IMAGING THE BURIED RIM OFCAMPI FLEGREI CALDERA (ITALY) FROM ARRAY ANALYSIS OF AIR-GUN SEA-SHOTHS

NISIIV.(1);SACCOROTTIG.(1);ABRILM.(2);ALMENDROSJ.(2);CARMONAE.(2);GALLUZZOD.(1)
(1)OSSERVATORIOVESUVIANO(I.N.G.V.),NAPLES,ITALY
(2)INSTITUTOANDALUZDEGEOFISICA,GRANADA,SPAIN

OSSERVATORIOVESUVIANO
ISTITUTONAZIONALEGEOFISICAEVULCANOLOGIA

INTRODUCTION&DATA-SET

OnSeptember2001anextendedactiveseismicsurvey(SERAPIS,SeismicReflection AcquisitionProjectforImagingStructure)wasconductedintheGulfofNaplesand PozzuoliwiththeaimofprovidingnewinsightsontheCampiFlegreicalderastructure andofinvestigatingitsfeedingsystem(fig.1).About3000air-gunsea-shotswereshot (fig.3a,b,c).Intheframeworkofthisproject,anarrayof28vertical-componentand4 three-componentsensorswasdeployedintheSolfataracrater(fig.2).Thearrayhadan apertureofabout200m,andreceivershadanaturalfrequencyof1Hz.Anexam pleof therecordedwaveformsisshowninfigure4.

Figure4

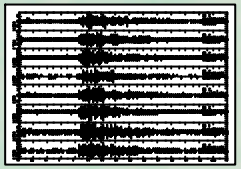
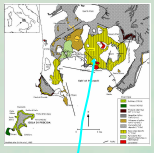


Figure1



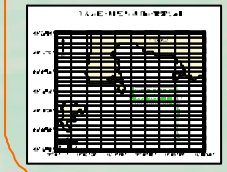


Figure3a

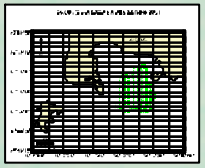


Figure3b

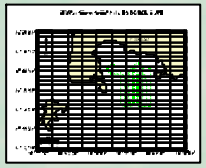


Figure3c

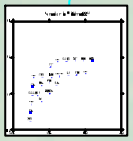


Figure2

ZLCCANALYSISALONGN-SSHOTSPROFILE

Thezerolagcross-correlationanalysis(ZLCC)(Frankeletal.,1991;DelPezzoetal.,1997)wasconductedonrecordings fromN-SshotsprofilesintheGulfofPozzuoli(fig.6).Thisanalysisestimatestheslownessofthecoherentwavefie ld crossingthearraybymaximizingthearray-averaged,time-domaincross-correlation.Figure9showsanexampleof ZLCCanalysis.Figure5comparestheobservedrayparameterPofP-waveonset(blusquare)withthosepredicted(red line)forthe1Dvelocitymodelshowninfigure10.Thetheoreticalrayparametercorrespondtowavesrefractedat0.5-kmand1-km-deepdiscontinuities.

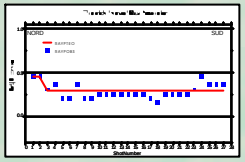


Figure5

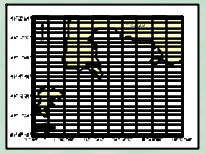


Figure6

ZLCCANALYSISALONGE-WSHOTSPROFILE

TheZLCCanalysiswasextendedtorecordingsfromanE-Wshotsprofileintheg ulfofPozzuoli (fig.7).Thisanalysisgivesanestimateofthebackazimuthofthecoherentwavefieldcrossingthe array. Figure8comparestheobservedbackazimuthofP-waveonset(greencircle)withthetheoretical backazimuths(redline).Theobservedbackazimuths, irregularlydistributedaroundthe theoreticalcurve,giveevidenceofanomalouswavepropagationinbetweenthesourcesandthe array.

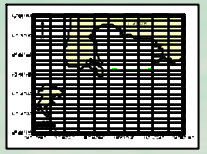


Figure7

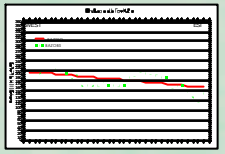


Figure8

ZLCCANALYSISALONG16N-SSHOTPROFILES

ZLCCanalysiswasthenappliedtoarrayrecordingsfrom16N-SshotprofilesintheGulfofPozzuoli(fig.11).Figure8depicts16 panelswiththeZLCCcoherencecurvesasafunctionoftime.EachpanelcorrespondstoaN-Sshotsprofile. Theresultsshowthepropagationofacorrelatedphase(redellipse)afterthearrivalofthePwavesforeachN-Sshots profile. Thiseffectisinterpretedintermsofscatteringphenomenaoccurringatamarkedcrustalheterogeneity. Thesesecondaryarrivalsareevidentonpanelsrelativetothecentralsectorsofeachprofile,suggestingthattheinferred heterogeneityislocatedinthemiddleoftheGulfofPozzuoli. Thisisinagreementwithresultstheobtainedfromvelocitytomography(Zolloetal,2003)andscatteringtomographystudies (Tramelliet al.,2004,thisassembly)recentelyperformedinthearea,thatshowstheprese nceofa buriedriminCampiFlegrei caldera,detectedasanhighvelocityandhighdensitybodyatabout0.8-2kmdepth.

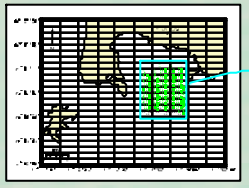


Figure11

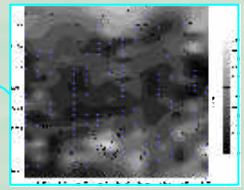


Figure12

OBSERVEDRAYPARAMETERMAP

Thecontour-mapinfigure12showstheobserved rayparametersofP-wavefirstarrivalforeach shotsprofile(violetcircle). Inthecenterofthemapthevaluesarecomparable withthetheoreticalrayparametersderivedfrom the1Dvelocitymodelshowninfigure10. Inthebottomofthemaptherearean omalous values probably associated to crustal heterogenitiesinthevolumebelowthesources.

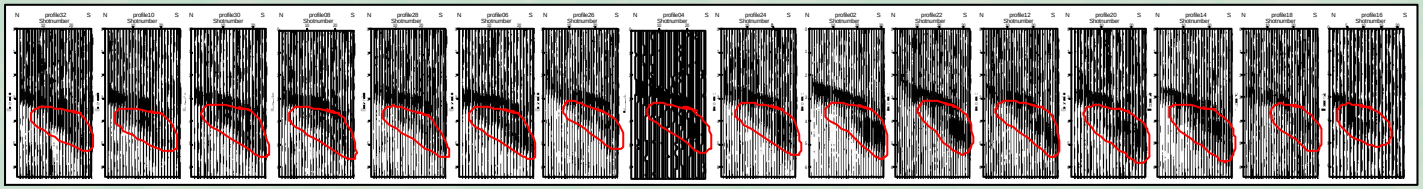


Figure13

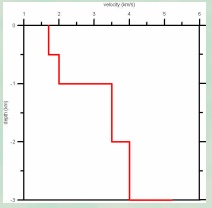


Figure10

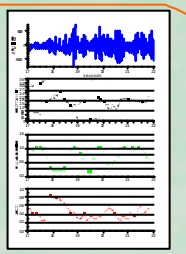


Figure9

CONCLUSIONS

. Theresultsoftheanalysiswith ZLCCtechniqueonrecordingsacquiredwithaseismic arrayintheSolfataracrater,suggesttherepresenceinGulfofPozzuoliofahighly heterogeneusshallowcrust.Theseresultsareconsistentwiththeresultsfromindependent studiesofscatteringandvelocitytomography.Nextstepswillinclude: .1.Calculationofsynthticswaveformsaimedatelucidatingthesignificanceofthe secondary,highlycoherentarrivals; .2.Double-beamanalysisofconjugatesource-andreceiver-arraysconfigurations,aimedat improvingtheresolutionintheestimate aboutlocationandsizeoftheinferredanomalies. .3.Detailedpoalrisationandfrequency-slownessanalysesofthelateportionofthearray recordings,withthespecificgoalofinvestigatingtheoccurrenceofpossiblelatephases associatedtoreflections/conversionsatdeepdiscontinuities.