

MONITORAMENTO DE EMISSÁRIOS SUBMARINOS POR MEIO DO SONAR DE VARREDURA LATERAL

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Moysés G. Tessler [2] e Eduardo A. Yassuda [3]

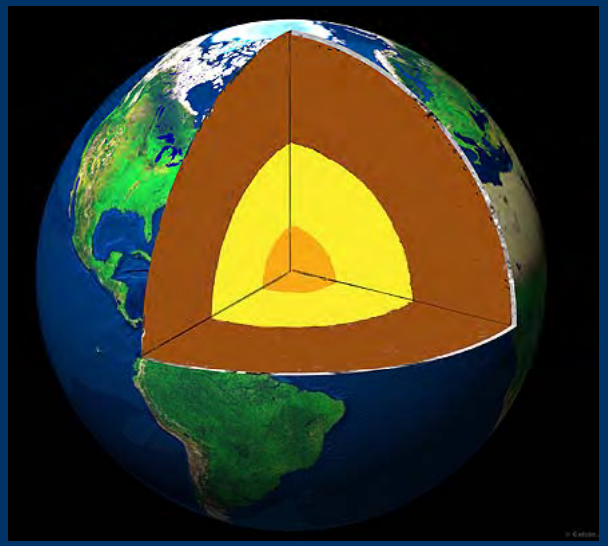
1 ipt INSTITUTO DE PESQUISAS TECNOLÓGICAS

2 IO Instituto Oceanográfico

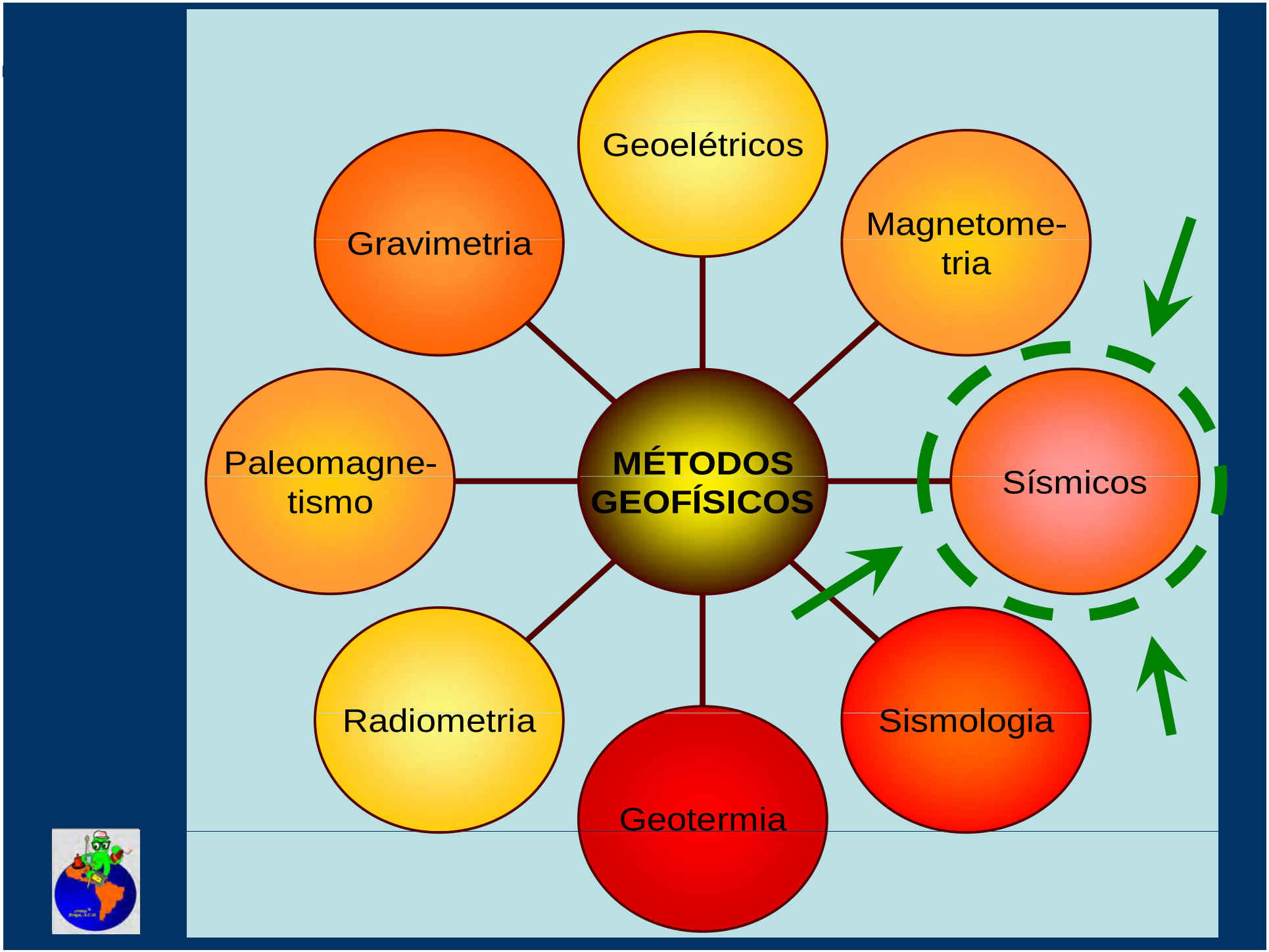
3 asa science. services. solutions.

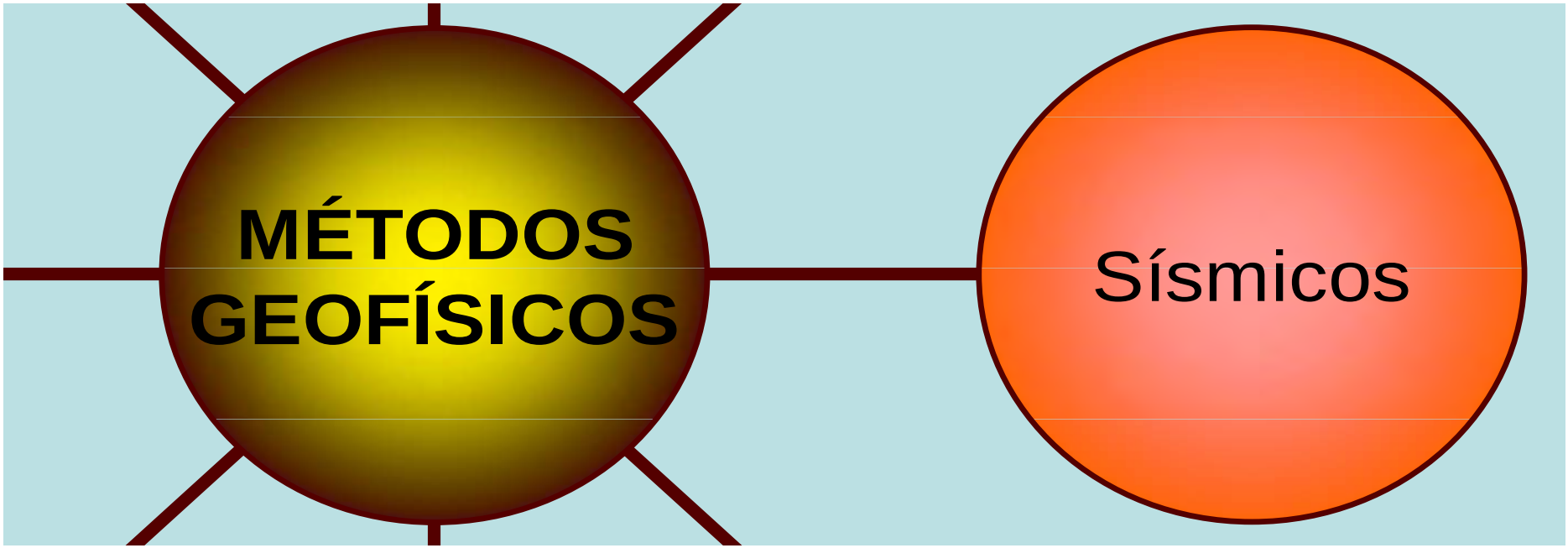
G E O F Í S I C A

Ciência que investiga os fenômenos físicos e as propriedades físicas do interior da Terra, da superfície ao núcleo






Geoelétricos
Gravimetria
Magnetome-
tria
Paleomagne-
tismo
MÉTODOS
GEOFÍSICOS
Sísmicos
Radiometria
Sismologia
Geotermia



GEOFÍSICA APLICADA

Métodos Acústicos

SONAR DE VARREDURA LATERAL

propagação do som na água

A importância / vantagens do uso sonar de varredura lateral

1 . ambientes submersos

2 . método indireto / não destrutivo

3 . rápida aplicação (5-10 km/h)

4. relação custo/benefício favorável

5. cobertura ampla (25-1000m)

6. portabilidade do sistema



Klein

EdgeTech

MarineSonic

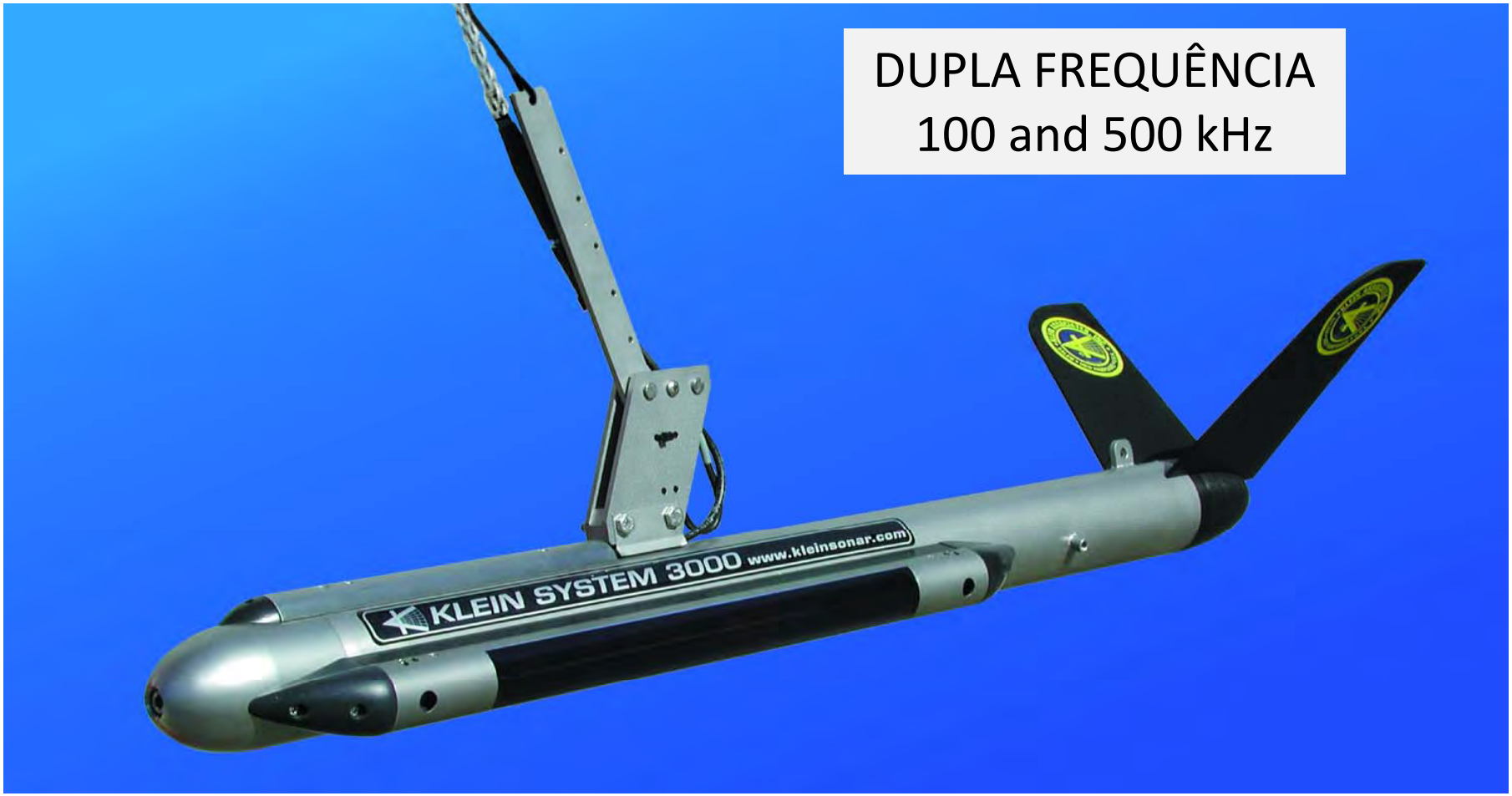






“PEIXES”

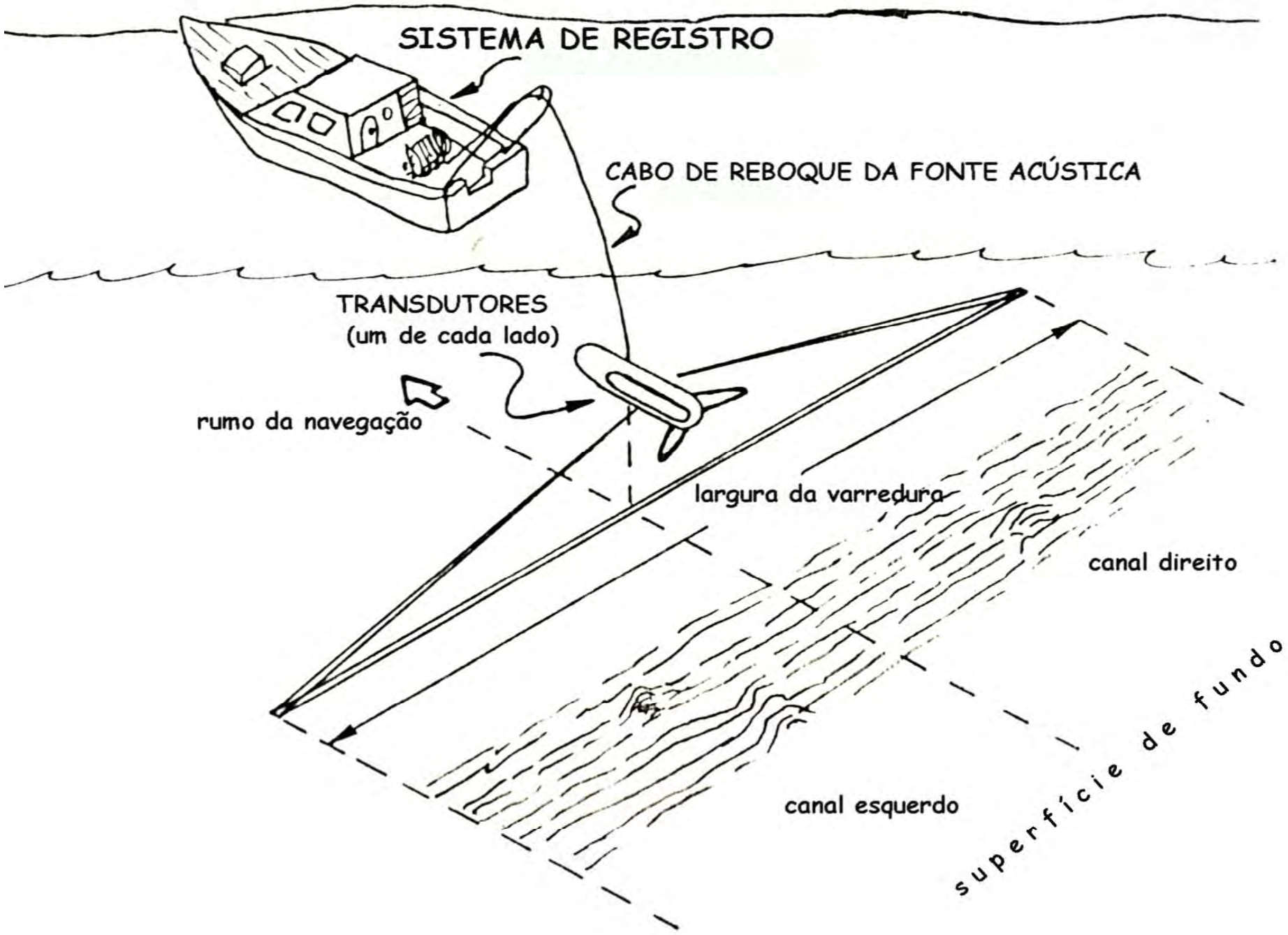
Side Scan Sonar



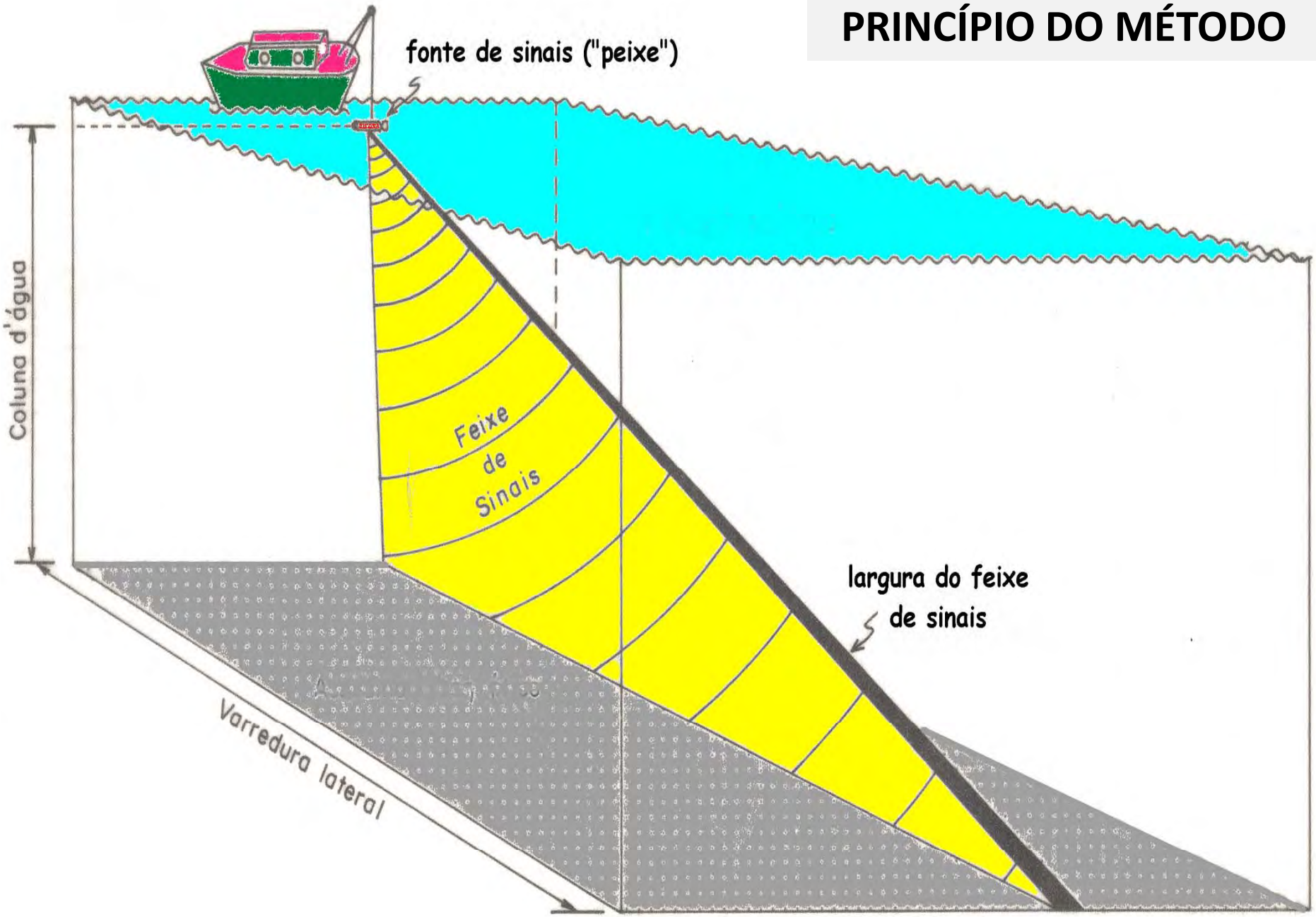
Equipamento do IPT adquirido em projeto Finep



Klein 3000 100/500 kHz do IPT


SISTEMA DE REGISTRO
CABO DE REBOQUE DA FONTE ACÚSTICA
TRANSDUTORES
(um de cada lado)
rumo da navegação
largura da varredura
canal direito
canal esquerdo
superfície de fundo

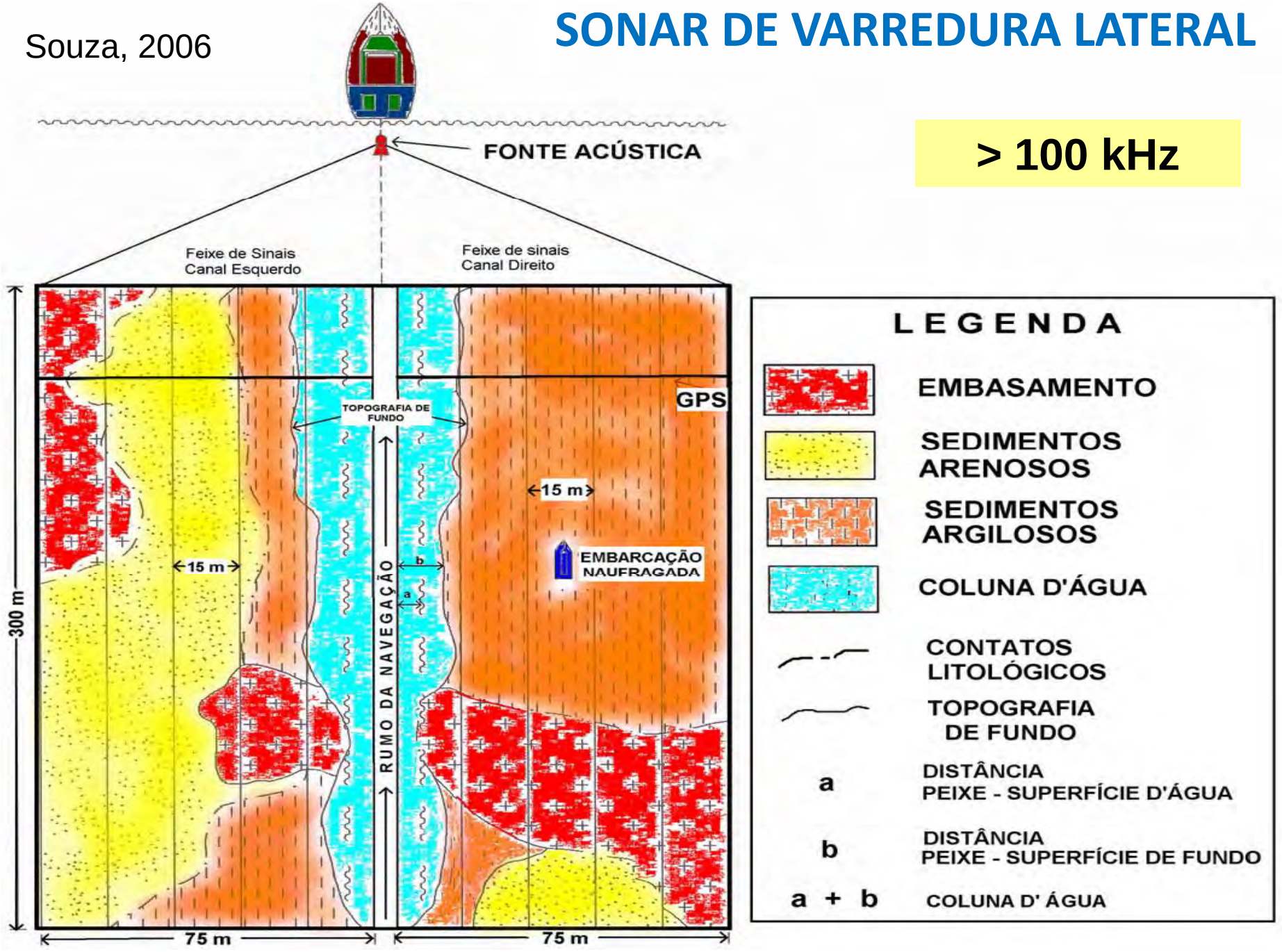
PRINCÍPIO DO MÉTODO



Souza, 2006

SONAR DE VARREDURA LATERAL

> 100 kHz




Praia Grande, SP
Side Scan Sonar
(a fonte acústica
de 100 e 500kHz)


SANTOS, SP
Side Scan Sonar







Lago do Parque da Aclimação, SP

Sabesp + ASA + IPT



Rio Araguaia – Araunã



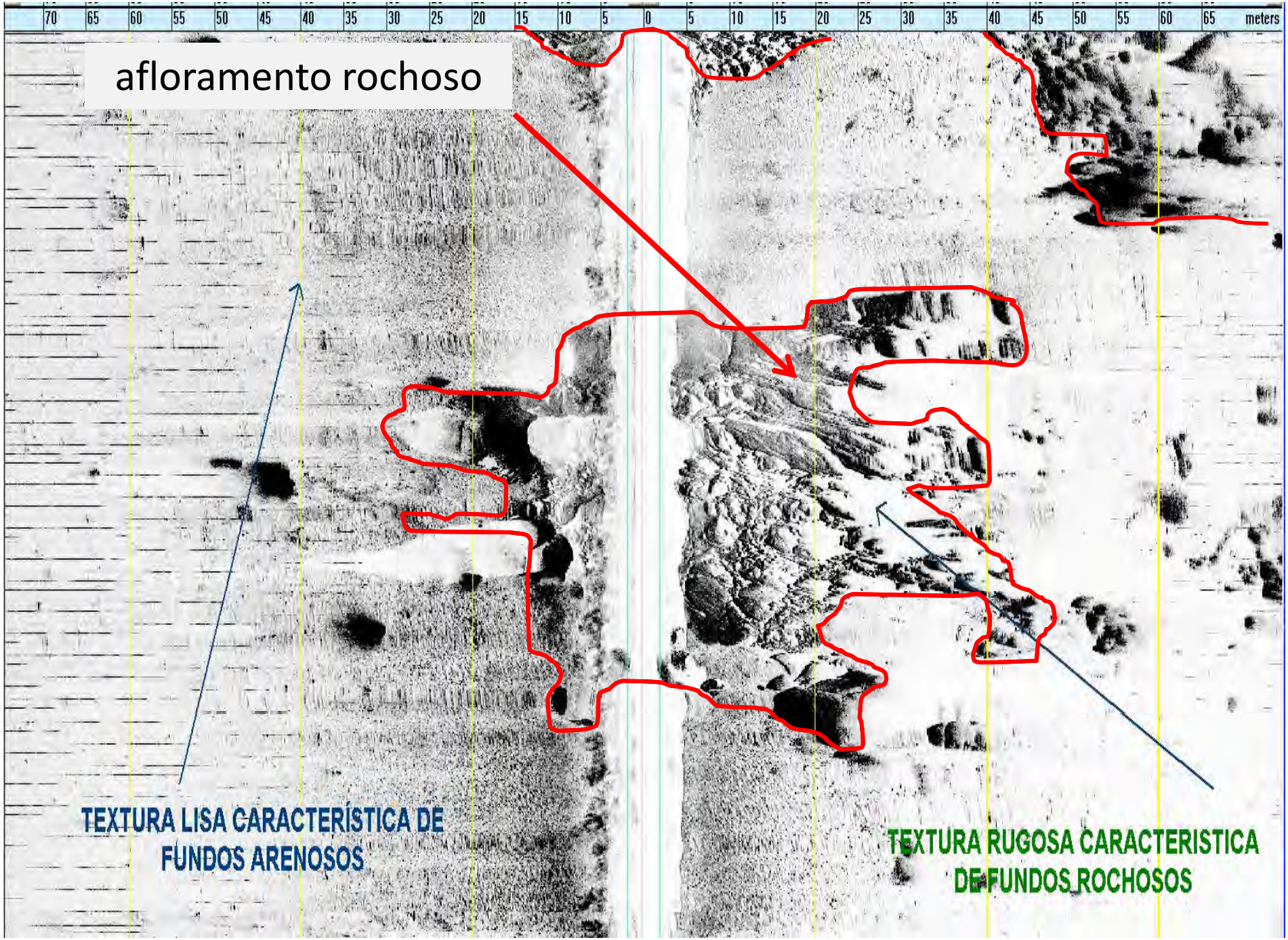


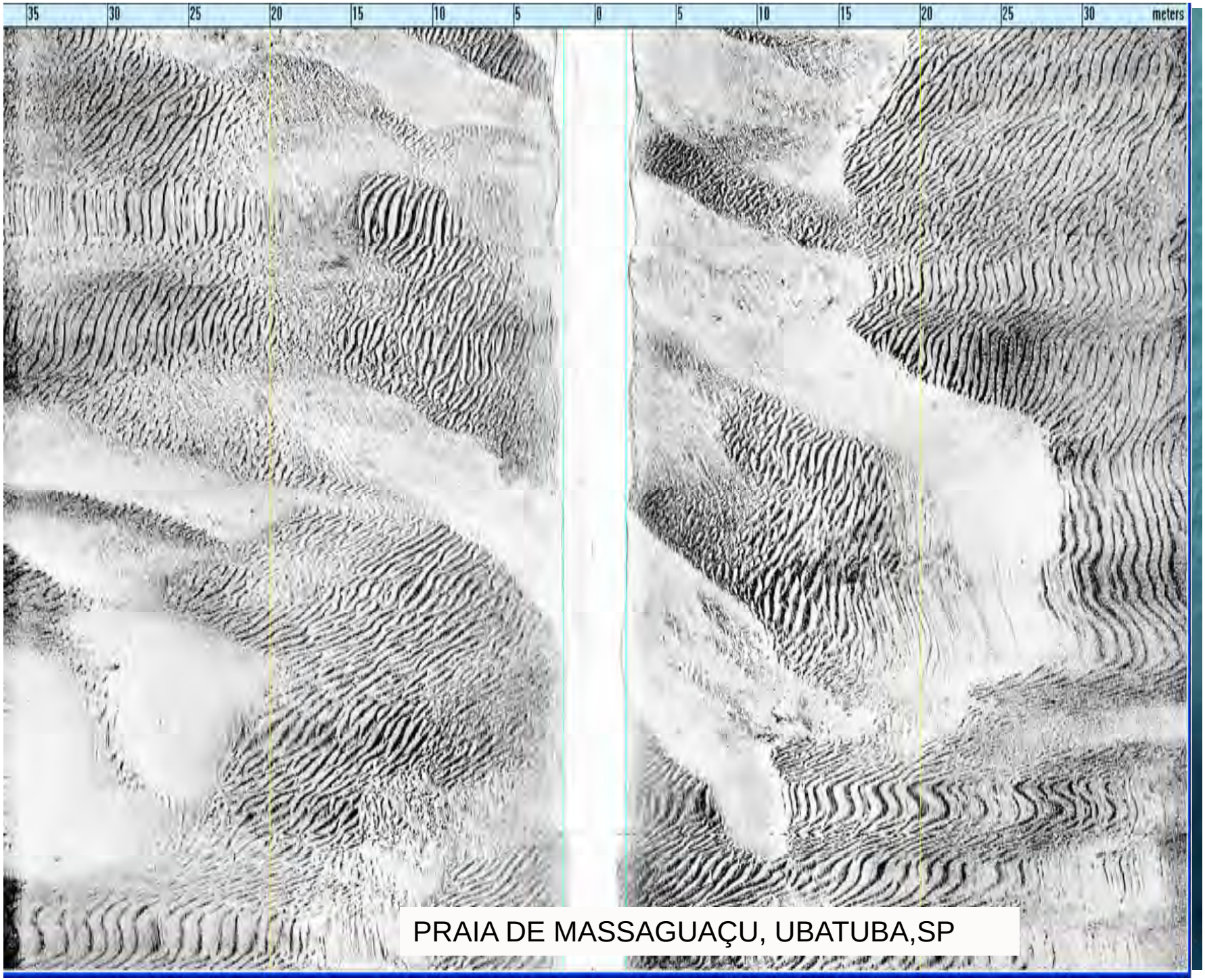


Reserv. Cachoeira do França, Juquitiba, SP

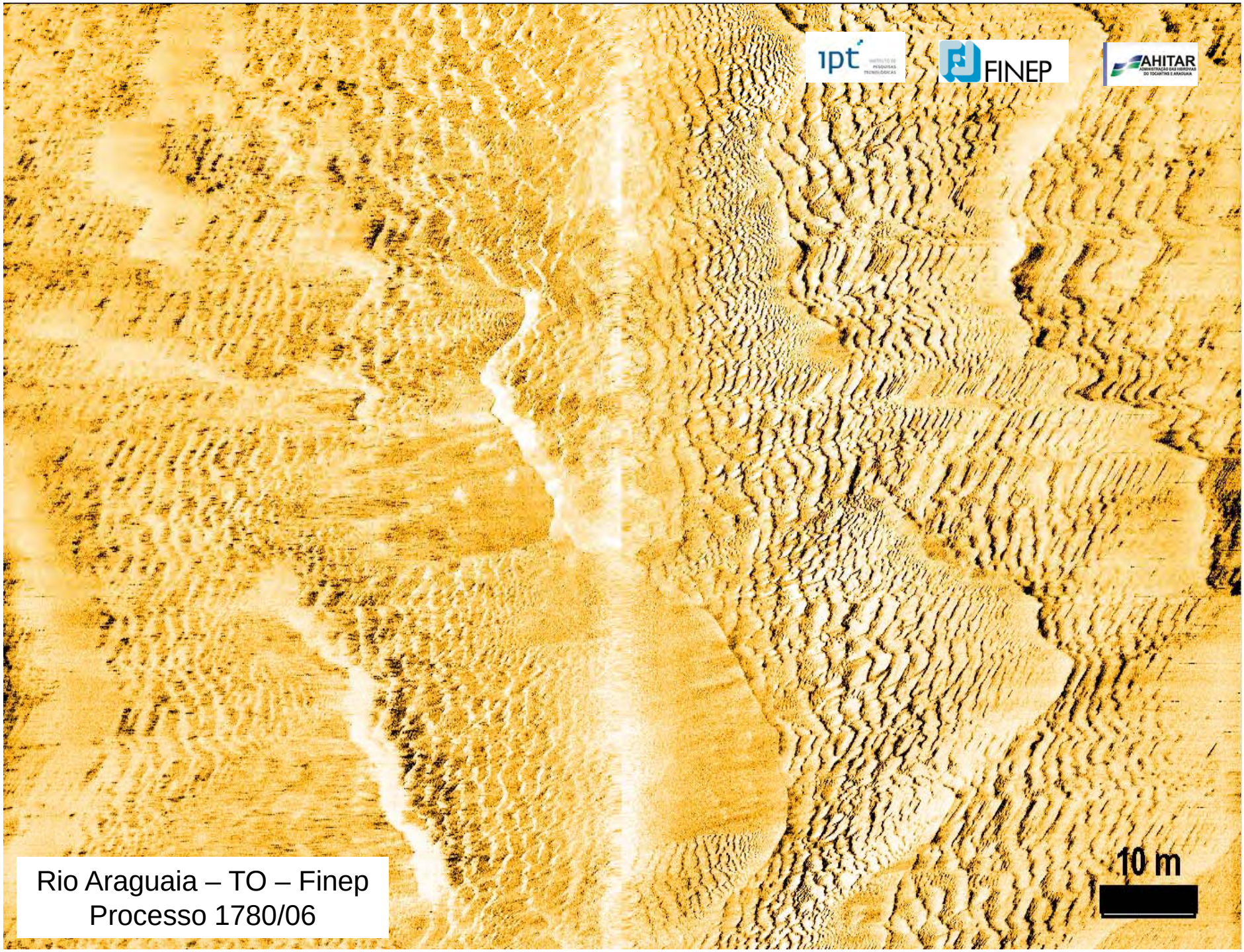
IPT + Zanettini Arqueologia

EXEMPLOS DE PRODUTOS DO SONAR DE VARREDURA LATERAL

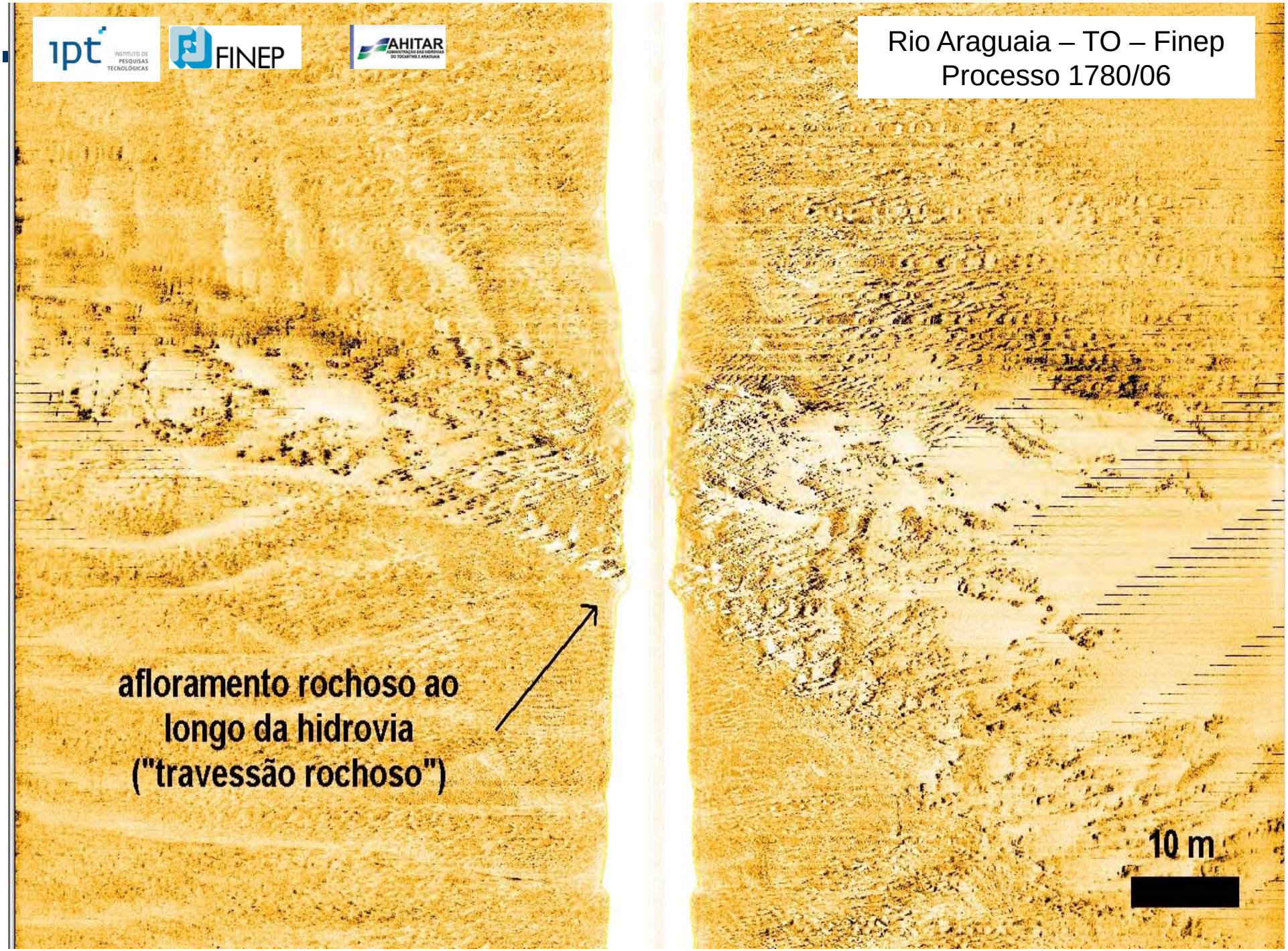

70 65 60 55 50 45 40 35 30 25 20 15 10 5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 meters
afloramento rochoso
TEXTURA LISA CARACTERÍSTICA DE FUNDOS ARENOSOS
TEXTURA RUGOSA CARACTERISTICA DE FUNDOS ROCHOSOS

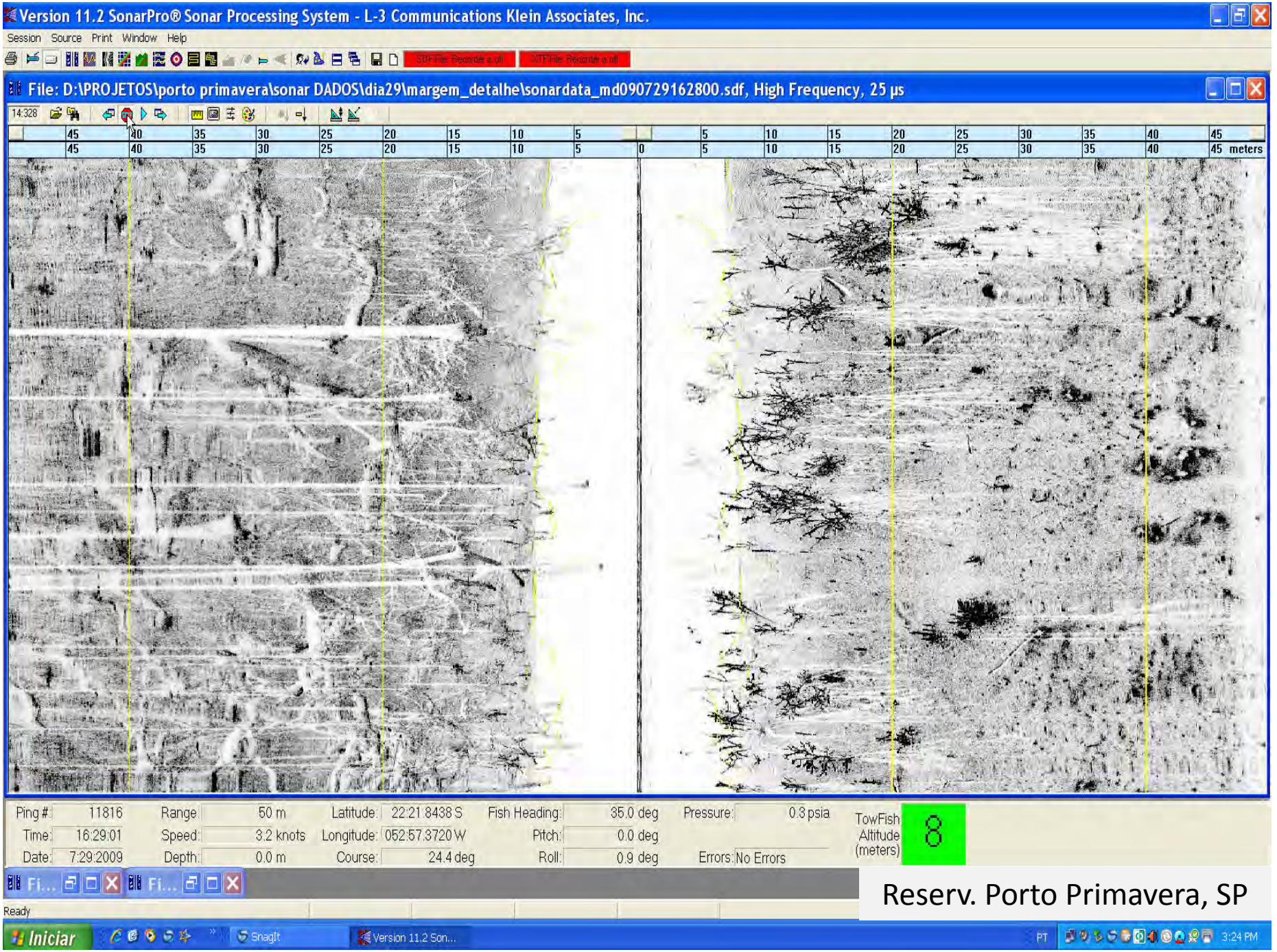


PRAIA DE MASSAGUAÇU, UBATUBA,SP

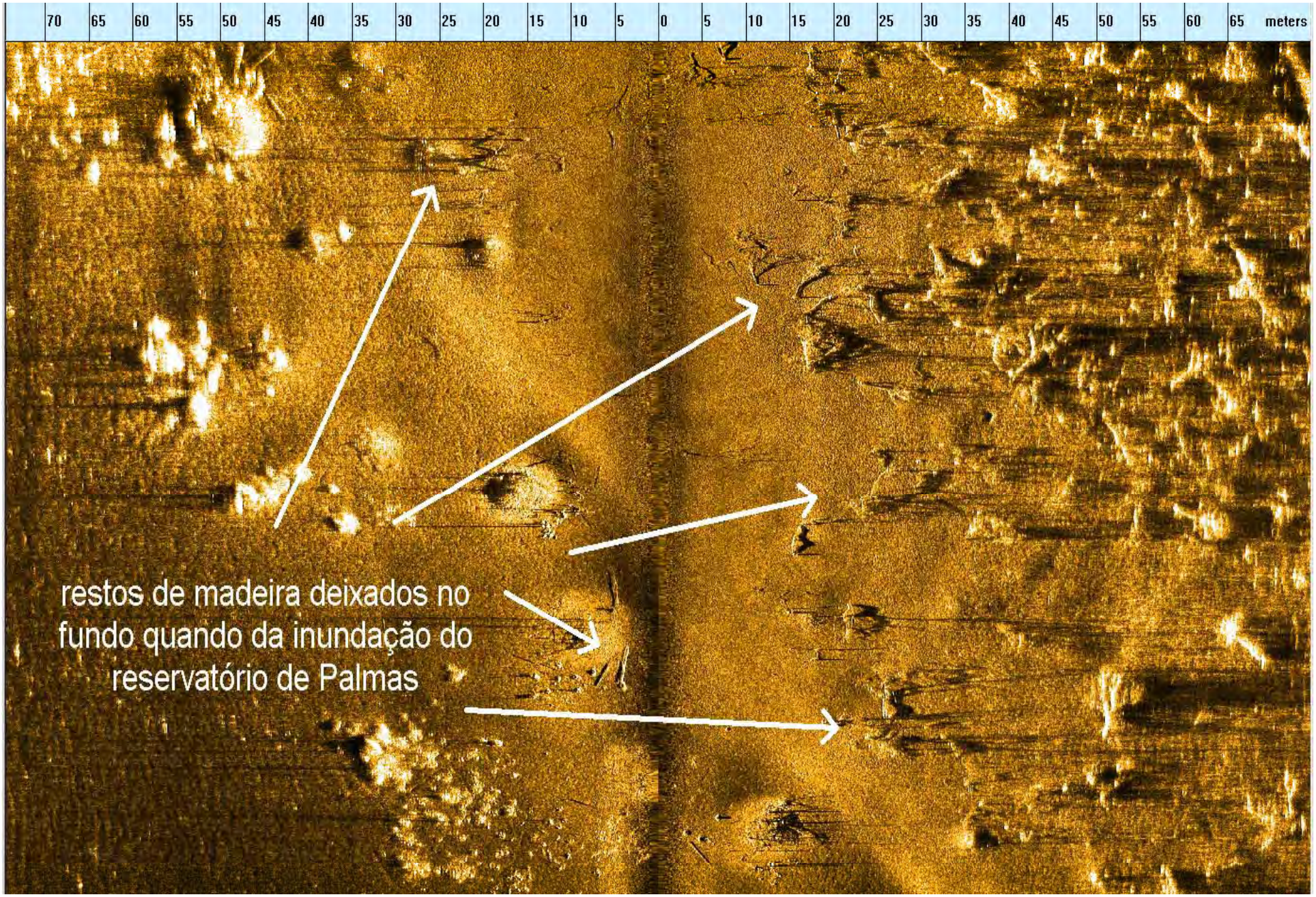


Rio Araguaia – TO – Finep
Processo 1780/06

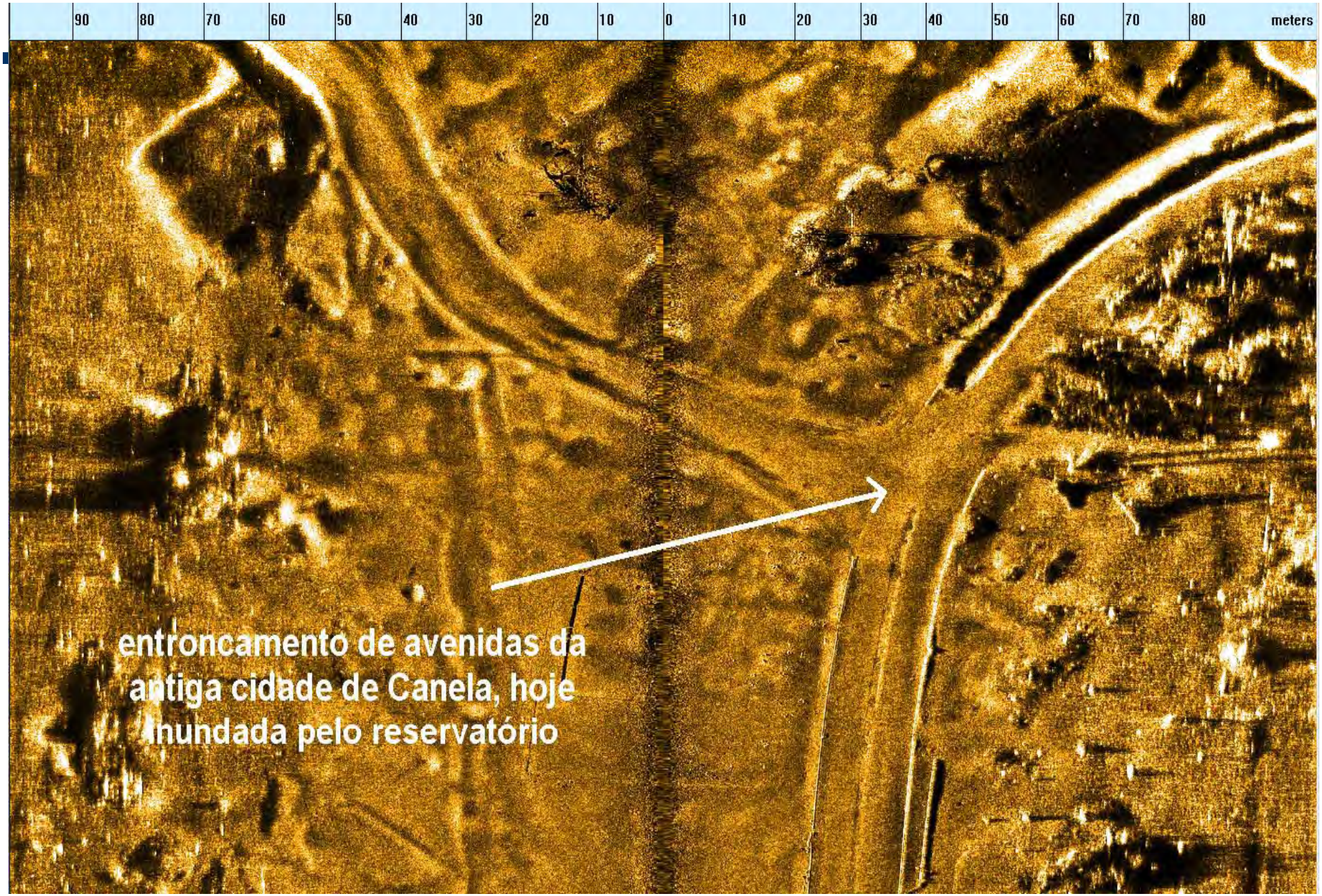

Rio Araguaia – TO – Finep
Processo 1780/06
afloramento rochoso ao
longo da hidrovia
("travessão rochoso")
10 m



Reserv. Porto Primavera, SP



Reservatório de Lajeado – Palmas - TO



Reservatório de Lajeado – Palmas - TO

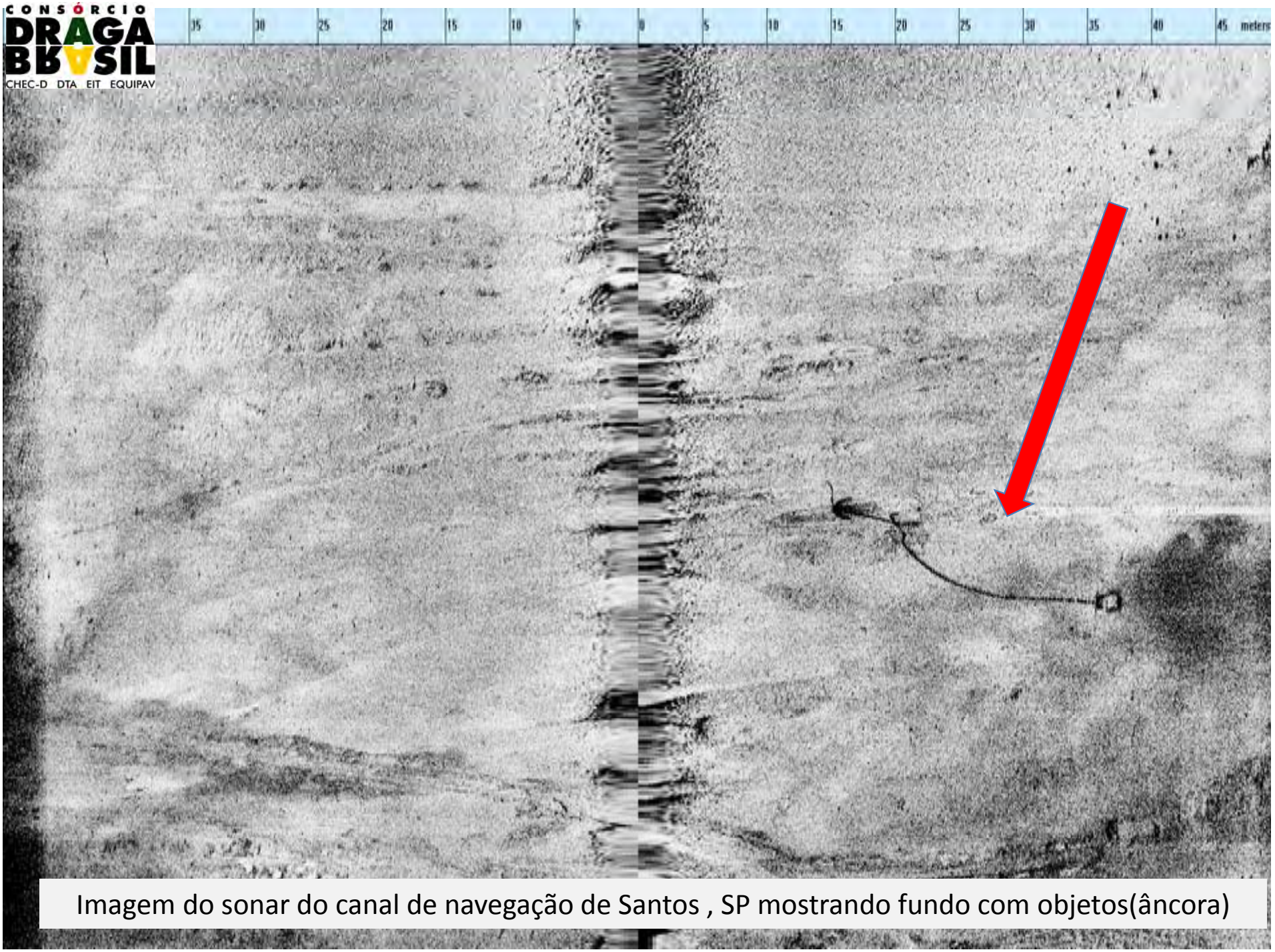
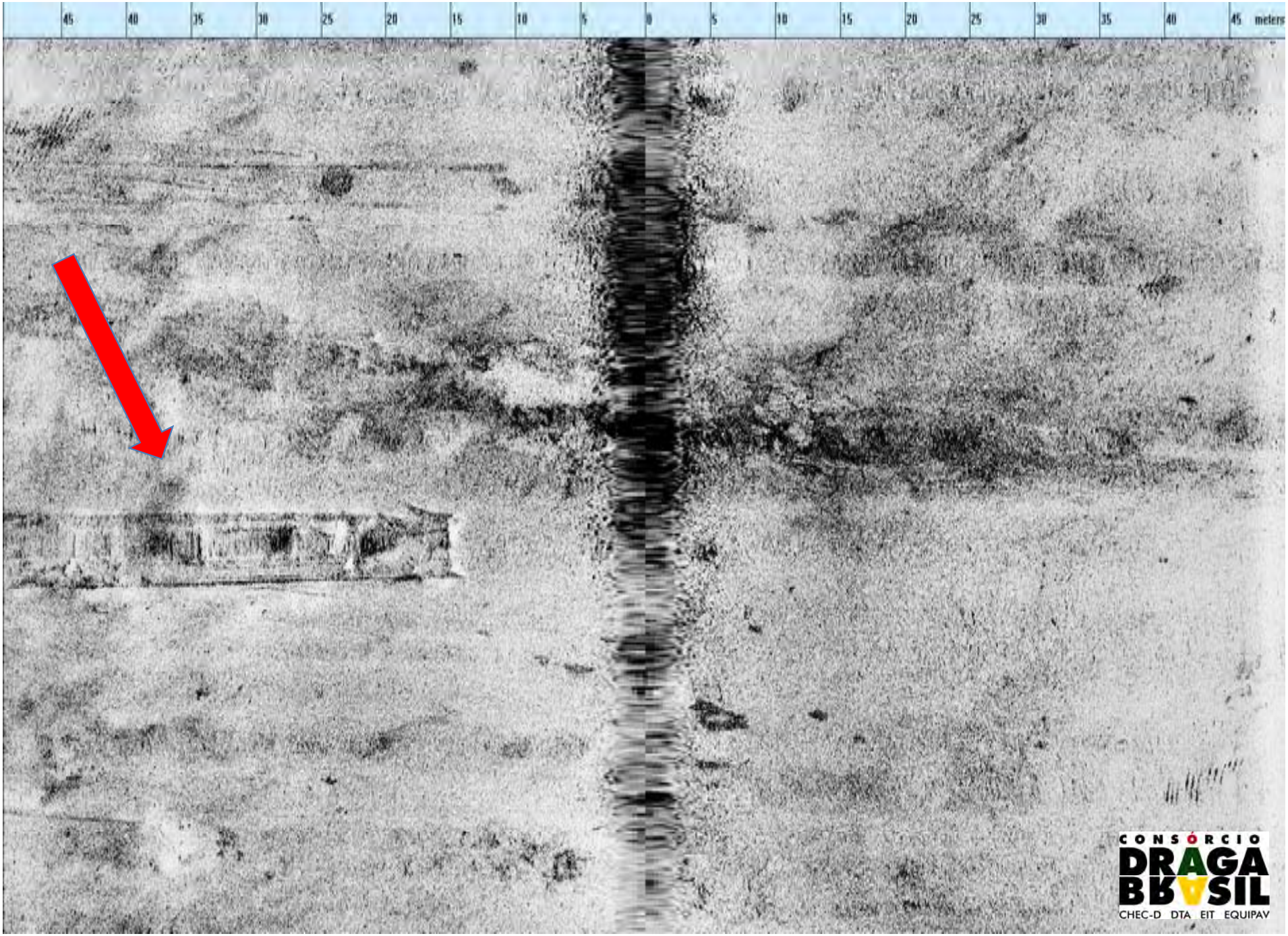
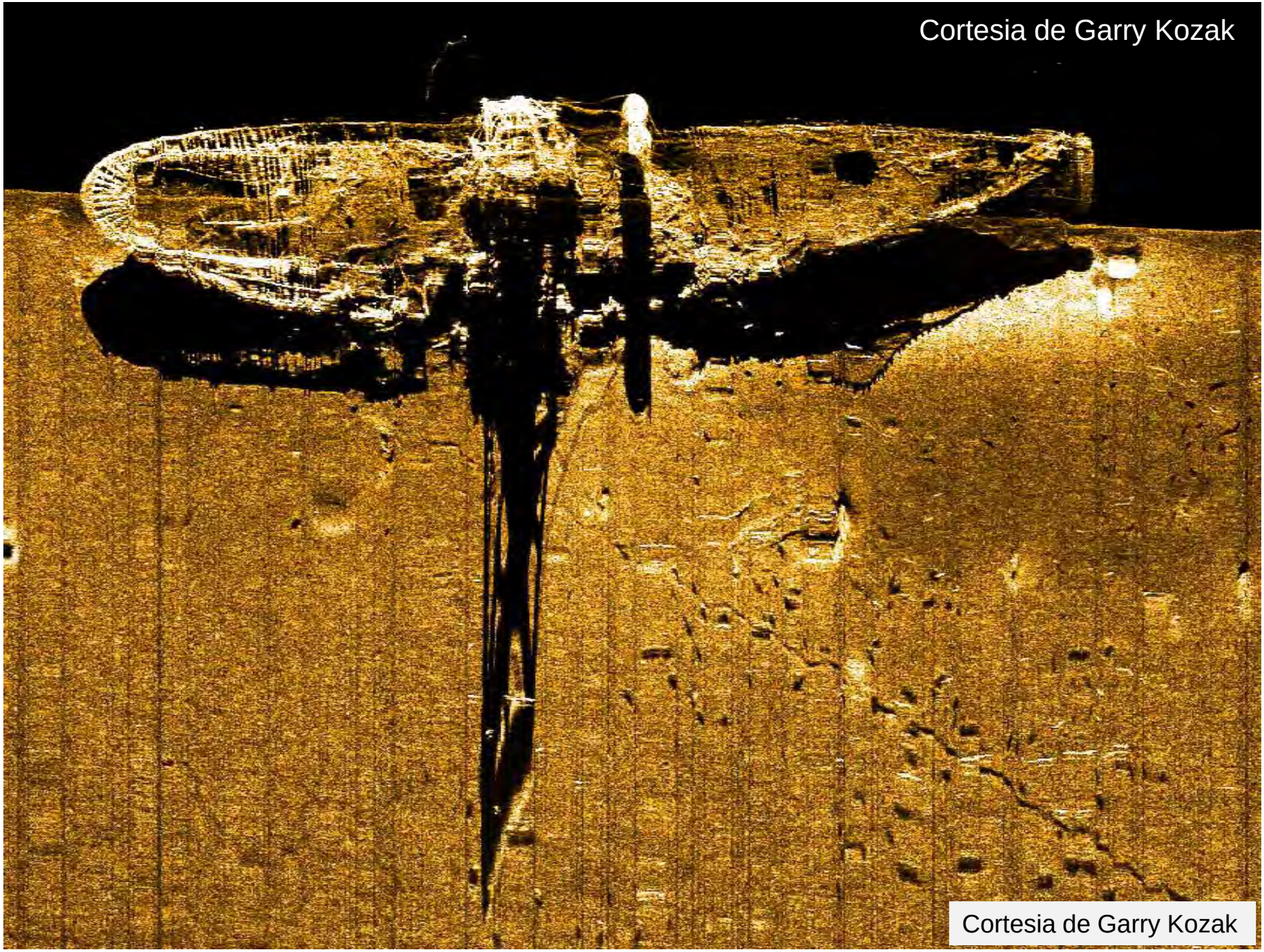


Imagem do sonar do canal de navegação de Santos , SP mostrando fundo com objetos(âncora)

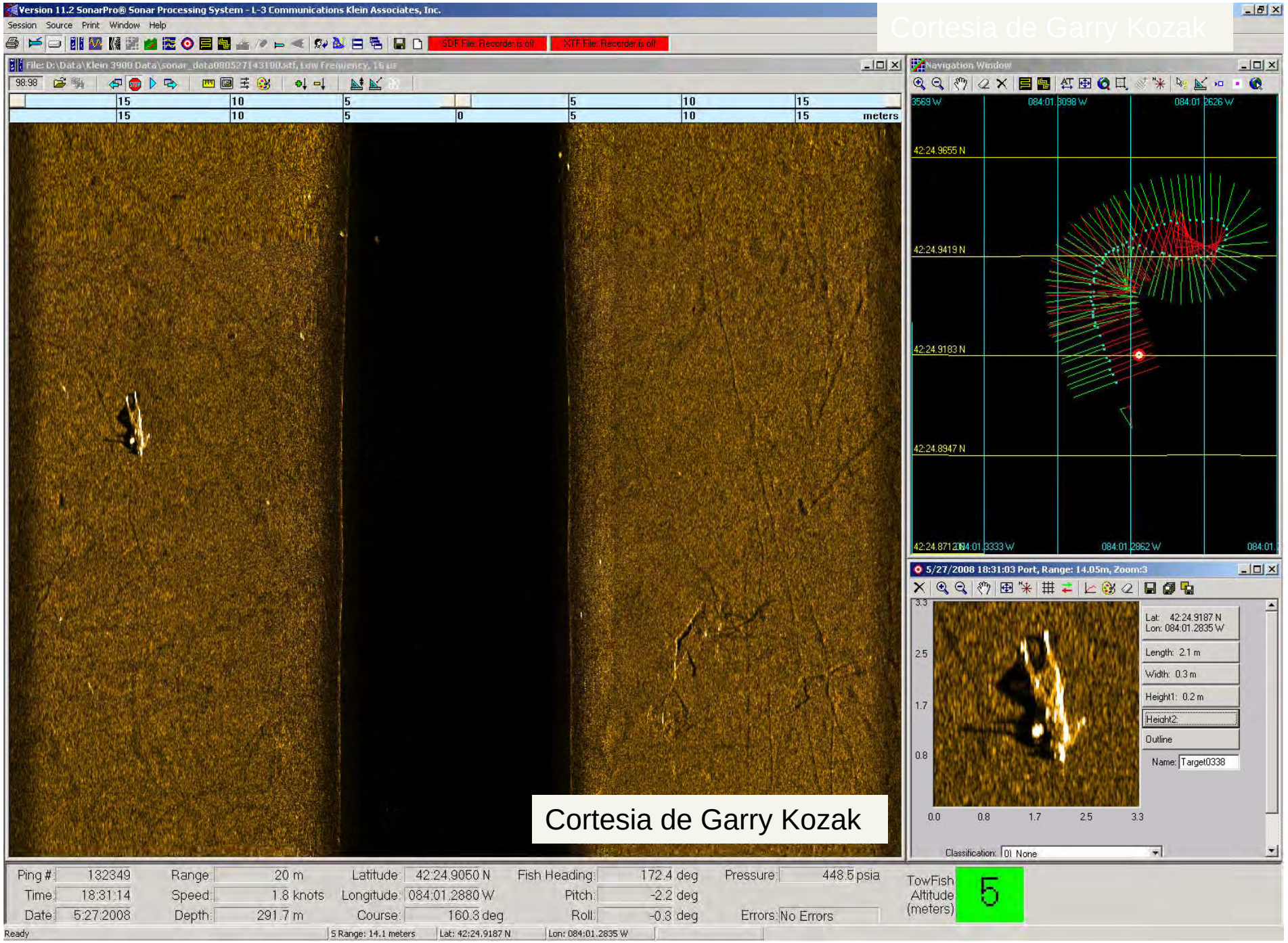

45 40 35 30 25 20 15 10 5 0 5 10 15 20 25 30 35 40 45 meters
CONSÓRCIO
DRAGA BRASIL
CHEC-D DTA EIT EQUIPAV


Cortesia de Garry Kozak
Cortesia de Garry Kozak





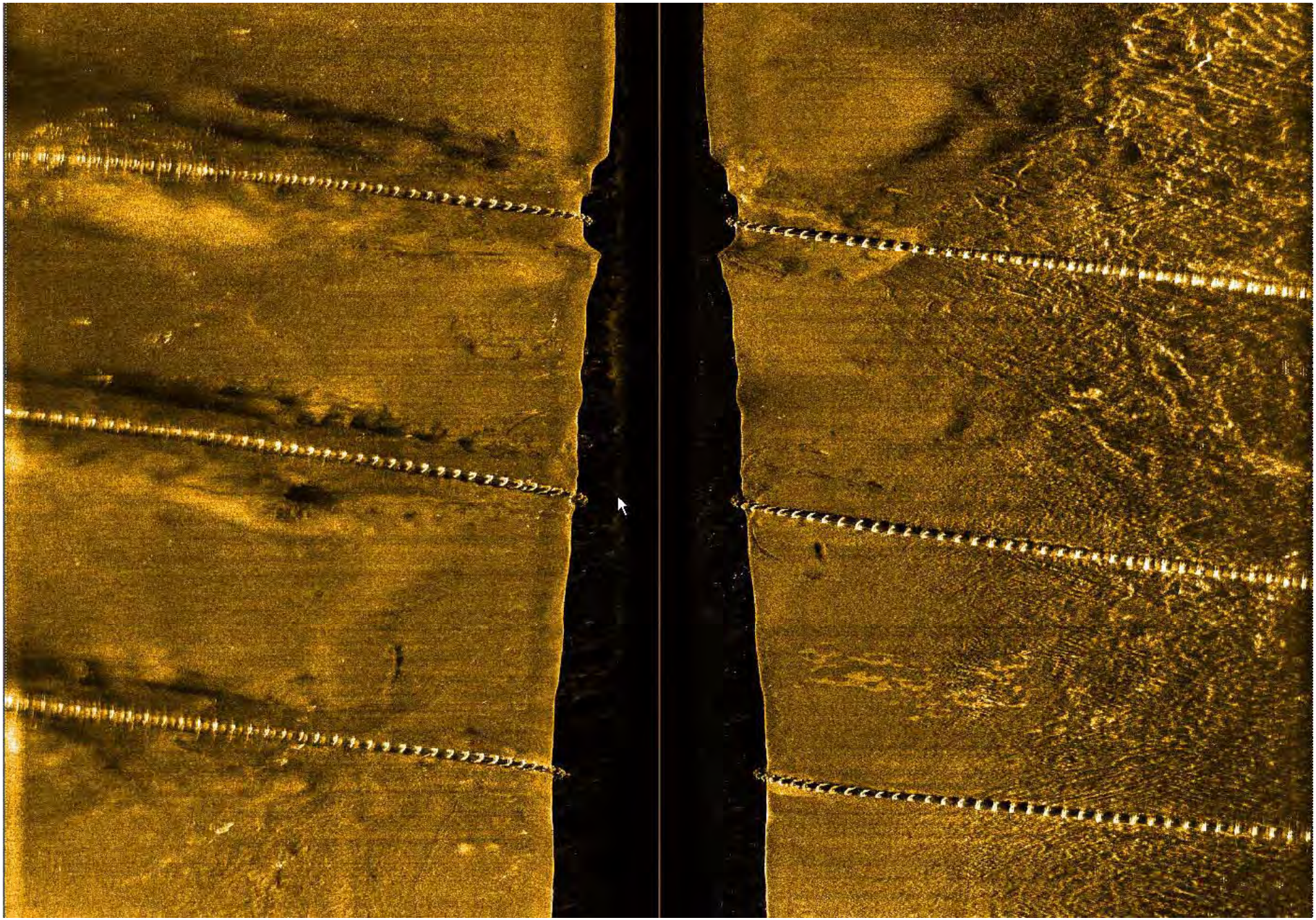
Cortesia de Garry Kozak



Cortesia de Garry Kozak

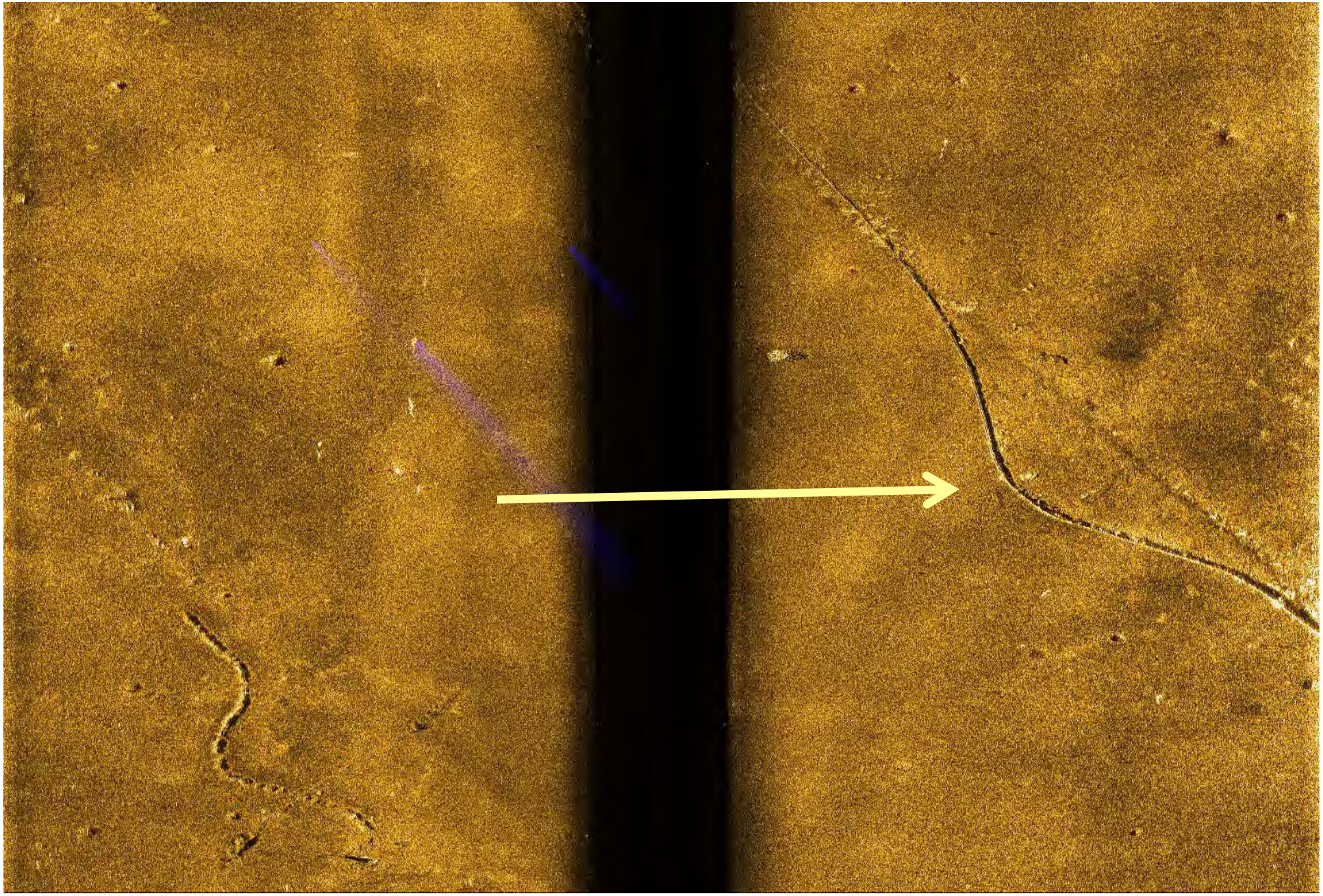
Cortesia de Garry Kozak


BILLINGS, SP



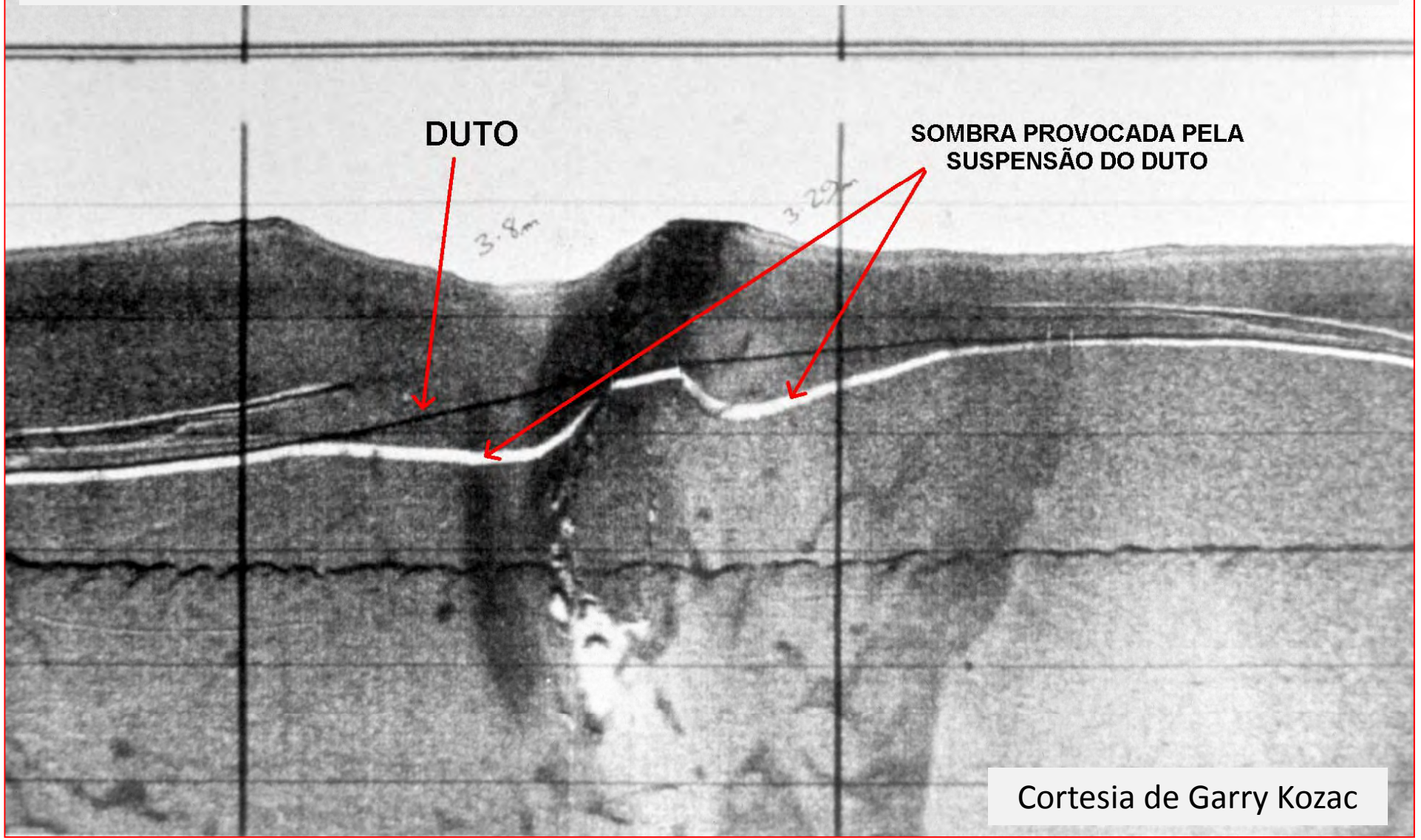
Dutos na posição original de projeto

Cortesia de Garry Kozak



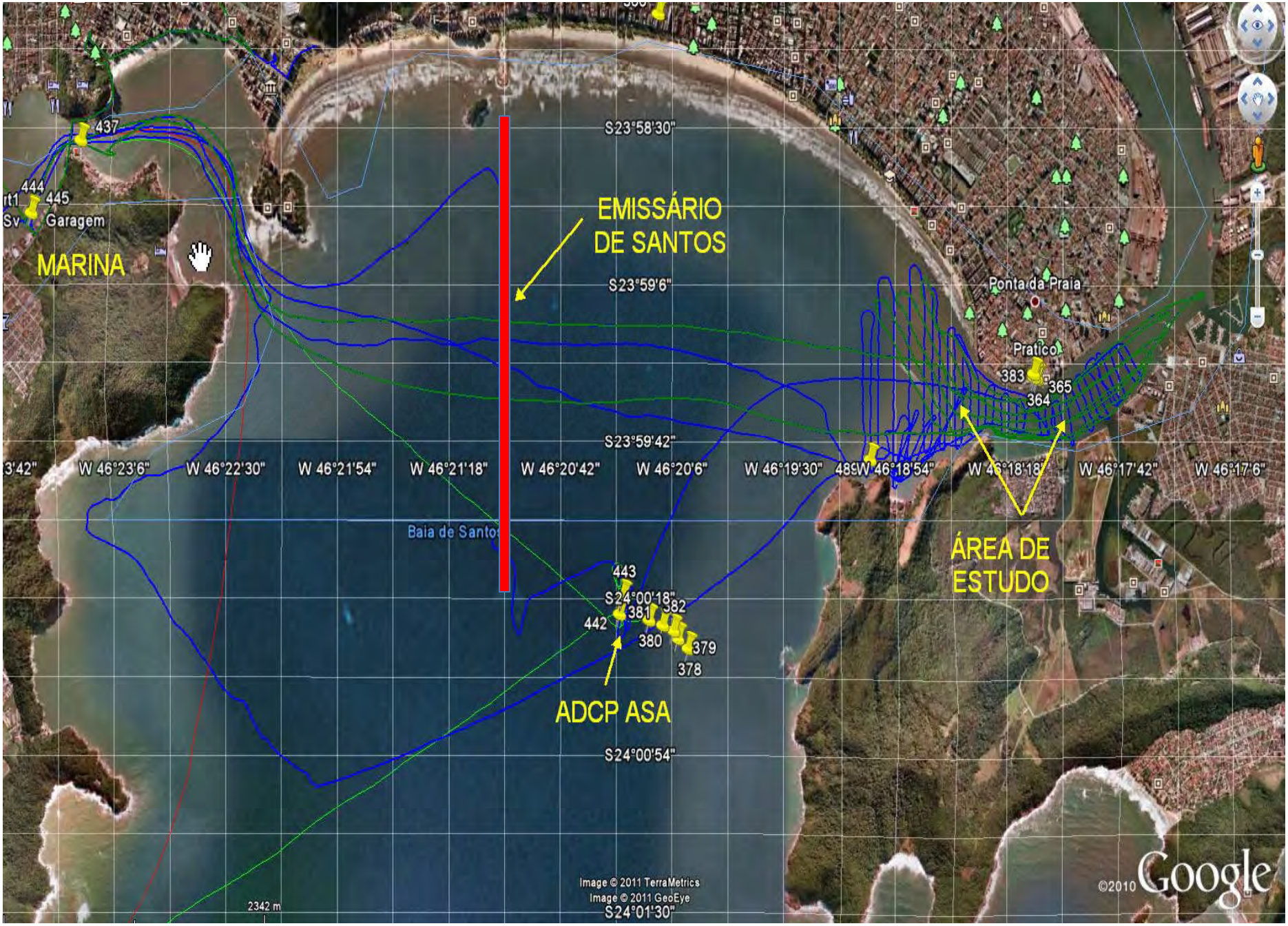
Dutos fora da posição original de projeto. Cortesia de Garry Kozak

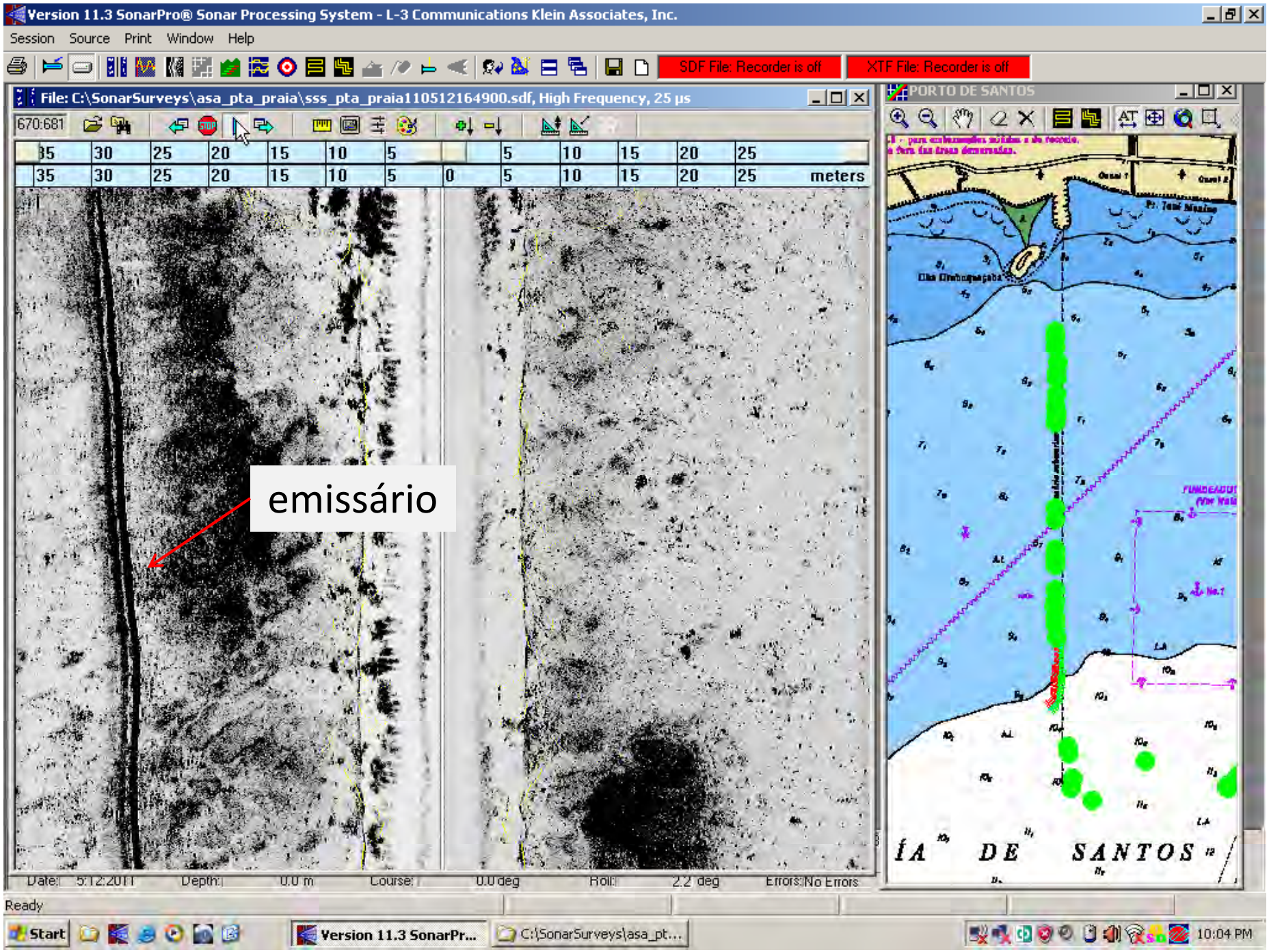
Exemplo mostrando **sombras** sob o duto resultante de processo de erosão (remoção) de sedimentos que suportavam o duto no projeto original

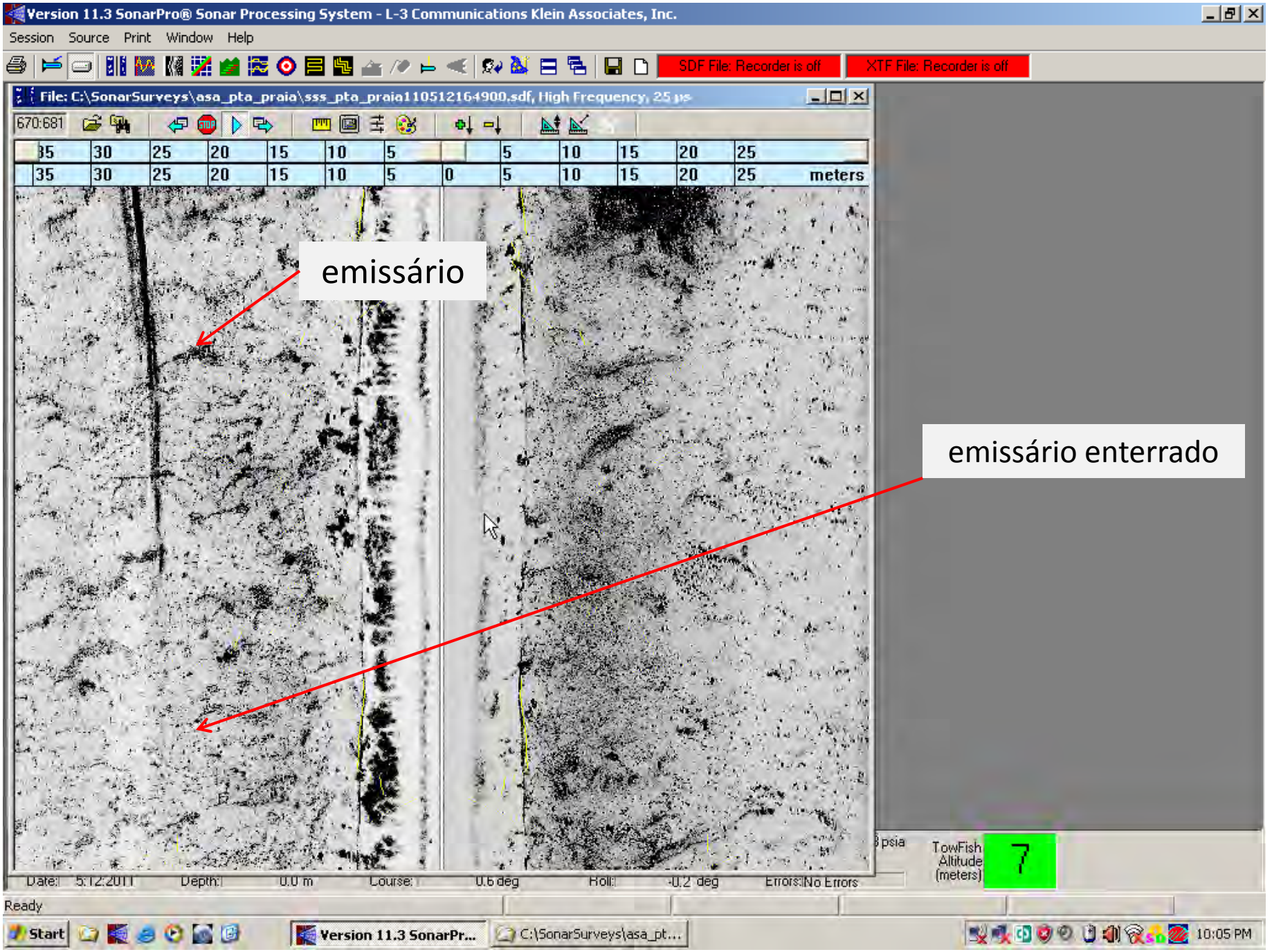


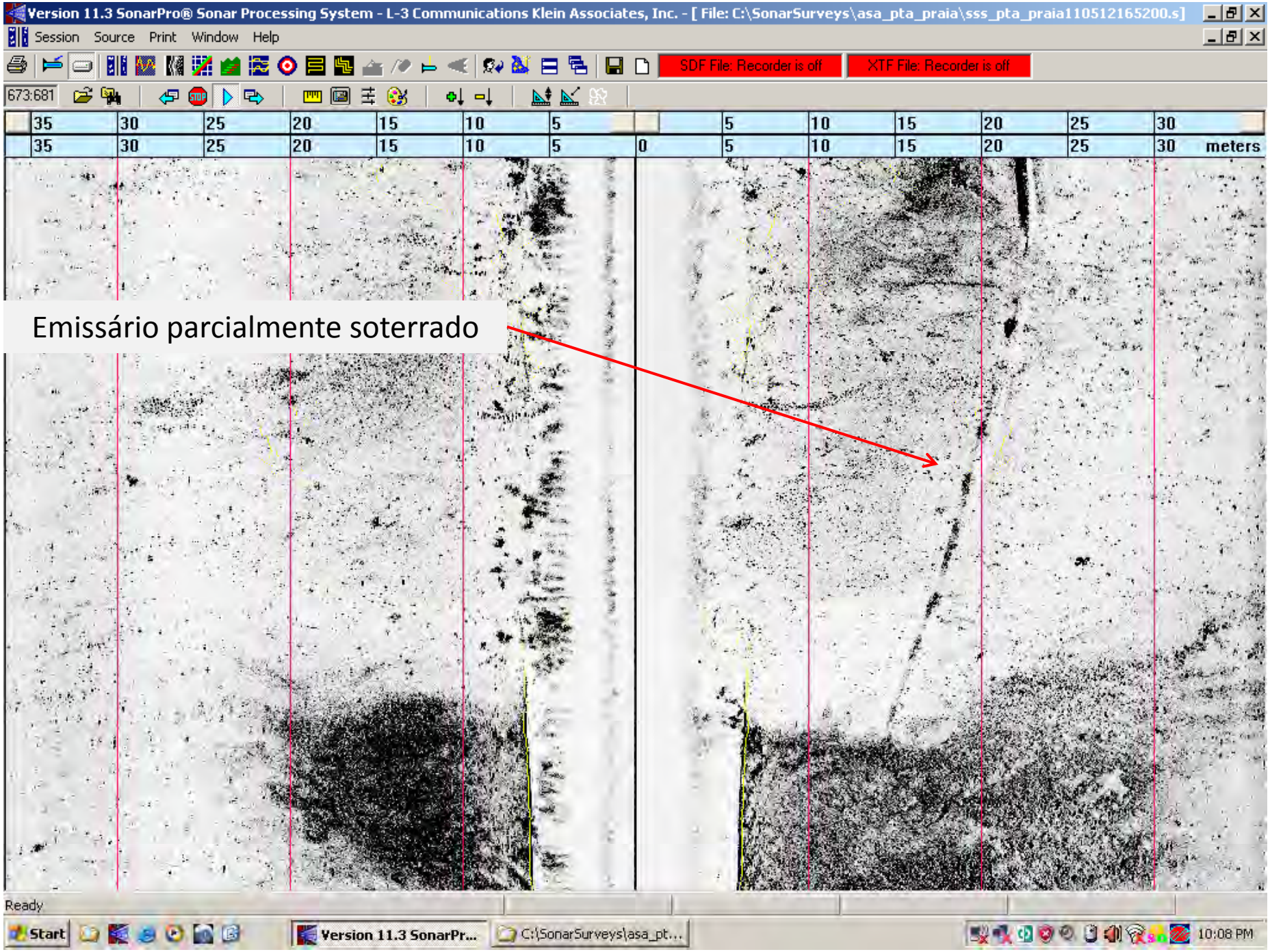
SANTOS, SP

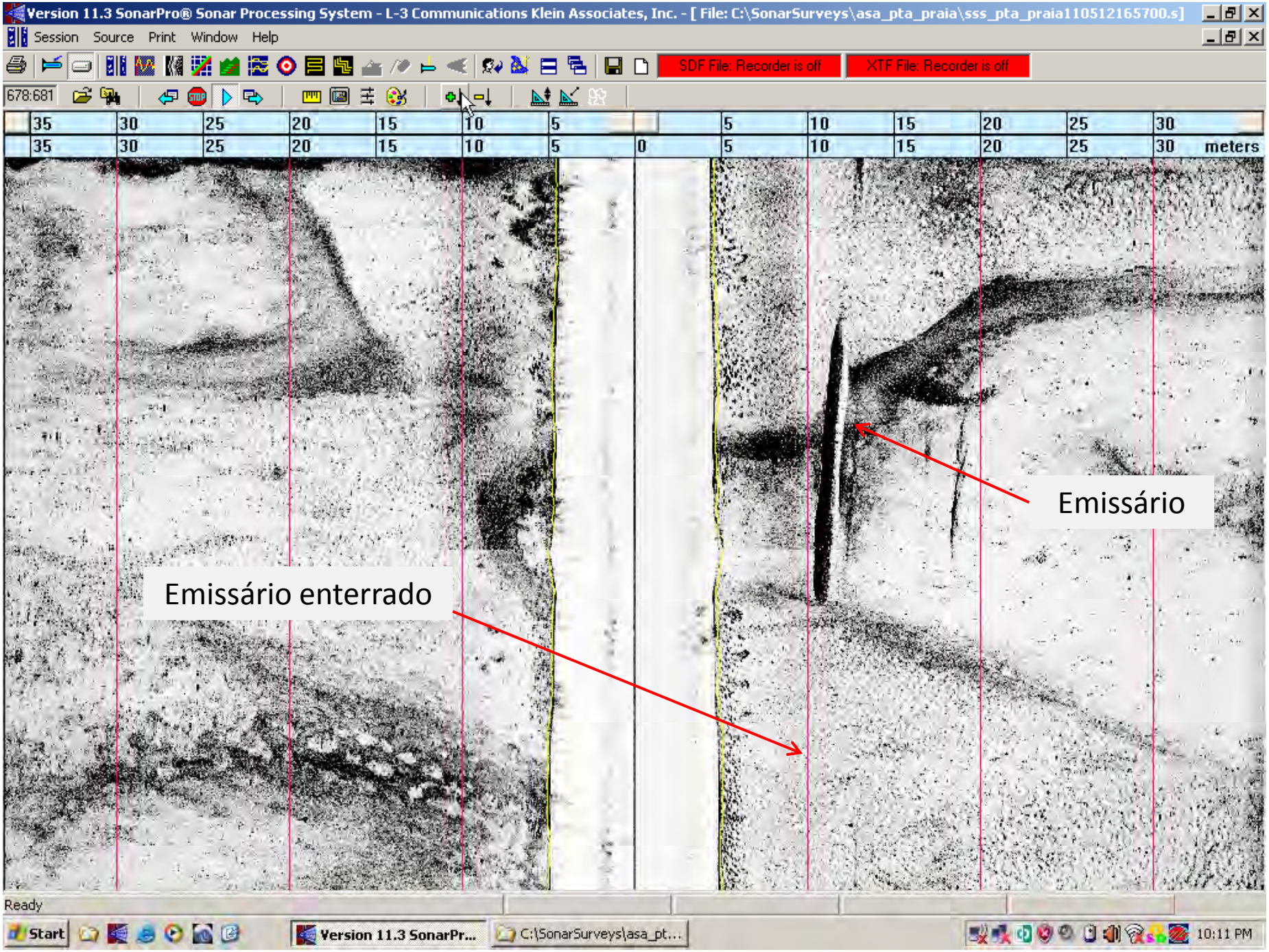


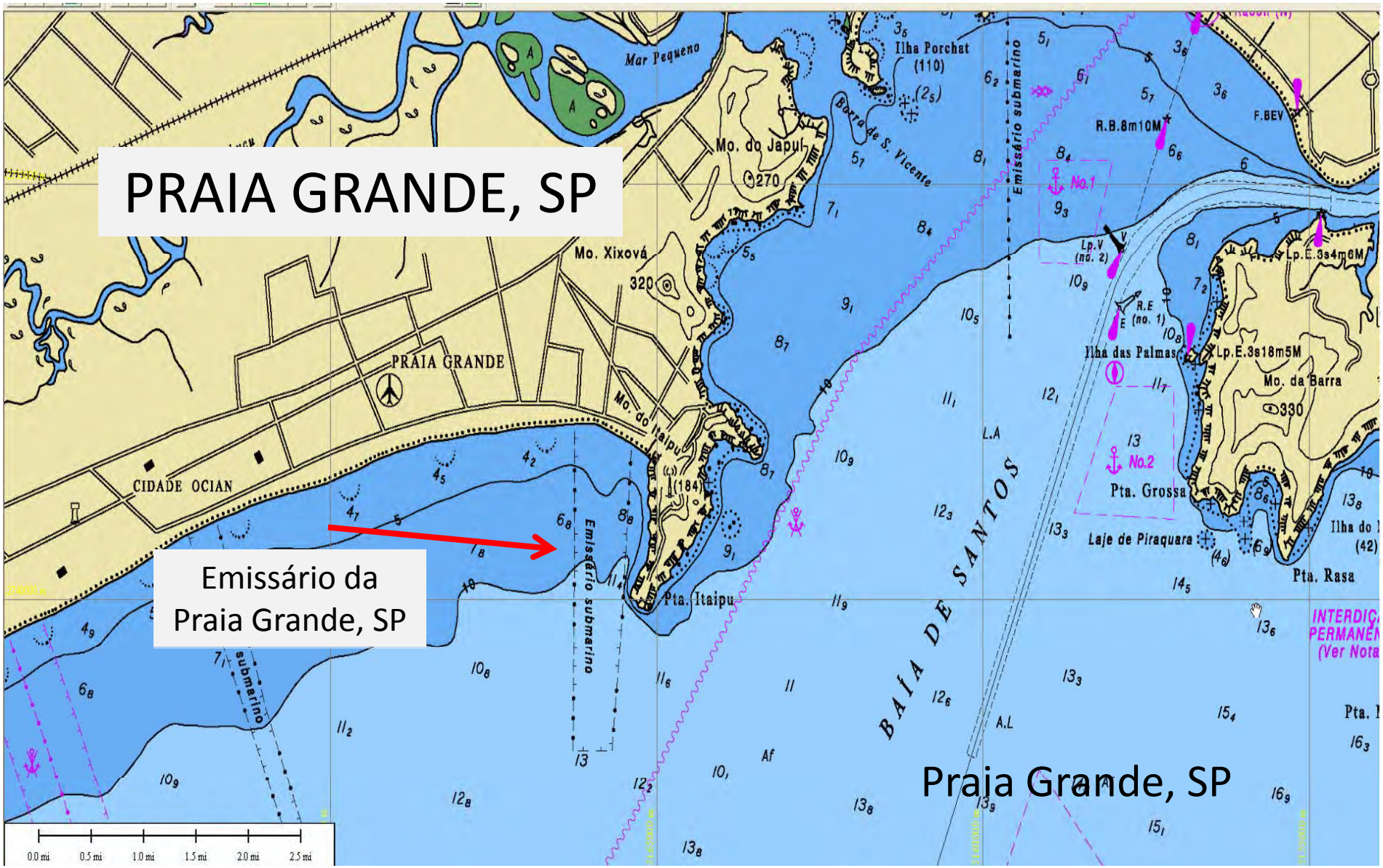

437
444
445
Garagem
MARINA
EMISSÁRIO
DE SANTOS
S23°58'30"
S23°59'6"
S23°59'42"
Ponta da Praia
Pratico
383
365
364
W 46°23'6"
W 46°22'30"
W 46°21'54"
W 46°21'18"
W 46°20'42"
W 46°20'6"
W 46°19'30"
W 46°18'54"
W 46°17'42"
W 46°17'6"
Baia de Santo
ÁREA DE
ESTUDO
443
S24°00'18"
382
381
442
380
379
378
ADCP ASA
S24°00'54"
Image © 2011 TerraMetrics
Image © 2011 GeoEye
S24°01'30"
2342 m
©2010 Google


Version 11.3 SonarPro® Sonar Processing System - L-3 Communications Klein Associates, Inc.
Session Source Print Window Help
SDF File: Recorder is off
XTF File: Recorder is off
File: C:\SonarSurveys\asa_pta_praia\sss_pta_praia110512164900.sdf, High Frequency, 25 µs
670:681
35 30 25 20 15 10 5 0 5 10 15 20 25
35 30 25 20 15 10 5 0 5 10 15 20 25 meters
emissário
Date: 5:12:2011 Depth: 0.0 m Course: 0.0 deg Roll: 2.2 deg Errors: No Errors
PORTO DE SANTOS
ÍA DE SANTOS
Ready
Start
Version 11.3 SonarPr...
C:\SonarSurveys\asa_pt...
10:04 PM


Version 11.3 SonarPro® Sonar Processing System - L-3 Communications Klein Associates, Inc.
Session Source Print Window Help
SDF File: Recorder is off
XTF File: Recorder is off
File: C:\SonarSurveys\asa_pta_praia\sss_pta_praia110512164900.sdf, High Frequency, 25 µs
670:681
35 30 25 20 15 10 5 0 5 10 15 20 25 meters
emissário
emissário enterrado
TowFish Altitude (meters)
7
Date: 5:12:2011 Depth: 0.0 m Course: 0.6 deg Roll: -0.2 deg Errors:No Errors
Ready
Start
Version 11.3 SonarPr...
C:\SonarSurveys\asa_pt...
10:05 PM

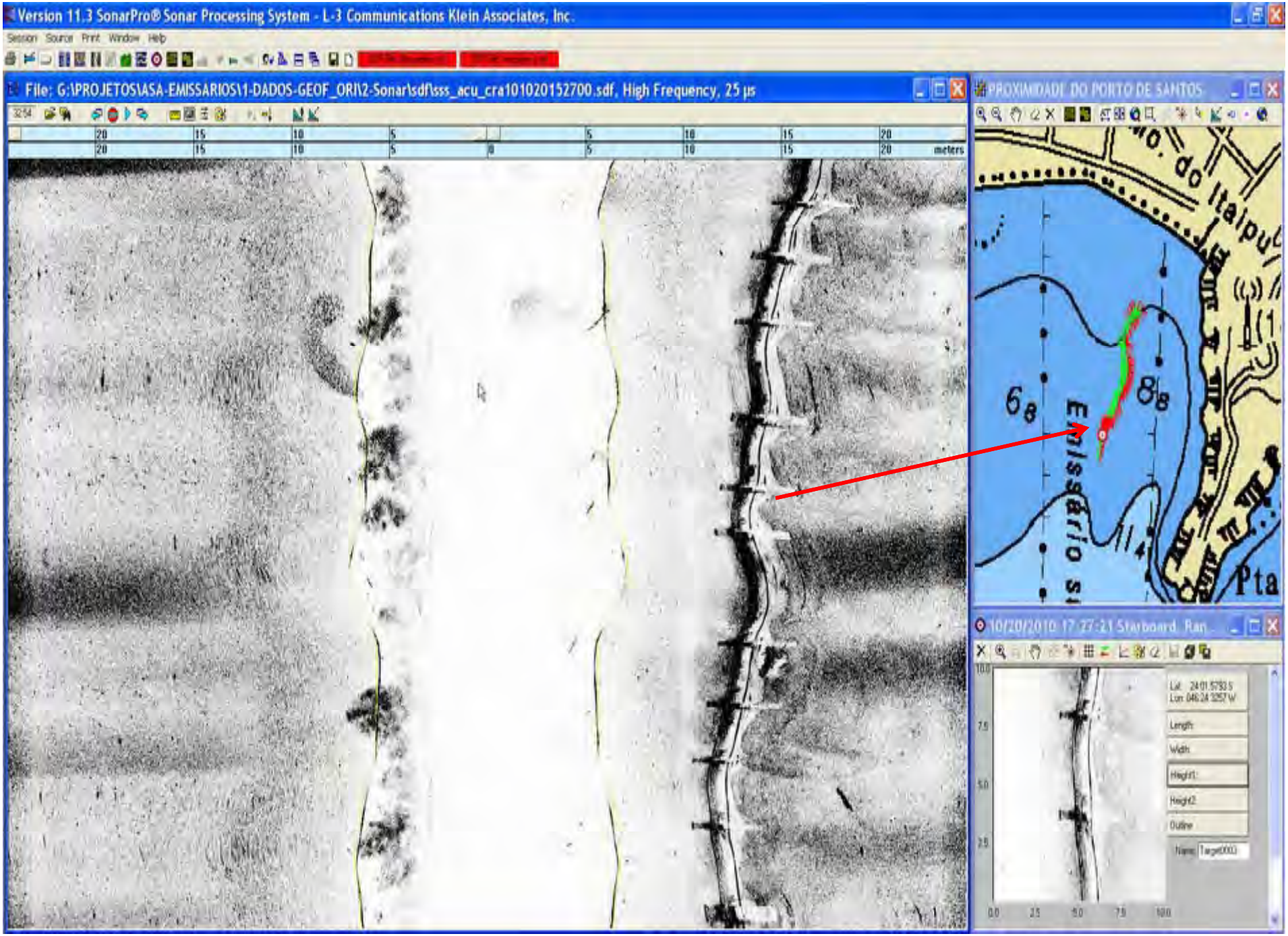

Version 11.3 SonarPro® Sonar Processing System - L-3 Communications Klein Associates, Inc. - [File: C:\SonarSurveys\asa_pta_praia\sss_pta_praia110512165200.s]
Session Source Print Window Help
SDF File: Recorder is off
XTF File: Recorder is off
673:681
35 30 25 20 15 10 5
0 5 10 15 20 25 30 meters
Emissário parcialmente soterrado
Ready
Start
Version 11.3 SonarPr...
C:\SonarSurveys\asa_pt...
10:08 PM

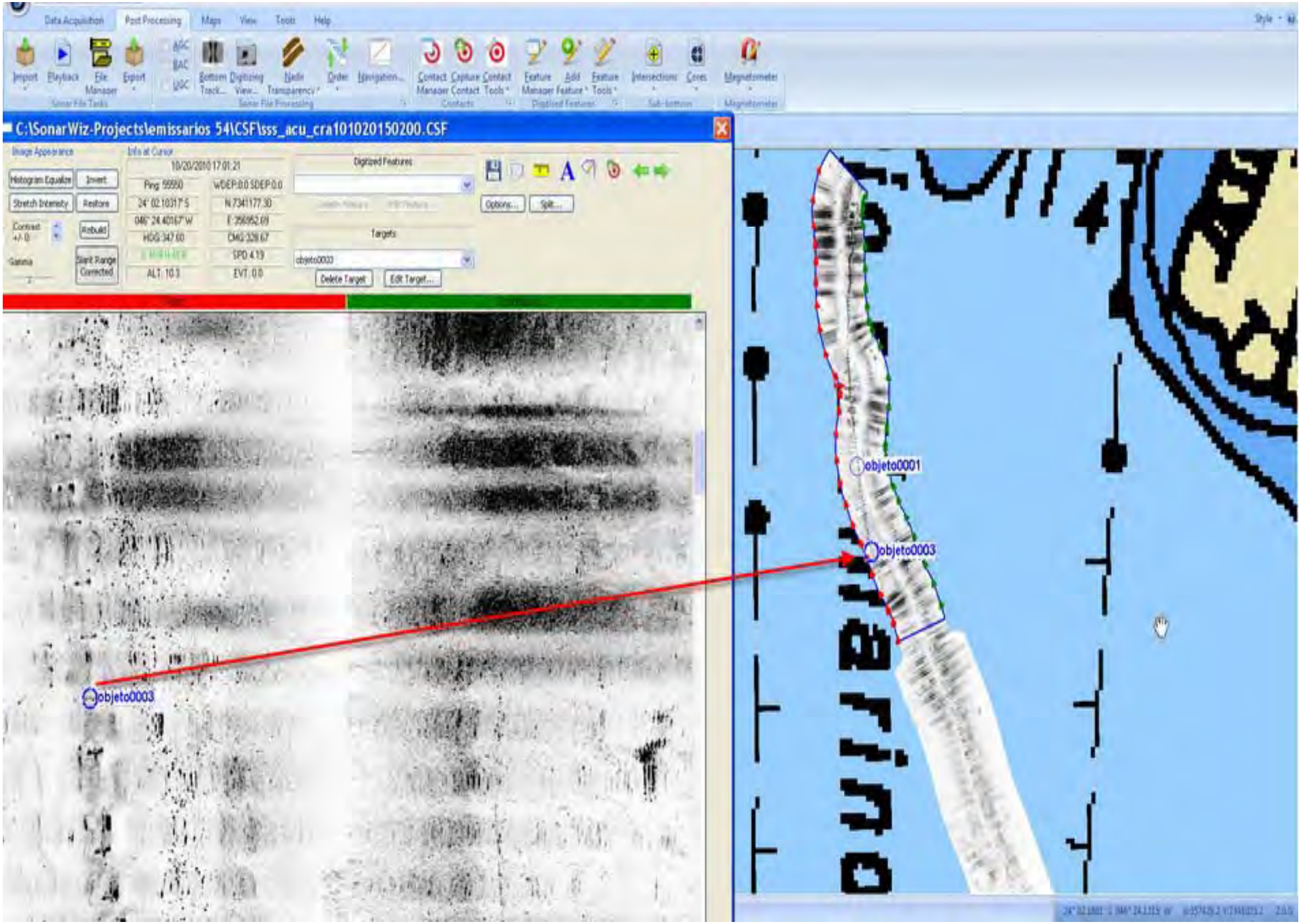

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Session Source Print Window Help
SDF File: Recorder is off
XTF File: Recorder is off
678:681
35 30 25 20 15 10 5 0 5 10 15 20 25 30 meters
Emissário
Emissário enterrado
Ready
Start
Version 11.3 SonarPr...
C:\SonarSurveys\asa_pt...
10:11 PM



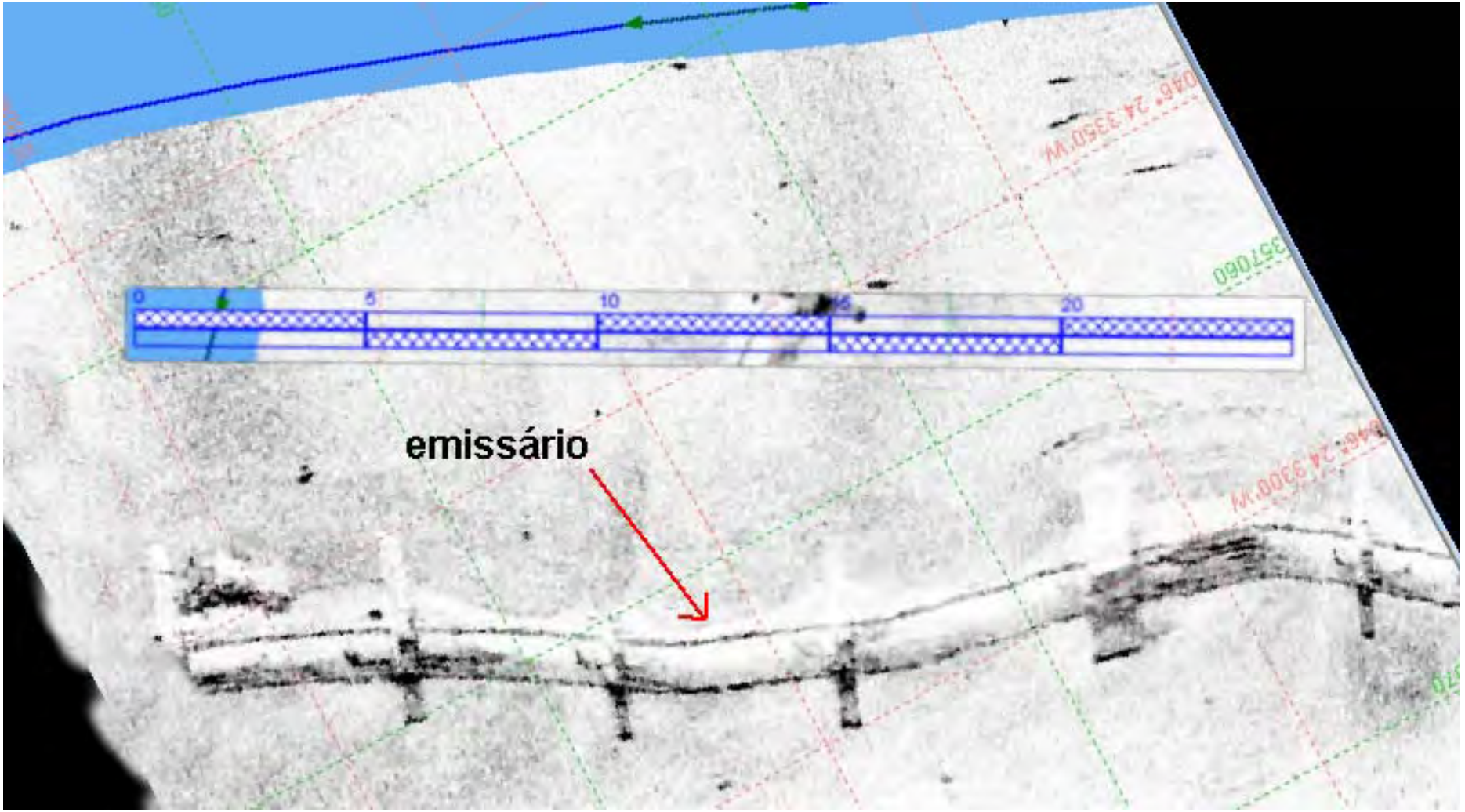
MAPEAMENTO DE EMISSÁRIOS SUBMARINOS

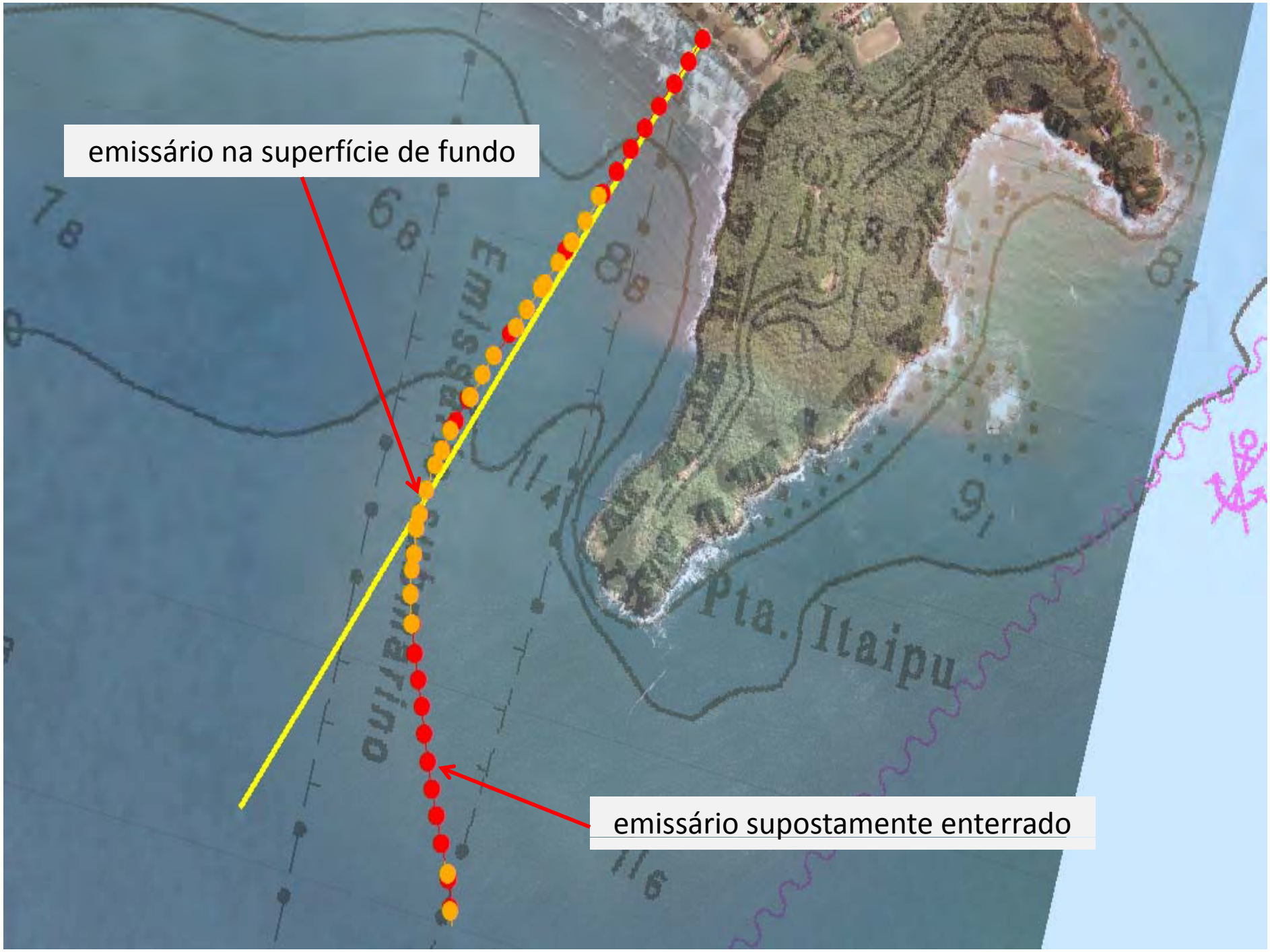

emissario
submarino na
praia grande


Version 11.3 SonarPro® Sonar Processing System - L-3 Communications Klein Associates, Inc.
Session Source Print Window Help
File: G:\PROJETOS\ASA-EMISSARIOS\1-DADOS-GEOF_ORI\2-Sonar\sdf\sss_acu_cra101020152700.sdf, High Frequency, 25 µs
meters
PROXIMIDADE DO PORTO DE SANTOS
Emissário
Pta
Length:
Width:
Height1:
Height2:
Outline:


Data Acquisition
Post Processing
Maps
View
Tools
Help
Import
Playback
File Manager
Export
Bottom Track...
Digitizing View...
Mode Transparency
Order
Navigation...
Contact Manager
Capture Contact
Contact Tools
Feature Manager
Add Feature
Feature Tools
Intersections
Cores
Magnetometer
C:\SonarWiz-Projects\emissarios 54\CSF\sss_acu_cra101020150200.CSF
Image Appearance
Histogram Equalize
Invert
Stretch Intensity
Restore
Contrast +/- 0
Rebuild
Gamma
Slant Range Corrected
Info at Cursor
10/20/2010 17:01:21
Ping: 99990
W:DEP:0.0 S:DEP:0.0
24° 02.10317' S
N:7341177.30
046° 24.40167' W
E:256952.69
HDG:347.60
CMG:326.67
SPD:4.19
ALT: 10.3
EVT: 0.0
Digitized Features
Options...
Split...
Targets
objeto0003
Delete Target
Edit Target...
objeto0003
objeto0001
objeto0003


rede de pesca
emissário
0
5
10
15
20


0
5
10
15
20
emissário


emissário na superfície de fundo
emissário supostamente enterrado
Pta. Itaipu
Emissário Submarino

CONCLUSÕES

O método geofísico **Sonar de Varredura Lateral** (*Side Scan Sonar*) constitui-se em uma ferramenta de investigação geológica/geotécnica fundamental em projetos de implantação de emissários submarinos.

Associado aos métodos clássicos de investigação de áreas submersas, possibilita:

1. o mapeamento geológico e geotécnico das áreas de interesse tornando possível a escolha da rota mais adequada e segura para o emissário

2. o **monitoramento** sistemático dos emissários subaquáticos, criando instrumentos gerenciais que minimizam os riscos inerentes a estes projetos, viabilizando ações preventivas e corretivas ao longo da vida útil destes empreendimentos



OBRIGADO PELA ATENÇÃO

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Moysés G. Tessler [2] e Eduardo A. Yassuda [3]

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1 ipt INSTITUTO DE PESQUISAS TECNOLÓGICAS

2 IO Instituto Oceanográfico

3 asa science. services. solutions.