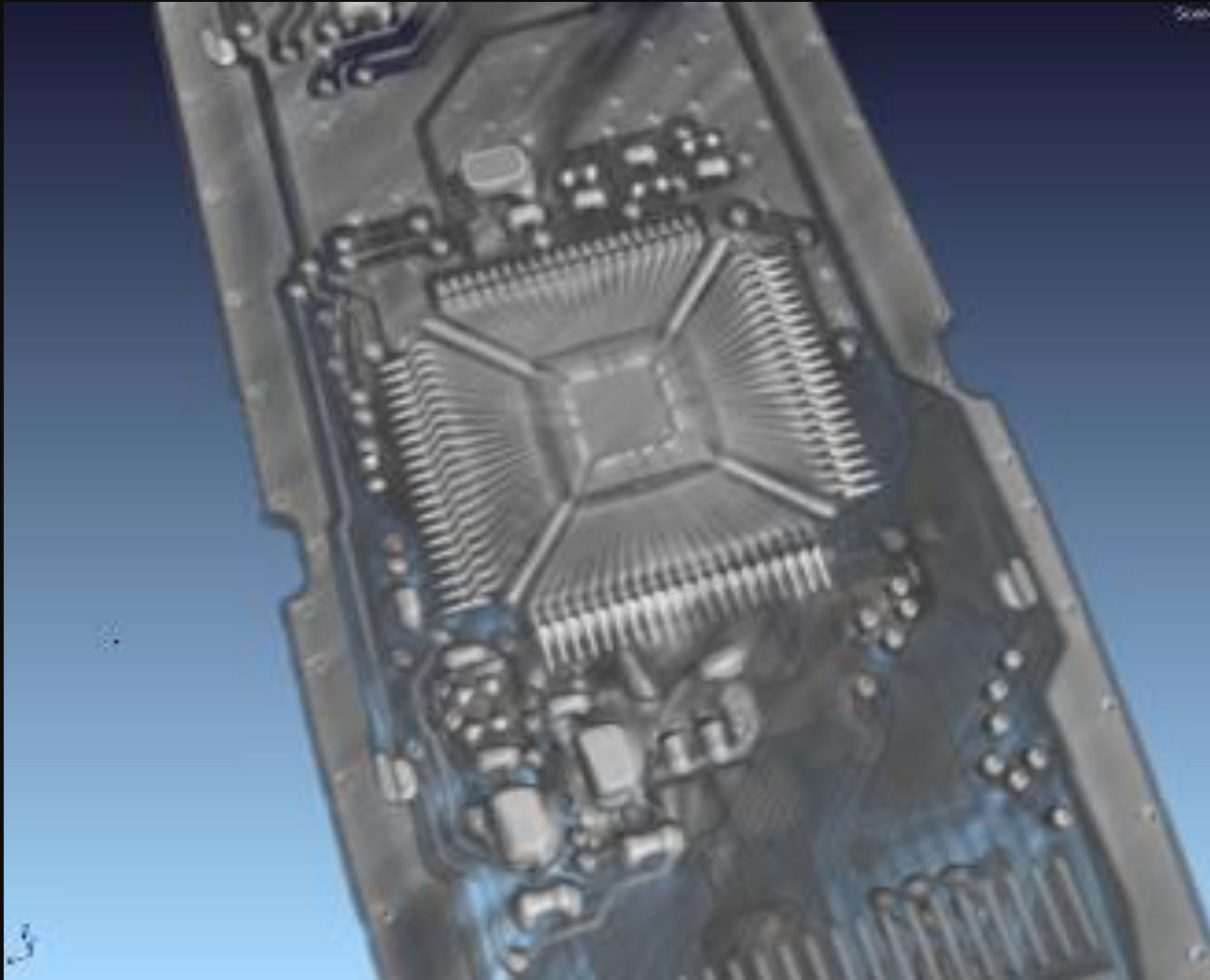


Fig. X ray of a Glucose meter circuit

Gamma-Ray imaging (Medical)

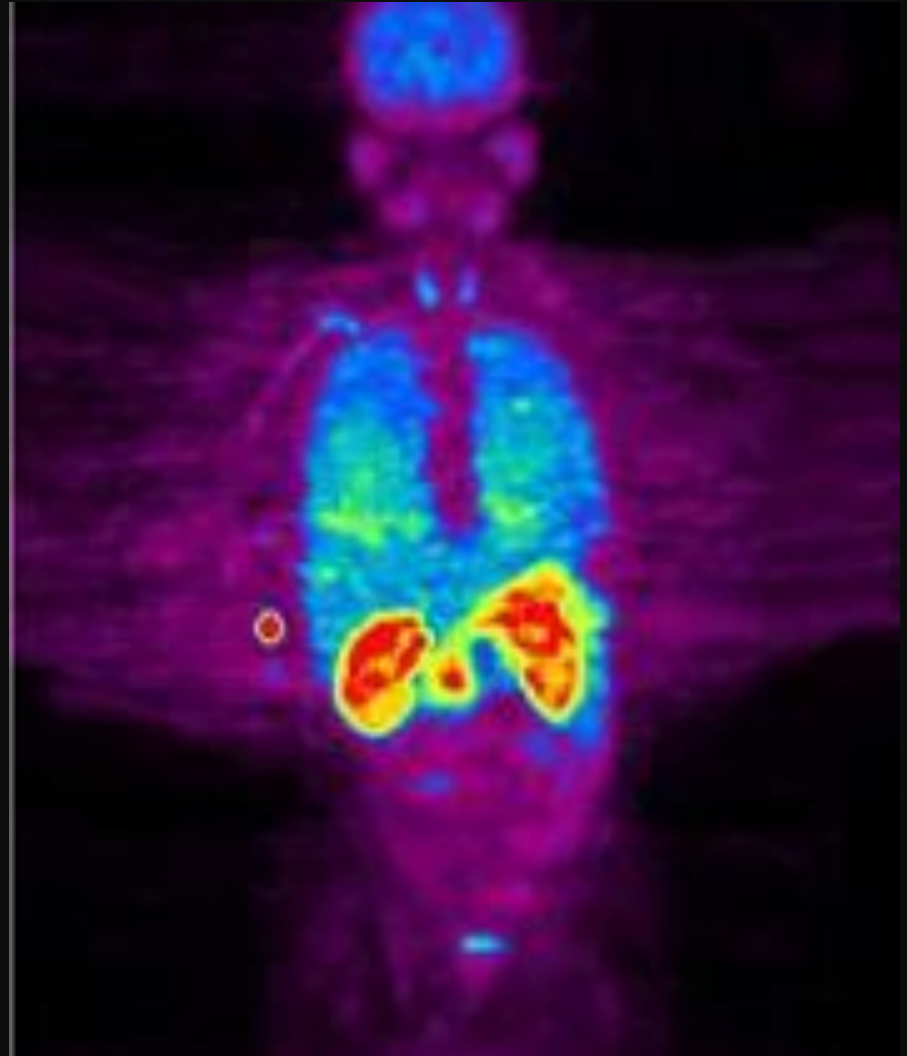


Fig. Gamma ray exposed images

Gamma-Ray imaging (Astronomy)



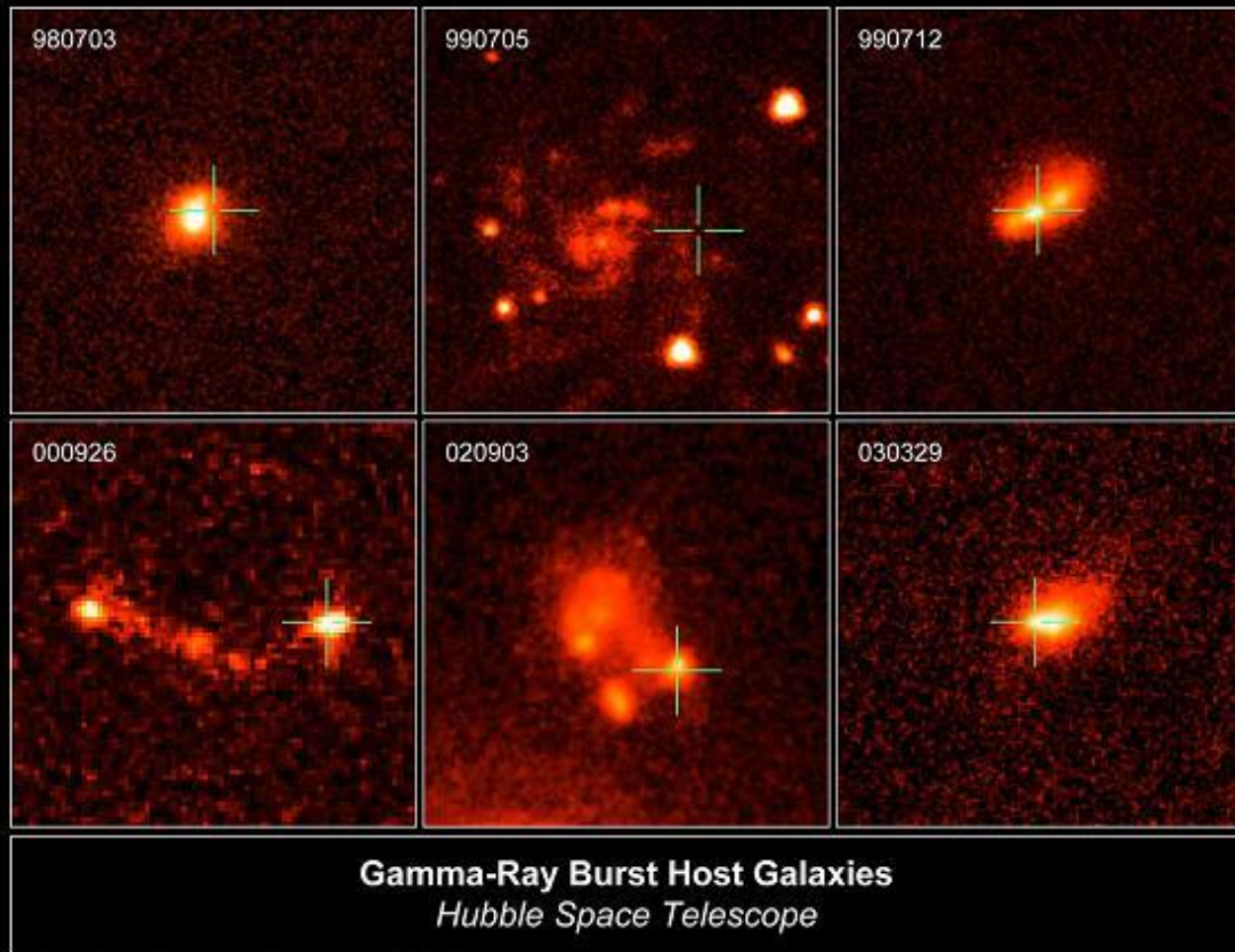
Fig. Gamma ray bursts in space

Gamma-Ray imaging (Astronomy)



Fig. Gamma ray bursts in space

Gamma-Ray imaging (Astronomy)



NASA, ESA, A. Fruchter (STScI), and the GOSH Collaboration

STScI-PRC06-20

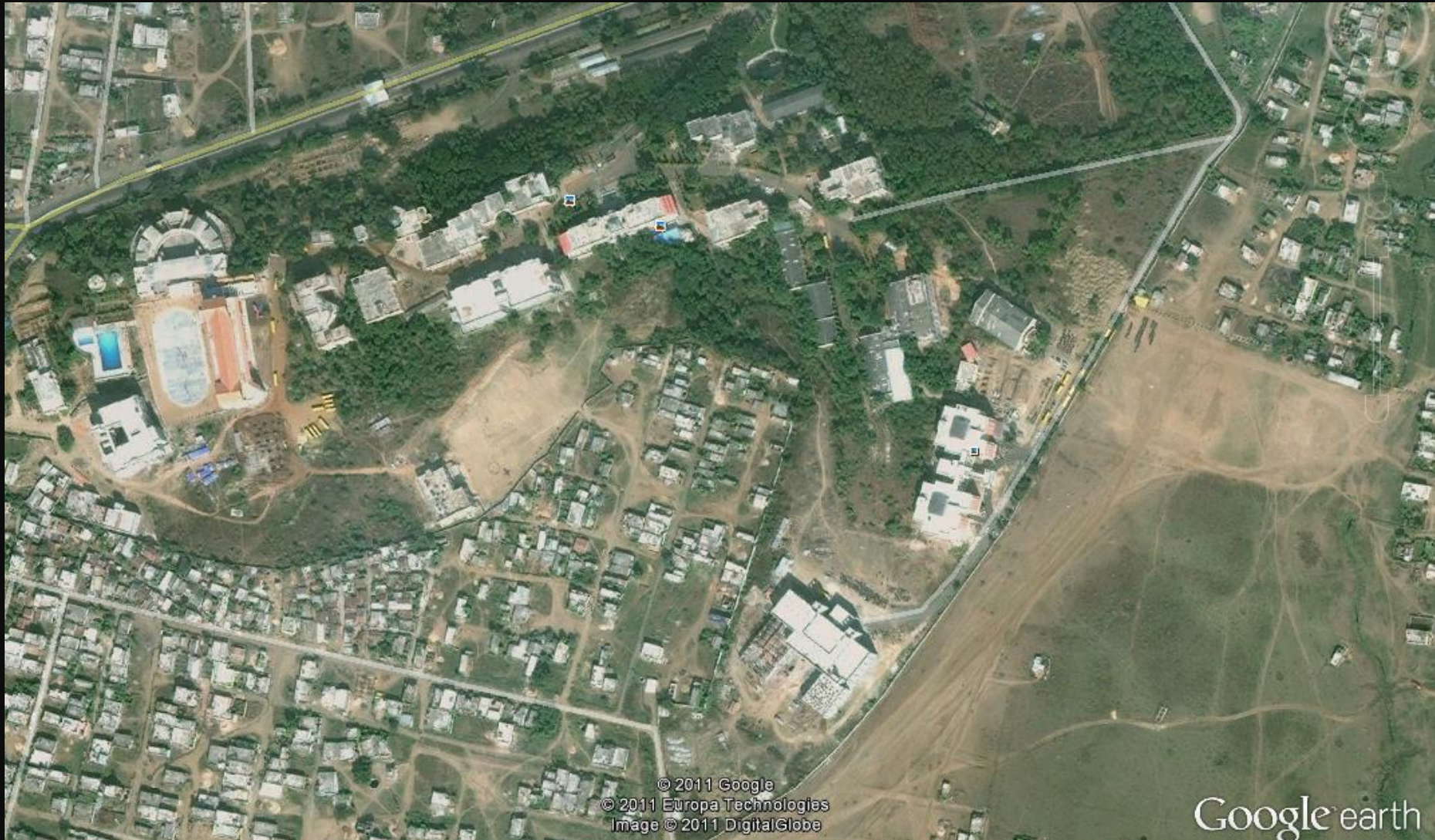
Fig. Gamma ray bursts in space

Remote Sensing



Fig. Satellite images of Mumbai suburban(Left) and Gateway of India (Right)

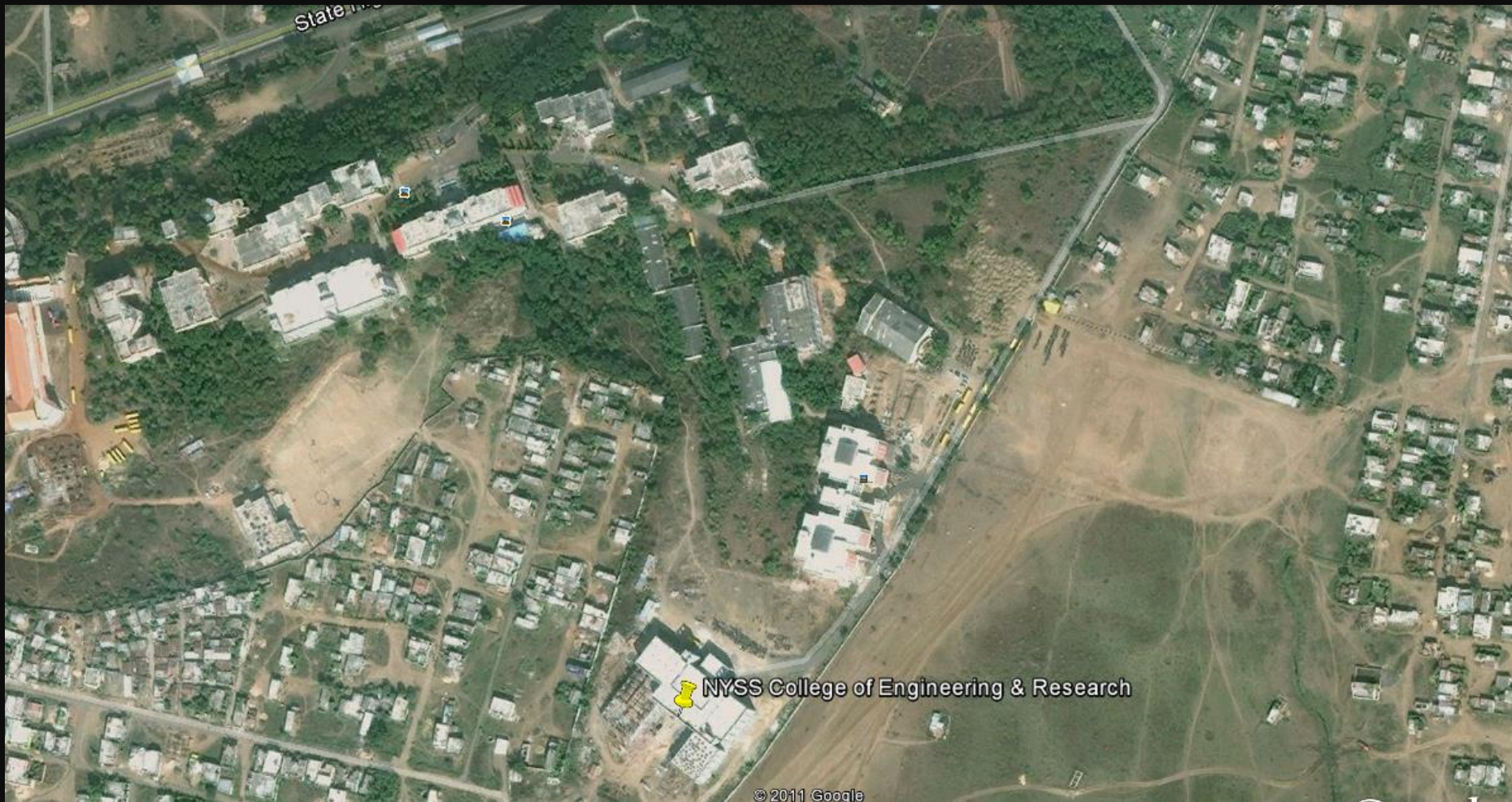
Remote Sensing



© 2011 Google
© 2011 Europa Technologies
Image © 2011 DigitalGlobe

Google earth

Remote Sensing



a	b
c	d
e	f

FIGURE 1.14

Some examples of manufactured goods often checked using digital image processing. (a) A circuit board controller.

(b) Packaged pills.

(c) Bottles.

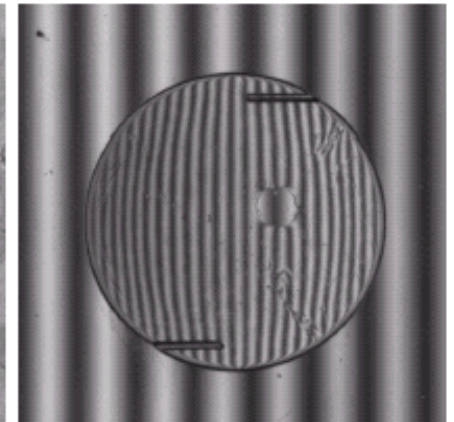
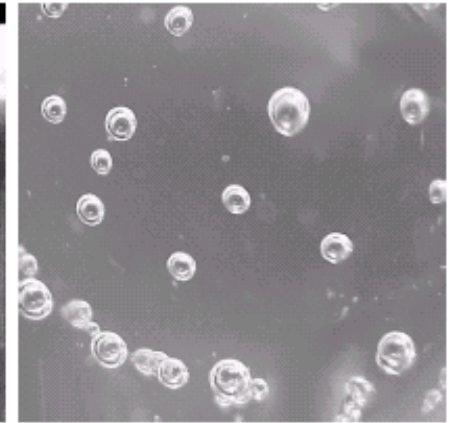
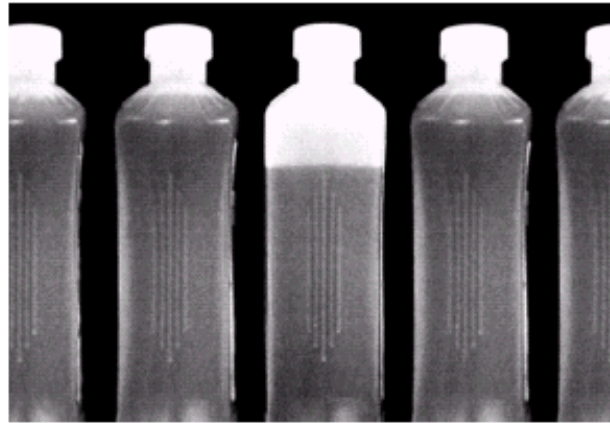
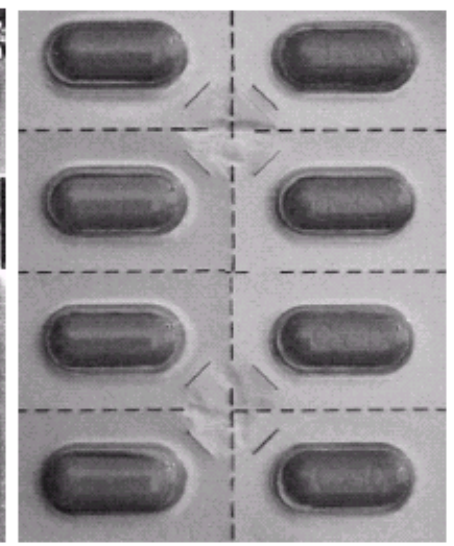
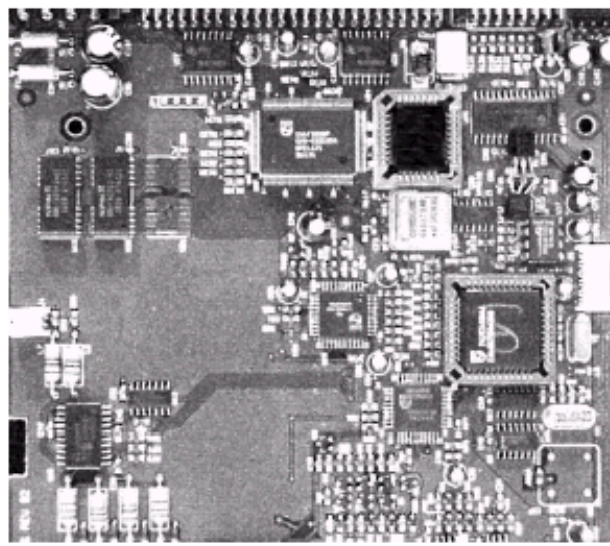
(d) Bubbles in clear-plastic product.

(e) Cereal.

(f) Image of intraocular implant.

(Fig. (f) courtesy of Mr. Pete Sites, Perceptics Corporation.)

▣ Automated visual inspection





a b
c
d

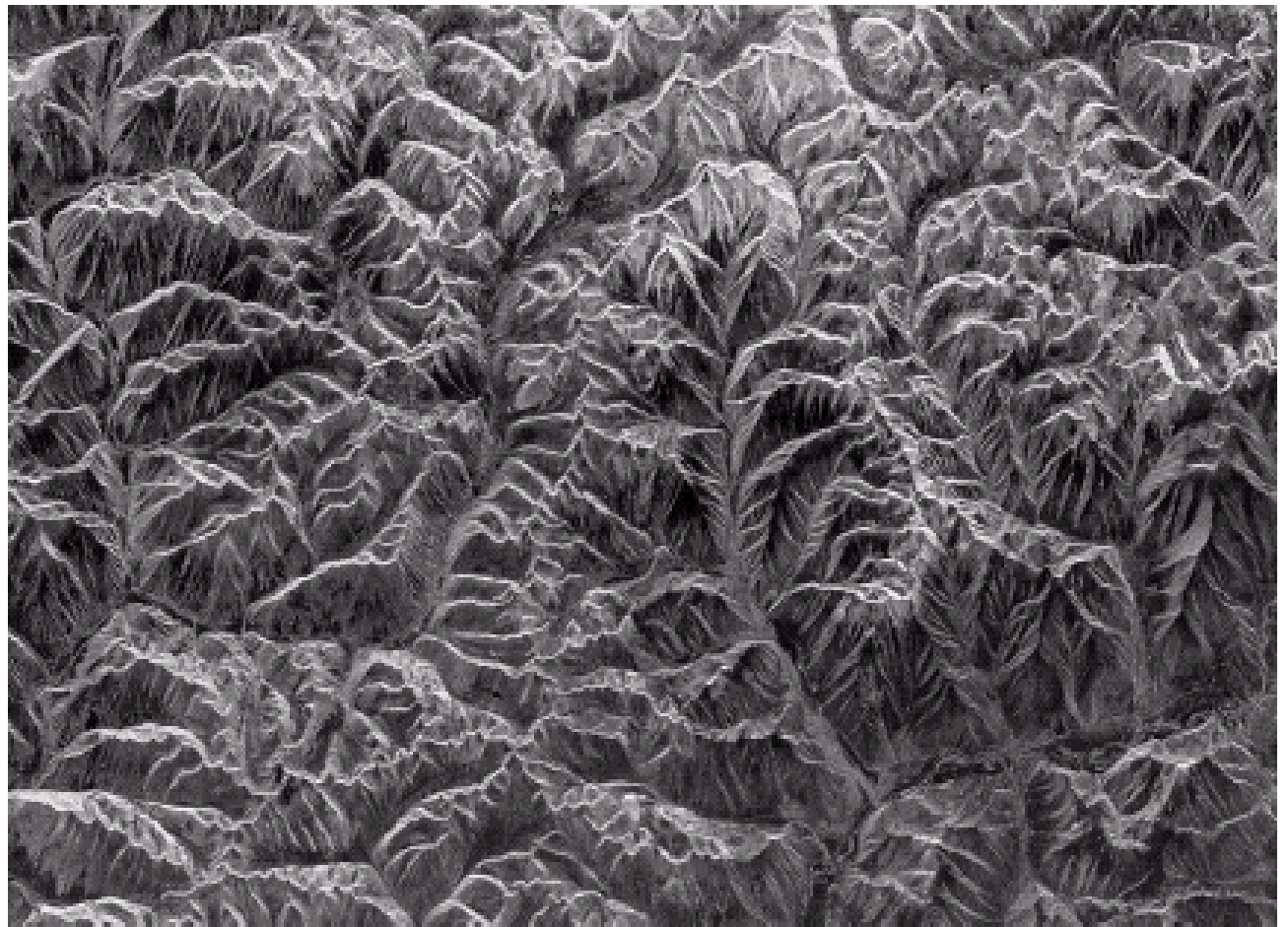
FIGURE 1.15
Some additional examples of imaging in the visual spectrum. (a) Thumb print. (b) Paper currency. (c) and (d). Automated license plate reading. (Figure (a) courtesy of the National Institute of Standards and Technology. Figures (c) and (d) courtesy of Dr. Juan Herrera, Perceptics Corporation.)



Imaging in the Microwave Band

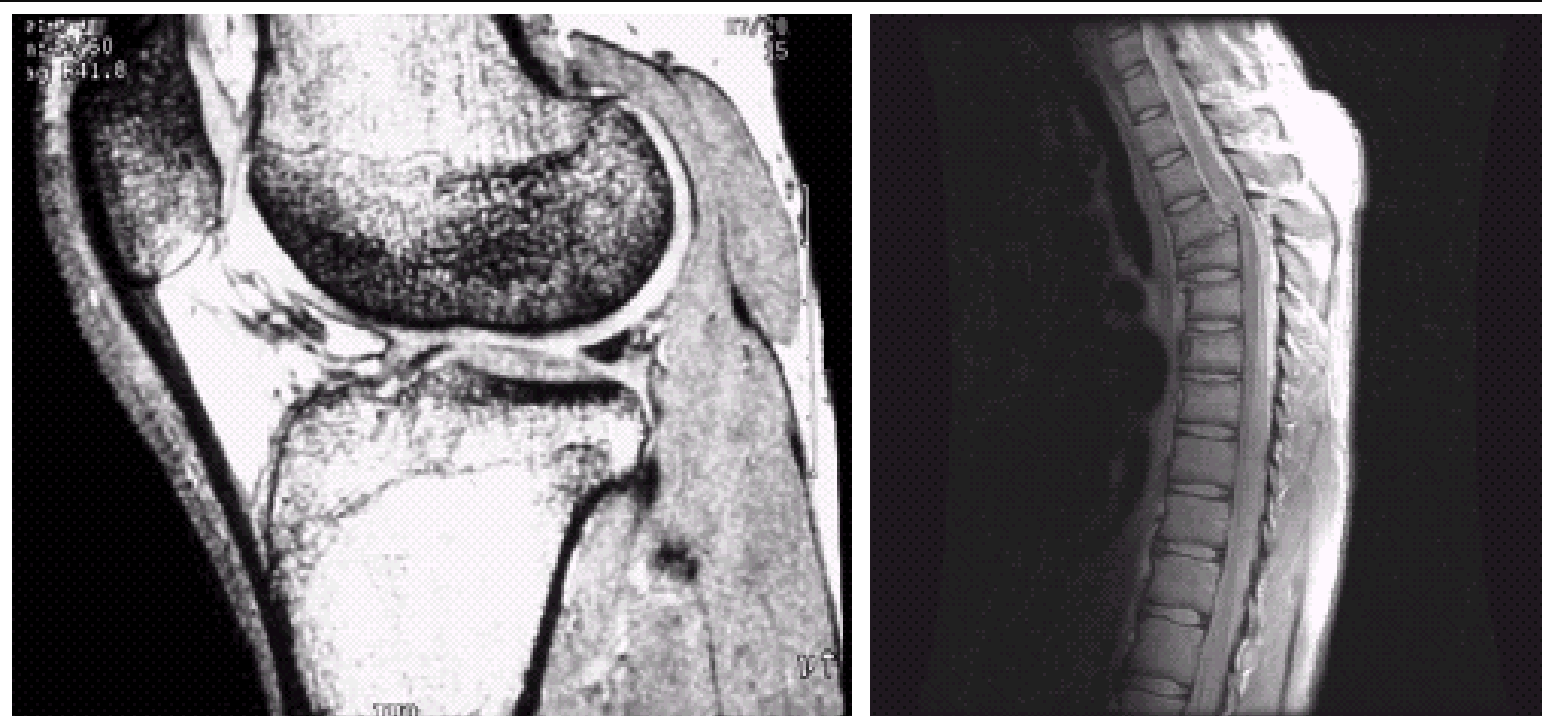
FIGURE 1.16

Spaceborne radar image of mountains in southeast Tibet. (Courtesy of NASA.)



Imaging in the Radio Band

▣ MRI



a b

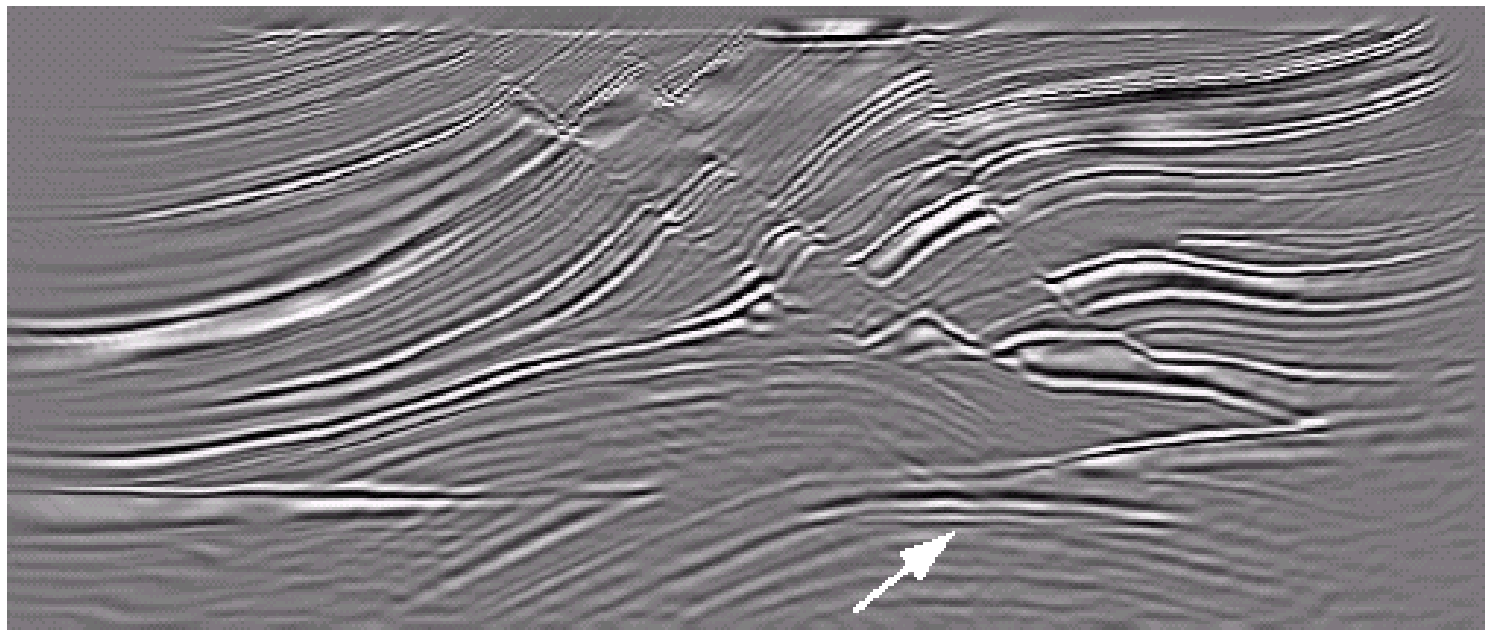
FIGURE 1.17 MRI images of a human (a) knee, and (b) spine. (Image (a) courtesy of Dr. Thomas R. Gest, Division of Anatomical Sciences, University of Michigan Medical School, and (b) Dr. David R. Pickens, Department of Radiology and Radiological Sciences, Vanderbilt University Medical Center.)

Examples in which Other Imaging Modalities Are Used

▣ Sound

FIGURE 1.19

Cross-sectional image of a seismic model. The arrow points to a hydrocarbon (oil and/or gas) trap. (Courtesy of Dr. Curtis Ober, Sandia National Laboratories.)



▣ Ultrasound

a	b
c	d

FIGURE 1.20
Examples of
ultrasound
imaging. (a) Baby.
(2) Another view
of baby.
(c) Thyroids.
(d) Muscle layers
showing lesion.
(Courtesy of
Siemens Medical
Systems, Inc.,
Ultrasound
Group.)

