

**APRUEBA CONVENIO DE FINANCIAMIENTO
QUE INDICA.**

DECRETO EXENTO N° 00.741/2016.

Arica, julio 22 de 2016.

Con esta fecha la Rectoría de la Universidad de Tarapacá,
ha expedido el siguiente decreto:

VISTO:

Lo dispuesto en el DFL N°150, de 11 de diciembre de 1981, del Ministerio de Educación; Resolución N° 1600, de noviembre 06 de 2008, de la Contraloría General de la República; Resoluciones Exentas CONTRAL. N°s. 0.01 y 0.02/2002, ambas de fecha enero 14 de 2002; Carta AB. VAF. N°183/2016, de junio 28 de 2016, Resolución Exento N° 3421/2016, de abril 20 de 2016, de la Comisión Nacional de Investigación Científica y Tecnológica, Traslado REC. N° 314/16, de junio 16 de 2016, Carta D.G.I. N° 383.2016, de julio 04 de 2016, Traslado REC. N° 410/16, de julio 06 de 2016, los antecedentes adjuntos, y las facultades que me confiere el Decreto N° 268, de 17 de junio de 2014, del Ministerio de Educación.

CONSIDERANDO:

Que, por Resolución Exento N° 3421/2016, de la Comisión Nacional de Investigación Científica y Tecnológica, de fecha 20 de abril de 2016, se adjudica a la Universidad de Tarapacá el "Concurso Proyectos Internacionales de Investigación, Programa de Cooperación Internacional, Convocatoria 2015", para la ejecución y desarrollo del proyecto titulado: Reconstructing landscapes, climate and ecology during the late Pleistocene in the Atacama desert of northern Chile, Código PII20150081.

Que, con fecha 25 de abril de 2016, se suscribe un Convenio de Financiamiento entre la Comisión Nacional de Investigación Científica y Tecnológica – CONICYT; la Universidad de Tarapacá; el Investigador Responsable del Proyecto, Sr. José Mariano Capriles Flores; y el Investigador Alterno del Proyecto, Sr. Calogero Mauricio Santoro Vargas; para la ejecución del proyecto señalado en el párrafo precedente.

Lo solicitado por el Sr. Horacio Díaz Rojas, Director General de Investigación, en Carta D.G.I. N° 383.2016, de julio 04 de 2016.

DECRETO:

1.- Regularizase el siguiente acto administrativo.

2.- Apruébase el **CONVENIO DE FINANCIAMIENTO CONCURSO DE APOYO AL DESARROLLO DE PROYECTOS INTERNACIONALES DE INVESTIGACIÓN CONVOCATORIA 2015**, suscrito entre la Comisión Nacional de Investigación Científica y Tecnológica – CONICYT; la Universidad de Tarapacá; el Investigador Responsable del Proyecto, Sr. José Mariano Capriles Flores; y el Investigador Alterno del Proyecto, Sr. Calogero Mauricio Santoro Vargas; de fecha 25 de abril de 2016, contenido en documento adjunto, compuesto de once (11) hojas y un anexo compuesto de veintiocho (28) hojas, rubricadas por el Secretario de la Universidad de Tarapacá.

Regístrese, comuníquese y archívese.


LUIS TAPIA ITURRIETA
Secretario de la Universidad


ARTURO FLORES FRANULIC
Rector



Comisión Nacional de Investigación
Científica y Tecnológica - CONICYT

**CONVENIO DE FINANCIAMIENTO
CONCURSO DE APOYO AL DESARROLLO DE PROYECTOS
INTERNACIONALES DE INVESTIGACIÓN
CONVOCATORIA 2015**

En Santiago de Chile, a 25 de abril de 2016, entre la Comisión Nacional de Investigación Científica y Tecnológica, en adelante CONICYT, representada por su Director Ejecutivo, don CHRISTIAN NICOLAI ORELLANA, Rut N° [REDACTED] [REDACTED] ambos domiciliados en calle Moneda N° 1375, comuna de Santiago, por una parte y por otra, el/la Investigador/a Responsable, la Institución Nacional Patrocinante Principal y el Investigador Alterno, individualizados y representados en la forma señalada al final del presente instrumento; todos en conjunto "las Partes"; acuerdan lo siguiente:

PRIMERA: ANTECEDENTES

CONICYT declara que en el "Concurso Proyectos Internacionales de Investigación, Convocatoria 2015", fue evaluado y adjudicado, según consta en la Resolución Exenta N°3421 del 20 de abril de 2016 de CONICYT, el siguiente proyecto:

Código	Título	Institución Nacional Patrocinante Principal	Investigador/a Responsable
PII20150081	Reconstructing landscapes, climate and ecology during the late Pleistocene in the Atacama desert of northern Chile	Universidad de Tarapacá	José Capriles Flores

Las Partes declaran que el proyecto es un todo y asumen las obligaciones que establece el presente convenio por el período total de su ejecución.

CONICYT encomienda a la Institución Nacional Patrocinante Principal y al/a la Investigador/a Responsable la ejecución y desarrollo del proyecto individualizado, conforme a los términos que se establecen en el presente convenio y su Anexo.

Por su parte, la Institución Nacional Patrocinante Principal y el/la Investigador/a Responsable declaran que se obligan a ejecutar y desarrollar el proyecto ya referido, de acuerdo con las estipulaciones del presente convenio, con estricta sujeción a los contenidos expresados en el proyecto adjudicado, a



las reglas establecidas en las bases de concurso, en la adjudicación y en la carta certificada que informa de la misma.

SEGUNDA: DURACIÓN

El proyecto tendrá una duración de **34 meses**, y su ejecución será considerada a partir de la fecha de la total tramitación del acto administrativo que apruebe el presente convenio.

El primer año de ejecución tendrá una duración de **10 meses**. El segundo y tercer año tendrán una duración de **12 meses cada uno**.

TERCERA: APORTES

- 3.1. CONICYT entregará a la Institución Nacional Patrocinante Principal un monto total de **\$105.000.000 (ciento cinco millones de pesos chilenos)**, durante todo el período de ejecución del proyecto. El monto máximo que puede destinarse a cada ítem solicitado se encuentra desglosado en el Anexo N°1 del presente convenio.
- 3.2. Los fondos transferidos se regirán, en lo que corresponda, por la Resolución N° 30/2015 de la Contraloría General de la República.
- 3.3. El aporte de la Institución Nacional Patrocinante Principal, asciende a la suma total de \$53.967.000 (cincuenta y tres millones novecientos sesenta y siete mil pesos), cuyo desglose es el siguiente:

Institución Nacional Patrocinante Principal	Item	Aporte	
		Pecunario (\$ Pesos)	No Pecunario (\$ Pesos)
Universidad de Tarapacá	Equipos	0	18.500.000
Universidad de Tarapacá	Honorarios	0	30.967.000
Universidad de Tarapacá	Gastos de Operación	4.500.000	0



CUARTA: GARANTÍA DE FIEL CUMPLIMIENTO

- 4.1. La transferencia de los recursos aportados por CONICYT se efectuará contra la entrega de un documento de garantía de fiel cumplimiento en favor de CONICYT, con el propósito de garantizar el fiel uso de los recursos y de los compromisos contraídos, consistente en vale vista endosable, boleta de garantía bancaria pagadera a la vista o póliza de seguro de ejecución inmediata, por el monto total de los recursos transferidos para el primer año del proyecto en virtud del presente convenio o por el monto total del proyecto, y con una vigencia no inferior a 90 días después de terminado el correspondiente periodo. En caso que el presente convenio sea prorrogado, se deberá renovar la garantía de fiel cumplimiento, de manera que tenga una vigencia no inferior a 90 días adicionales al período de extensión. Si corresponde, se deberá renovar la garantía al final del primer y segundo año, en la medida que el proyecto sea renovado, de manera que tenga vigencia superior a 90 días adicionales al periodo de extensión.
- 4.2. Esta caución será exigible a toda institución que no se encuentre exenta de acuerdo a Dictamen N°15978/2010 de la Contraloría General de la República.
- 4.3. El costo financiero que implique obtener la caución (vale vista endosable, boletas bancarias ó pólizas de seguro), y eventuales renovación/modificación de las garantías, si corresponde, podrá ser cargado al ítem correspondiente del proyecto.
- 4.4. CONICYT podrá solicitar que se aumente el plazo cubierto con la garantía, para asegurar la eficiencia del proceso de seguimiento y control del proyecto.

QUINTA: TRANSFERENCIA DE RECURSOS POR PARTE DE CONICYT

- 5.1. La transferencia del monto correspondiente aportado por CONICYT se realizará de forma anual, al inicio de cada año de ejecución del proyecto, según acta de adjudicación y presupuesto del proyecto (Anexo N°1).
- 5.2. No obstante lo anterior, el aporte de CONICYT queda sujeto a las siguientes condiciones:
- i. Total tramitación del acto administrativo que aprueba el presente convenio de financiamiento.
 - ii. Disponibilidad presupuestaria de CONICYT.
 - iii. Entrega y renovación, según corresponda, de la garantía de fiel cumplimiento.



- iv. Destinación de los recursos que recibe el/la Institución Nacional Patrocinante Principal a la ejecución fiel del Proyecto, en la forma que éste describe y de acuerdo a las bases concursales, la carta certificada que informa la adjudicación del proyecto y el presente convenio.
 - v. Para el pago de la segunda y tercera cuota, el/la Investigador Responsable deberá entregar para su evaluación el informe técnico de avance y la correspondiente rendición de cuentas según indicado en la Cláusula Novena del presente convenio.
- 5.3. La Institución Nacional Patrocinante Principal tendrá una cuenta corriente bancaria exclusiva o una cuenta presupuestaria, según corresponda para administrar los recursos financieros del proyecto.
- 5.4. Se prohíbe la inversión de los fondos transferidos por CONICYT para la ejecución del presente proyecto, en cualquier tipo de instrumento, financiero de renta fija o variable de corto o largo plazo (fondos mutuos, acciones, depósitos a plazos, bonos, etc.) con y sin riesgo financiero. Asimismo, se encuentra especialmente excluida la imputación de los fondos transferidos al pago de indemnizaciones de cualquier especie y, en especial, las derivadas de las relaciones laborales.

SEXTA: MODIFICACIONES AL PROYECTO

Durante la ejecución del proyecto, el/la Investigador/a Responsable podrá solicitar por escrito y de manera fundada y oportunamente a CONICYT, a través de su Programa de Cooperación Internacional, modificaciones tales como: cambios en las actividades y/o integrantes de los equipos, la redistribución de los beneficios otorgados, plazos de ejecución del proyecto, rendición de cuentas, entre otros. ***Dichas modificaciones deberán solicitarse con un mínimo de 60 días corridos de anticipación a la fecha de término de ejecución de cada año del proyecto,*** y no podrán hacerse efectivas sin autorización de CONICYT, previo informe del Programa de Cooperación Internacional.

SÉPTIMA: OBLIGACIONES DEL/DE LA INVESTIGADOR RESPONSABLE

- 7.1. Las Partes declaran que el/la Investigador/a Responsable del proyecto será el/la responsable de la coordinación científica, financiera y técnica del proyecto, de la puesta en marcha y de la estructuración de la colaboración entre los participantes del proyecto. Asimismo, el/la Investigador/a Responsable será responsable de la producción generada en el marco del proyecto, de las reuniones de avance y comunicación de resultados.



- 7.2. El/la Investigador/a Responsable se compromete a ejecutar el proyecto de acuerdo a la descripción que se realiza en el mismo en el respectivo documento de postulación, a las reglas establecidas en las bases de concurso, en la adjudicación, en el presente convenio y en las señaladas en la carta certificada que informa de la adjudicación del proyecto.
- 7.3. En caso de ausencia del/de la Investigador Responsable titular, el/la Investigador Alternativo/a, compareciente a este acto de acuerdo a lo señalado al final del presente instrumento, perteneciente a la misma Institución Nacional Patrocinante Principal, asumirá las responsabilidades y obligaciones correspondientes al/a la Investigador/a Responsable.
- 7.4. El/la Investigador/a Responsable, al suscribir el presente convenio manifiesta tener pleno conocimiento de su contenido, aceptando que se obliga a:
- 7.4.1. Actuar como contraparte técnica del proyecto ante CONICYT;
 - 7.4.2. Asumir la responsabilidad de ejecutar y dirigir la investigación hasta el cabal cumplimiento de los objetivos propuestos para cada una de las etapas del proyecto;
 - 7.4.3. Utilizar los recursos asignados exclusivamente para la ejecución del proyecto, sin sobrepasar la asignación anual aprobada, de acuerdo a las instrucciones contenidas en el Instructivo Rendición de Cuentas;
 - 7.4.4. Incluir en las publicaciones, productos y actividades que se desarrollen en o con ocasión de eventos de difusión, una leyenda que dé cuenta del aporte efectuado por CONICYT, a través del presente instrumento denominado **"CONICYT + NERC + Programa/Instrumento + Folio (Cód. Proyecto)"**.
 - 7.4.5. Someter a consideración de CONICYT, a través de su Programa de Cooperación Internacional, cualquier cambio al proyecto según lo estipulado en la Cláusula Sexta.
 - 7.4.6. Informar a la/s Institución/es Patrocinante/s, los bienes de capital adquiridos con recursos asignados a este ítem, con el propósito que sean inventariados por ésta en cuanto se materialice la recepción de los bienes;
 - 7.4.7. Contratar los seguros correspondientes a fin de garantizar el adecuado funcionamiento de los bienes de capital durante todo el período de ejecución del proyecto, costo que podrá descontarse de los gastos operacionales del proyecto, según lo contemplado en el presupuesto aprobado para la ejecución del presente proyecto.
 - 7.4.8. Observar estricto y oportuno cumplimiento de las fechas de presentación de informes técnicos y financieros, de acuerdo a lo indicado en el presente convenio.
 - 7.4.9. Informar y mantener actualizada la dirección y teléfono de su domicilio institucional y particular, así como la dirección electrónica para efectos de facilitar su ubicación.



OCTAVA: ADMINISTRACIÓN DE FONDOS TRANSFERIDOS

- ## NOVENA: INFORMES TÉCNICOS DE AVANCES, INFORMES FINALES Y RENDICIONES DE CUENTAS

UNIVERSIDAD DE TARAPACA
ABOGADOS
VAF
ARICA



9.1. Informe Técnico de Avance

A los 10 y 22 meses de ejecución del Proyecto, el/la Investigador/a Responsable deberá entregar al Programa de Cooperación Internacional de CONICYT un Informe Técnico de Avance, donde dé cuenta del progreso del proyecto en todos sus aspectos, los indicadores y medios de verificación para los resultados, como parte de los requisitos para el monitoreo y evaluación de los avances del proyecto.

9.2. Rendición de Cuentas

Asimismo, deberá presentar al Programa de Cooperación Internacional (instituciones públicas) o a la Unidad de Control de Rendiciones de Cuenta (instituciones privadas) la Rendición de Cuentas de los recursos asignados para el periodo de ejecución que se informa, según el Instructivo Rendición de Cuentas.

Para efectos de rendición de cuentas, sólo se aceptarán gastos a nombre de la Institución Nacional Patrocinante Principal, con cargo al proyecto según corresponda, por cuanto son ellas quienes firman los convenios, reciben los fondos y si corresponde presenta las respectivas garantías.

Sin perjuicio de la presentación de las rendiciones de cuentas, en caso de auditorías, CONICYT podrá solicitar la documentación original o bien coordinar una visita a terreno para la revisión de ésta.

9.3. Informe Técnico y Rendición de Cuentas Final

A los 30 días máximo de finalizado el proyecto, el/la Investigador Responsable deberá entregar al Programa de Cooperación Internacional un Informe Técnico Final de los resultados obtenidos. Asimismo, deberá entregar a la Unidad de Control de Rendiciones (instituciones privadas) o al Programa de Cooperación Internacionales (instituciones públicas), la **rendición de cuentas** de la totalidad de los recursos transferidos del último año.

DÉCIMA: FINALIZACIÓN DEL PROYECTO

- 10.1. Se entenderán como terminadas las obligaciones de la Institución Nacional Patrocinante Principal y del/de la Investigador/a Responsable del proyecto en CONICYT, cuando hayan sido cumplidos a satisfacción de CONICYT sus objetivos y resultados comprometidos y sean aprobados los informes técnicos y las rendiciones de cuentas respectivas. Ocurrido esto se suscribirá el respectivo finiquito, el que será aprobado por medio del acto administrativo del Servicio.
- 10.2. En el evento que la Institución Nacional Patrocinante Principal y el/la Investigador/a Responsable no dé cumplimiento a cualquiera de las obligaciones que se deriven de las bases concursales así como del presente convenio, y el Instructivo de Redición de Cuentas, CONICYT podrá poner término anticipado a la propuesta, pudiendo además



solicitar la devolución total o parcial de los recursos transferidos, o bien hacer efectiva la caución presentada, sin perjuicio de reservarse el derecho a ejercer las demás acciones legales que correspondan.

DÉCIMAPRIMERA: FACULTADES DE CONICYT

- 11.1. Corresponderá a CONICYT, a través del Programa de Cooperación Internacional la supervisión, el seguimiento y control académico, técnico y financiero del Proyecto, mediante actividades que pueden incluir visitas a terreno, exposición frente a un panel de expertos, exposición frente al comité de evaluación y seguimiento, o a través de una evaluación hecha por expertos, pudiendo poner término anticipado al proyecto, como se establece en el numeral 10.2. Asimismo, deberá supervisar, que los recursos transferidos a la Institución Patrocinante Principal y/o asociada (si aplica) sean utilizados en el proyecto para los fines solicitados y aprobados.
- 11.2. Para la cabal y oportuna ejecución de las diversas actividades contempladas en el proyecto, CONICYT a través de su Programa de Cooperación Internacional, está facultado para impartir instrucciones al/a la Investigador/a Responsable las cuales deberán ser cumplidas. Tales instrucciones deberán necesariamente referirse a materias de orden administrativo relativas a las obligaciones que asume el/la Investigador/a Responsable.
- 11.3. CONICYT también se reserva la facultad de fijar el sentido, alcance e interpretación del presente convenio y sus Anexos y autorizar o denegar solicitudes del/de la Investigador/a Responsable.

DÉCIMOSEGUNDA:

Comparecen a la suscripción del presente convenio, la Institución Nacional Patrocinante Principal, a través de su Representante Legal, además del/de la Investigador/a Responsable y el/la Investigador/a Alterno/a del Proyecto, cuya individualización se detalla y consta al final del presente convenio, declarando que han tomado pleno conocimiento y aceptan del contenido de este instrumento, de las Bases del Concurso de Proyectos Internacionales de Investigación, Convocatoria 2015; bases que, junto a los antecedentes fundantes de la presentación del respectivo proyecto individualizado en la cláusula primera de este instrumento y la Resolución Exenta N° 3421 de fecha 20 de Abril de 2016, que adjudicó el concurso, se entienden parte integrante del presente convenio.



DÉCIMOTERCERA:

El/la Representante Legal de la Institución Patrocinante Principal, el/la Investigador/a Responsable y el/la Investigador/a Alterno/a del Proyecto, declaran conocer y aceptar la obligación de CONICYT de hacer pública la información presente en este convenio, de acuerdo al artículo 7 letra f) y demás normas aplicables de la Ley N°20.285 sobre Acceso a Información Pública.

DÉCIMOCUARTA:

En la especie CONICYT no está contratando o subcontratando Obra o Servicio alguno, si no que otorga una subvención Estatal para el fomento de actividades científicas y/o tecnológicas a ser desarrolladas por terceros adjudicatarios de aquellas subvenciones, de acuerdo a la normativa legal y reglamentaria que regula las funciones del mencionado Servicio. Por ello, entre CONICYT y la o las Instituciones Patrocinantes Principales, el/la Investigador/a Responsable y el/la Investigador/a Alterno/a del o cualquier otro personal que ellos contraten o preste servicios para ellos, no existe vínculo alguno de subordinación y dependencia, en consecuencia entre ellos no existe contrato de trabajo, ni en lo principal ni en lo accesorio, ni se rigen en consecuencia por la normativa laboral vigente.

DÉCIMOQUINTA:

Para todos los efectos que deriven de este contrato, las partes fijan su domicilio en la ciudad de Santiago y acuerdan someterse a la competencia de sus Tribunales Ordinarios de Justicia.

DÉCIMOSEXTA:

El presente convenio se suscribe en cuatro originales de igual valor legal, quedando uno en poder de CONICYT, otro en poder de la Institución Nacional Patrocinante Principal, uno en poder del/de la Investigador/a Responsable y otro en poder del/de la Investigador/a Alterno/a del proyecto.


DÉCIMOSÉPTIMA:



Las Partes acuerdan que los Anexos N° 1 y 2 forma parte integrante del presente convenio:


INVESTIGADOR/A RESPONSABLE DEL PROYECTO	: José Mariano Capriles Flores
R.U.T.	: [REDACTED]
Domicilio Particular	[REDACTED]

FIRMA :



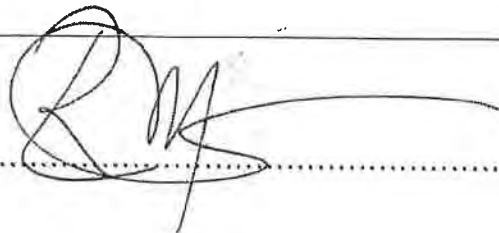
INVESTIGADOR/A ALTERNO/A DEL PROYECTO	: Calogero Mauricio Santoro Vargas
R.U.T.	[REDACTED]
Domicilio Particular	[REDACTED]

FIRMA :



INSTITUCIÓN NACIONAL PATROCINANTE PRINCIPAL	: Universidad de Tarapacá
REPRESENTANTE LEGAL	: RUDECINDO ARTURO FLORES FRANULIC
R.U.T.	[REDACTED]
CARGO	: RECTOR
DOMICILIO	: AVDA. GRAL. VELASQUEZ N° 1775
PERSONERÍA	: DECRETO 285 DE 17 DE JUNIO DE 2014 MINISTERIO DE EDUCACIÓN

FIRMA :





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COMISIÓN NACIONAL DE INVESTIGACIÓN CIENTÍFICA Y TECNOLÓGICA, CONICYT	
REPRESENTANTE LEGAL	CHRISTIAN NICOLAI ORELLANA
R.U.T.	
CARGO	DIRECTOR EJECUTIVO
DOMICILIO	Moneda N° 1375, Santiago
PERSONERÍA	Decreto Supremo N° 97/2015 del Ministerio de Educación

FIRMA :

ANEXO N°1 Presupuesto del proyecto

ITEM	FUNDING REQUESTED (Chilean pesos \$CLP)			TOTAL REQUESTED (\$CLP)
	Year 1	Year 2	Year 3	
INCENTIVES	18.350.000	18.350.000	18.350.000	55.050.000
INTERNSHIPS ABROAD	2.600.000	2.600.000	2.600.000	7.800.000
WORKING VISITS IN CHILE	4.100.000	4.100.000	4.100.000	12.300.000
WORKING VISITS ABROAD	3.050.000	3.050.000	3.050.000	9.150.000
OTHER ACTIVITIES RELATED TO THE RESEARCH PROJECT	5.900.000	5.900.000	5.900.000	17.700.000
NATIONAL AND INTERNATIONAL TRAVEL	1.000.000	1.000.000	1.000.000	3.000.000
TOTAL	35.000.000	35.000.000	35.000.000	105.000.000





Comisión Nacional de Investigación
Científica y Tecnológica - CONICYT

Only for applications with United States and Germany

CALL FOR PROPOSALS INNATIONAL RESEARCH PROJECTS - 2015 APPLICATION FORM

PROJECT STRUCTURE AND ORGANIZATION

RECONSTRUCTING LANDSCAPES, CLIMATE AND HUMAN ECOLOGY DURING THE LATE PLEISTOCENE IN THE ATACAMA DESERT OF NORTHERN CHILE

1. CONTEXT AND PROJECT RELEVANCE

(Maximum 2 pages)

Economic and social context

Describe the economic, social and legal framework in which the project is positioned by providing an analysis of the social, economic, industrial, environmental and /or industrial challenges that it will have to embrace. If possible, show statistical facts and values for your argument, for example, relevance and domain of the project within the economic demands (marketing analysis, tendencies analysis), analysis of the competition, cost reduction indicators, market perspectives (application fields, etc.), environmental gains indicators, social impact indicators, etc.

Developing sustainable ways of life in desert environments is a major social, political and economic concern both in Chile and worldwide. Understanding how prehistoric societies lived sustainably in desert ecosystems, and how they responded to climatic and environmental changes can provide a historical perspective for solving current issues of sustainability, such as renewable and non-renewable resources management. Moreover, human subsistence strategies in prehistory provide essential information for developing predictive models regarding the adaptive response of human societies as well as how these strategies affect ongoing climate change and natural resource availability (e.g. Lee & Daly, 2004; Palmer & Smith, 2014; Roscoe, 2014). Yet, few multidisciplinary archaeological studies have such objectives in mind.

The vast territory of northern Chile has been the home of rich mining resources (saltpeter, copper, lithium, rare earths) that have formed the foundation of the Chilean economy since the middle of the 19th century (Billinghurst, 2011; Contreras, 2011), but there has been little value placed on the Atacama Desert as a complex socio-natural ecosystem (Núñez et al., 2010). We believe that a long-term historical and cultural perspective of the Atacama Desert can help create a more humanized environmental paradigm, which is essential if we are to live sustainably and cope with the ongoing challenges that human-induced global climate change is creating. More specifically, by increasing our understanding of how the first inhabitants of the Atacama Desert were able to colonize and establish a long-term social tradition in this extreme region, this proposal aims to contribute towards answering questions such as When did the arid landscapes become populated by humans?, how did these first inhabitants develop different social strategies and cultural systems to successfully thrive in this region?, and can an integrated view of how people adapt to environmental and climate change help to enable societies to live more sustainably as well as adapt to ongoing human-induced global climate change?



We will investigate two regions of northern Chile: Arica y Parinacota and Tarapacá, both located in the Atacama Desert. The prehistoric inhabitants of these regions were part of a wider Andean cultural tradition, which developed over millennia, and involved adapting to and mitigating the effects of harsh environments and climatic change by complementing diverse resources, landscapes, and climatic settings. Today, these regions are unevenly populated with economic activities that are concentrated on mining and commerce that are for the most part unsustainable. Tarapacá is dedicated to mining and commerce, whereas Arica y Parinacota relies on higher education (the Universidad de Tarapacá is one of Arica's principal employer) and international trade. Both regions, however, face extreme water scarcity that is exacerbated by the fact that most of the population (>90%) is concentrated in the coastal urban areas where fresh water is limited, and by the high use of fresh water by the mining industry. These regions are therefore rapidly depleting fossil (un-renewable on economic timescales) water resources (Nester et al., 2007). Such large concentrations of people on the coast are the consequence of how the Spanish Conquistadors chose such emplacements as the safest and easiest places to inhabit, but they were not necessarily the places chosen by the native indigenous people. Consequently, older settlements and vast areas of the Atacama are currently unoccupied, and seemingly deserted. In summary, by focusing on sustainability in arid environments and adaptation strategies to climate and environmental change since humans first populated the Atacama Desert, we aim to provide a historical perspective to this highly socially relevant and candent topic. Our results are relevant not just for the communities that today live in the Atacama Desert and depend on the production of mining resources (40-50% of Chile's PGB come from this region), but for the planet as a whole. More than 30% of the Earth's surface is arid and this area will continue to increase under current climate change (IPCC, 2014).

Certainly, the problems of sustainability and adaptation strategies that people faced and managed 13,000 years ago occurred under a different scale, compared with the much greater number of humans that populate the planet today. This implies, among other issues, a much greater exploitation of all sorts of resources driven by human consumption. Conversely, the logic that we try to engage here stems from the ideas that the development of knowledge through science and other forms of thinking are key for the economic, industrial, and environmental challenges posed by the increasing social demand of human populations in the 21st century. Countries in Europe, Asia and America invest important quotas of their GDP in the development of knowledge, to better deal with dynamic environments and managerial decisions (Sturgis & Allum, 2004; Machlup, 2014; Winkelbach & Walter, 2015). A knowledgeable society is clearly better prepared to cope with the uncertainties and pressures that modern societies are facing, which more often than not results in arguments for enlarging economic and industrial processes.

Project Relevance

Describe the relevance of the project in relation to the scientific discipline in Chile and in the context of the collaboration.

In this proposal we have put together an international multidisciplinary research team to discover, evaluate, and characterize suitable environments for human habitation, particularly during the late Pleistocene (ca. 17,000-10,000 years ago) in the Atacama Desert of northern Chile. Our research project thus includes at least three different scientific disciplines: archaeology, paleoecology, and Quaternary geology. By building on our ongoing research, we will focus on understanding how humans that entered previously unexplored landscape in the Atacama Desert and created a social and cultural tradition characterized by integrate resources from different ecosystems of the Atacama. This may have included the establishment of social relations with other peoples within the western and eastern side of the Andes. To pursue this aim we will examine and study suitable environments for human habitation including the coast, the intermediate basin, and the Andean highlands. Current evidence indicates that the hyperarid core of the Atacama was occupied regularly since at least 13,000 years B.P., when increased availability of freshwater and plant and animal resources facilitated human occupation in what is today a barren and Mars-like landscape.

International multidisciplinary research teams, such as the one we propose here, are fundamental for comprehending the complexity of such processes. The Chilean research group is composed of archaeologists and paleoecologists, but lacks specialized on Quaternary geology, geoarchaeology and archaeometry, which is precisely what the US team will contribute. In recent years we have started a scientific collaboration with Dr. Jason Rech, the leader of the US team, through specific short visits. Similarly, the collaboration with Dr. Nicholas Tripcevich was initiated this year in the context of a CONICYT PIA Anillo project (SOC 1405), and will be heightened through this project.

This project is an opportunity, not only to enhance this collaboration to understand human subsistence strategies over millennia in an ever-changing climate and environment, but most importantly to will incorporate undergraduate and graduate students whom will have the opportunity to gain experience and training in geoarchaeology, Quaternary geology, paleoecology and cutting-edge archaeology and archaeometry. All of these are under-developed disciplines in Chile with less than a handful of active researchers. These specialists are rarely engaged with the other participant disciplines of this project, particularly in such a multifaceted research scenario like the Atacama, where complex juxtaposed depositional environments and surfaces are practically "fossilized" for thousands or millions of years. A better understanding of the geological processes that have affected the different desert ecosystems over time is now required.



generate new knowledge regarding how the desert and its resources changed over time, how these resources were managed in the past, and how they can be organized today within the context of evolving global change scenarios.

Our proposal will expand on our ongoing work in the Pampa del Tamarugal (PdT), a region with practically zero rainfall today and extremely slow rates of erosion. This in turn results in extraordinary preservation of cultural materials, which are readily available and visible on ancient surfaces. In contrast, the same does not occur in other regions where active surface processes present novel challenges for identifying early human occupation and local paleoecological conditions are still unknown. Current archaeological and paleoecological evidence suggests that the PdT, in the core of the Atacama started to be settled by the end of the Pleistocene (Latorre et al., 2013; Santoro et al., 2011). Cultural materials sourced from the coast and the Andes, however, were part of the resources that entered in the cultural and social life of these people. Yet, further studies are required to understand if early sites can be found in the coast and highlands of the Atacama, and in the Bolivian Altiplano. A better knowledge of the spatial distribution of these sites is essential for understanding how these societies lived sustainably in these settings, and will require better knowledge of the surface processes that affect the archaeological visibility and preservation of the sites. Archaeology alone is often insufficient to explore how such environments changed over time and how human societies adapted to these changes.

In sum, with the focus of this project to reconstruct landscapes in association with climate change and within a human ecology framework, we are laying the groundwork for the development in Chile of the interdisciplinary work involved in our proposal. Our collaboration with the US team constitutes a step forward in our attempt to understand the way of life for the societies that emerged during the late Pleistocene in the Atacama Desert of northern Chile and neighboring regions, and constitutes the roots for understanding the long-term human interaction with the extreme environments of the Atacama and surrounding areas.

2. SCIENTIFIC – TECHNICAL DESCRIPTION

State of the Art

(Maximum 3 pages)

Describe the context and scientific issues within which this project is embedded introducing an international and national state of the art of the subject knowledge. Include all necessary bibliographic references in appendix 7.1.

The early peopling of the New World continues to be one the most widely scrutinized and debated topics in the history of American archeology. South America was the last continent to be colonized by the human species. The broad distribution and great cultural diversity of archaeological sites along with a wide array of social contexts adapted to contrasting and changeable environments further compounds this issue. Due to a lack of well-dated sites within particular regions, however, this region remains one of the least studied in the world and we currently have many unanswered questions. For instance, Monte Verde and other evidence from Patagonia and the southern temperate forests show that these regions of South America were likely occupied by 14,500 years ago (Dillehay & Collins, 1988; Dillehay, 1989), yet, the cultural patterns seen in Monte Verde are not completely comparable to other late Pleistocene sites in South America, including some associated with fishtail points and megafauna such as Fell's cave, Tagua Tagua, and Santa Julia (Bird, 1988; Dillehay et al., 2008; Jackson et al., 2007; Jackson et al., 2012; Méndez, 2013; Montane, 1968; Núñez et al., 1994).

Even more surprising is how early most of the vastly different environments in South America were occupied after this initial exploratory wave. Not only was the southern cone inhabited but also the Patagonian Desert (Aschero, 2000; Borrero, 1999, 2015; Massone, 2004, 2010; Mena et al., 2003; Miotti et al., 2012; Nami, 2012), Amazonian tropical rainforest (Roosevelt et al., 1996), coastal Peru (Dillehay et al., 2007, 2012; Sandweiss et al., 1998; Keefer et al., 1998), the Peruvian puna (Rademaker et al., 2013, 2014; Aldenderfer, 1998, 1999, 2003, 2008; Capriles & Albarracin-Jordan, 2013) and even the extreme hyperarid Atacama Desert (Latorre et al., 2013; Santoro et al., 2011). Radiocarbon chronologies show occupation of these environments by c. 13,000 years ago. Differentiated local occupations show a high degree of association and knowledge of the environments they colonized (i.e. not just in an exploratory phase). Most of these sites (except for Huaca Prieta) postdate Monte Verde by approximately 1,500 years, so the potential for finding earlier exploratory camps is significant. Proposing to find even earlier sites, however, is always a risky prospect, but the search itself can reveal important aspects regarding the nature of association between these early occupants and their evolving landscape. This is especially true when the search spans different ecological zones and involves interdisciplinary research.

The study of the early peopling of the hyperarid Atacama Desert has been archaeologically neglected for decades. Deserts are fragile and challenging landscapes that often require extensive interdisciplinary research to characterize how they evolved over time. The Atacama Desert in particular is subject to extreme ecological conditions caused by millions of years of aridity that has affected plants, animals and human societies (Gayo et al., 2012; Guerrero et al., 2013; Núñez & Santoro, 2011; Jordan et al., 2014). Indeed, this fostered the prospect that such ecosystems were not attractive for the initial wave of humans entering South America. Until recently, different research disciplines that studied the past, both environmental and cultural, often



worked separately in the Atacama Desert. This is a reflection of how modern societies often see the world: as two separate spheres of influence, human society and nature (Descola, 2013; Ingold, 2000, 2011).

Only a handful of research projects have aimed at understanding the relationship between human societies and the environment of the Atacama (Lynch, 1990; Núñez et al., 2002; Santoro et al., 2011; Grosjean et al., 2005, 2007). Research over the last decade, however, has shown that the first occupations in the Atacama Desert occurred some 13,000 years ago in two geographic regions, the Pampa de Tamarugal (800-1200 m) and the central Atacama highlands (>2500 m) (Grosjean et al., 2005; Latorre et al., 2013; Núñez et al., 2002). Our research in Pampa del Tamarugal (PdT) shows variable occupations that range from residential bases to more ephemeral logistical camps, usually associated with permanent water sources (i.e. wetlands). Stone tools in these sites come from both local and distant sources, but exhibit attributes associated with curatorial strategies (high-quality raw materials and highly elaborated stone tools). This is further evidence that early foragers were highly skilled in elaborating lithic tool kits and hunting and gathering activities were planned out in advance. Furthermore, the extraordinary preservation afforded by the PdT reveals that a wide range of activities were carried out at these sites, including wood-working, pigment preparation, and the manufacture and use of decorative objects. The identification of seashells and extra-local rocks suggest these people interacted and procured resources from adjacent ecosystems, some of which were located tens to hundreds of kilometers away. Nevertheless, very little is known about human occupation in other regions, the nature of early human mobility through different ecosystems (i.e. coast vs. highlands vs. intermediate basins), and the overall colonization process in South America.

The Atacama Desert encompasses different ecosystems juxtaposed from the Pacific littoral zone to the high Andes. Consequently, to understand the history of its landscape variability and the development of human societies requires a scientific approaches working at different temporal, spatial and organization scales of analysis (Dillehay et al., 2012; Latorre et al., 2005; Núñez et al., 1995). Similar efforts are even more advanced in other southern hemisphere desert environments, such as the central Australian Desert or the Kalahari (Betancourt et al., 2000; Latorre et al., 2006; Smith & Hesse, 2005; Smith, 2009; Smith, 2013; Thomas, 2011; Williams, 2012). In fact, these kinds of paleoecological reconstructions have been key for discussing processes of social and cultural adaptation and sustainability, including the influence of changeable environments in the development of different systems of economic and social organization (Van der Leeuw & Redman, 2002). Furthermore, different archives, such as the establishment of high-resolution chronologies using radiocarbon dates and other geochemical dating techniques (i.e. Optical Stimulated Luminescence, Uranium-Thorium) (Aubert et al., 2007; Fitzsimmons & Telfer, 2008; Grün et al., 2010; Stone & Cupper, 2003) from different ecological settings, can help identify how societies initially settled in these natural landscapes and managed their resources under different modalities (Núñez & Santoro, 2011).

Current research suggests that the first inhabitants of the Atacama Desert and its neighboring regions created complex social systems that integrated the wide and bountiful array of resources in this territory. Unfortunately, comparatively less archaeological research has been carried out in the high Andes towards the east, which limits our understanding of how early this region was occupied and how these societies were related to the lowland populations of the PdT and the Pacific Coast. An exception is the site Quebrada Blanca (Figure 1), occupied at the very end of the late Pleistocene (Osorio et al., 2011). More importantly, in collaboration with Bolivian and North American scholars, we have been working at the site of Cueva Bautista, a late Pleistocene rock shelter situated in the Lipez highlands of Bolivia that is located immediately to the east of the PdT (Albarracín-Jordan & Capriles, 2011; Capriles & Albarracín-Jordan, 2013; Fraser, 2014). Our preliminary results suggest that this site was only occupied intermittently, and possibly by mobile foragers who visited the region from adjacent lowlands. The finding of comparable lithic raw materials (such as high-quality chert and obsidian in PdT and Lipez) is promising, but we also need to find additional intermediate sites between these two regions for improving our regional understanding of the settlement patterns of the earliest hunter-gatherers to occupy the Atacama Desert.

A very different situation occurs along the subtropical Pacific Coast. In fact, the coastal desert between Ilo to the Loa river mouth (17-21° S ca. 500 km, 300 miles) is dissected by eleven major *quebradas* that drain into the Pacific. Phreatic wetlands form at the outlets of these valleys, which are partially covered with totora reeds and other plants. These wetlands are also home to several seabirds and other waterfowl and mammals, which served as an important complement to marine resources (Dillehay & Saavedra, 2010; Fariña & Camaño 2012; Standen, 2003). Hunter-gatherer groups managed to transform their territory, albeit on a different scale than agricultural societies (Lee & Daly, 2004; Marquet et al., 2012; Santoro et al., 2012). Yet some of their practices had significant effects on local ecosystems. For instance, size selection over several millennia by coastal hunter-gatherers during the mid-Holocene may have decreased overall mollusk size (Rivadeneira et al., 2010).

Given that the coast was likely a primary migratory route to explore and colonize the continent (Coddling & Jones, 2013; Dillehay et al., 2008; Erlandson & Braje, 2011), the decision to stay in the hyperarid coast of the Atacama seems to be the consequence of the familiarity these human groups gained with this highly predictable, abundant, and diverse ecosystem. This means that early people had access to the bountiful resources of the Pacific, abundant in mammals, fish, mollusks, algae, and sea birds, favored by a rocky littoral and the upwelling of the Humboldt Current (Montecino & Lange, 2009; Thiel et al., 2007). Indeed, the archaeological evidence preserved along the western coast of South America shows a very early use of this habitat. Well known sites include Las Vegas, Ecuador (Stothert, 2003); Paiján (Chauchat et al., 2004) and Huaca Prieta



(Dillehay et al., 2012) in northern Peru; Quebrada Jaguay, Quebrada Tacahuay and Quebrada Los Burros in southern Peru (deFrance & Umire, 2004; Keefer et al., 1998; Lavallée et al., 1999; Lavallée et al., 2011; Sandweiss et al., 1998).

So far, no late Pleistocene archaeological sites show evidence of direct coastal adaptations to the littoral adjacent to the PdT. Nevertheless, considering that in southern Peru there are at least two well-documented examples of early coastal settlements (i.e., Quebrada Jaguay and Quebrada Tacahuay), it might be possible that such sites are yet to be discovered. In fact, the recently investigated site of Cueva Quebrada Agua de Cascabeles could possibly contain a late Pleistocene coastal site near Taltal, just south of our study area (i.e., Castelleti et al., 2010). Seashells found at QM12 clearly demonstrate that people had some connection with the littoral of northern Atacama. The area does have some major sites that span almost the entire Holocene, with extended occupational sequences established by radiometric dating (i.e. Caleta Vitor, Tiliviche, Aragón, Punta Patillo). Netting (assumed due to the small size of fish remains) has been very important since the Archaic period, along with a wide array of tools for catching and processing fish, mollusks, sea mammals and sea birds (Standen et al., 2004; Standen et al., 2015). This evidence shows a fully adapted human population to the coastal marine environments of the Atacama, and brings about the possibility that even earlier occupations are to be found in areas such as the coast at Punta Patillo (Figure 1), given its current elevated geographic position above the modern coastline and potential for preserving early archaeological sites. We especially anticipate the importance of the elevated marine terrace along the coastal escarpment that oversees the littoral. This would have been an ideal area for localized habitats with fresh water, plants and animals at the end of the Pleistocene. In Punta Patache we have localized, but as of yet undated, remains of an early human occupation that lends support to this idea. Clearly, more research is required to understand how early the occupations occurred in the coastal Pacific Desert and how these related to contemporary occupations in the PdT and the high Andes.

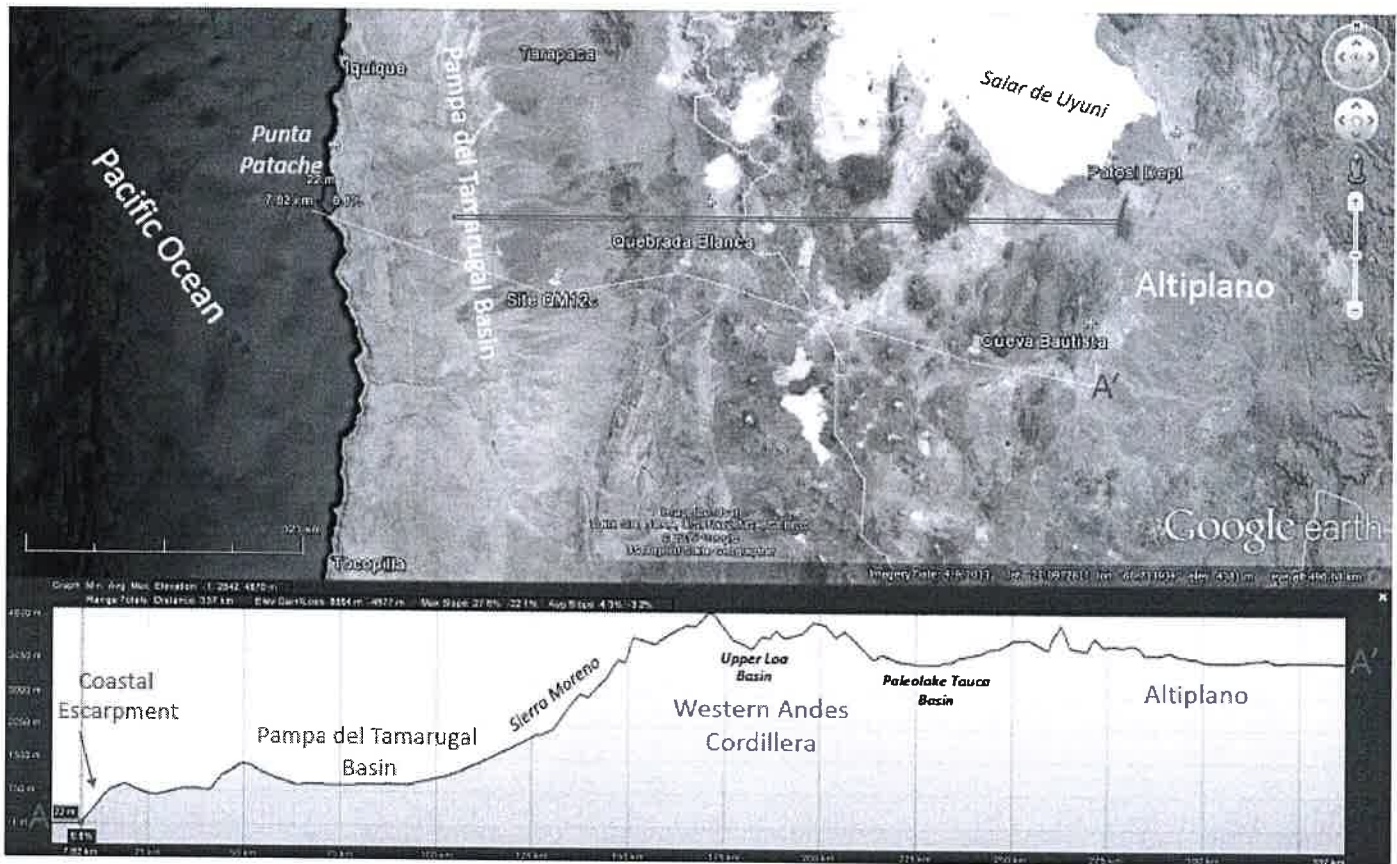


Figure 1. Our proposed transect (A-A') spanning known early Archaic sites at Punta Patache (red arrow) along the Pacific Coast, over the coastal escarpment into the Pampa del Tamarugal (PdT) Basin and the adjacent western Andes Cordillera and Altiplano. Late Pleistocene sites shown are Quebrada Maní 12 (Qm12, Latorre et al., 2013) in the PdT, Quebrada Blanca in the high Andes (Santoro & Standen, 1998) and Cueva Bautista located in the Bolivian Altiplano (Capriles & Albarracín-Jordan, 2013).

Scientific and Technical Objectives

(Maximum 3 pages)

Describe the scientific/technical objectives of the project and the hypotheses in which they are based. Either describe or give references of the methods, experiments and research activities that will be applied in order to accomplish the previously stated objectives. Justify the novelty and originality of the project. Describe the eventual final products that would be developed at the end of the project. In case of projects focusing in multidisciplinary scientific topics, demonstrate how the different disciplines articulate within the project. In case the country working teams are responsible of strongly different objectives please indicate so in this section.

Our previous research in the Atacama Desert was aimed at showing that by the end of the Pleistocene, the Atacama was not a barrier for human immigration from the Isthmus of Panama to Tierra del Fuego, but a suitable environment for humans. After eight years, we have established that the hyperarid core of the Atacama was peopled by at least 13,000 years ago during a wet phase that increased the available moisture in the lower desert (Latorre et al., 2013; Santoro et al., 2011). Paleoenvironmental reconstructions agree that during the initial period of human entry, this entire region was substantially more humid than today. Wetter conditions would have sustained greater biomass, which in turn, would have attracted bands of hunter-gatherers. Our ongoing work has focused on the Atacama hyperarid core, where we have excavated and dated three occupations: QM12, QM32 and Chipana-1, that have dates ranging between 12,800 and 11,700 years ago (Latorre et al., 2013). Nevertheless, these sites bear evidence that early hunter-gatherers were also occupying other environments. For instance, seashells of various taxa from the Pacific littoral are common, as well as chipped stone tools and debitage manufactured with raw materials originated in the Andes. As a natural next stage of our research we wish to further explore the regions where these materials originated as well as where potentially early human occupations are situated.

In tandem with our ongoing research in Pampa del Tamarugal, in this international collaboration project we will address the following set of **research questions**: (1) how were the coast and highlands integrated during late Pleistocene peopling of the Atacama Desert?, (2) to what extent were settlements in different environments articulated by means of consistent mobility and foraging strategies?, (3) to what extent have surficial processes preserved or obliterated the conservation of early settlements in the varying environments from the coast to the highlands?, and (4) how did occupation intensity of the earliest human adaptation vary in relation to climate change and environmental variability? In sum, integrating interdisciplinary and international research, we will approach the paleo-environmental context in which the earliest occupations of hunter-gatherers were situated along a latitudinal transect from the Pacific littoral to the high Andes.

Scientific Objectives

1. The overarching scientific goal of the proposal, is to establish the timing, spatial, and environmental scope of the peopling of the Atacama Desert during the late Pleistocene (17,000-10,000 years ago) by examining an altitudinal transect from the Pacific coast through the Pampa del Tamarugal, into the Precordillera, Altiplano, and high Andes of northern Chile and adjacent Bolivia.
2. By exploring the earliest human occupations and their landscapes, we expect to develop a novel interpretative framework for explaining the early human exploration, colonization, and adaptation to the changing conditions of the Atacama Desert, integrating late Quaternary paleoecological, paleoclimatic, and archaeological data within a general theoretical perspective.
3. Framed by a human ecological multidisciplinary perspective, we expect to contribute substantially to understanding the processes by which archaeological sites are formed in different environments including coastal, desert, and highland settings.

Technical Objectives

1. To increase our understanding of how paleoenvironments varied over time during the late Quaternary by increasing the number of geological sections and dating of key features at outcrops that show transitions between different depositional systems linked to climatic conditions (e.g. wetlands, mudflows, eolian dunes, etc.).
2. To survey selected landscapes for identifying and testing late Pleistocene archaeological sites across an altitudinal gradient from the Pacific Ocean towards the high Andes (Figure 1).
3. To understand different depositional environments within the Atacama, and infer possible suitable places for human habitation across the altitudinal gradient (coast, desert plains, precordillera, Altiplano, and highland Andes).



Hypothesis 1

Based on (1) our previous research in the PdT, (2) known archaeological sites and radiocarbon dates from neighboring areas, (3) available regional paleoenvironmental reconstructions, (4) cross-cultural human foraging and mobility strategies, and (5) human physiological constraints; we hypothesize that the late Pleistocene human peopling of northern Chile exhibits a dispersed settlement pattern. Social and economic strategies that involved generalized resource exploitation in different environments, high mobility, and preferential use of sites associated with abundant water and foraging resources produced these patterns.

Hypothesis 2

The exploration and eventual successful colonization of the various environments in the Atacama was a function of resource availability and landscape suitability, both of which depended on climatic and environmental fluctuation. In this sense, the initial adaptation to the Atacama occurred during a pluvial event with increased moisture availability and its colonization relied on the persistence of these conditions. Increased aridity would have motivated populations to migrate to regions of greater environmental suitability (i.e. "paleorefugia") and possibly change their systems of social integration and interaction.

Methods, experiments and research activities

To accomplish our research goals and to evaluate our research hypotheses, we will carry out fieldwork and multidisciplinary analyses involving judgmental sampling and opportunistic surveys along an altitudinal gradient established at 21° south focusing on the association among geomorphological, paleohydrologic, and archaeological landscapes (see transect A-A' in Figure 1).

Specifically, we will carry out a survey transect that crosses different ecosystems ranging between the Pacific Coast, the Atacama hyperarid core, the Precordillera, and the Andean highlands up to the Bolivian border. cursory evidence from coastal enclaves such as Punta Patache and Punta Patillos, suggests some very early sites might be present in the coast of Tarapacá. There are also a few well-dated early sites in the Andes, including Quebrada Blanca as well as Cueva Bautista, the latter situated in the Lipez Desert of southwestern Bolivia, but near the Ollagüe basin of northern Chile. In fact, the finding of obsidian and high-quality chert in PdT sites possibly originated in Bolivia, and suggests that the current political border may be a hindrance for an increased understanding of the broader circuits of mobility of these early hunter-gatherers. In this sense, by extending our collaboration to Bolivian colleagues (including the PI of this proposal), we hope to integrate a new component of the Project by extending our altitudinal gradient towards the eastern frontier.

By means of the directed and opportunistic survey of selected areas in the coast, the precordillera, and the highlands, we expect to locate new archaeological sites, which we will sample and date by means of AMS radiocarbon dating. In addition, complementary geological and paleoecological mapping will serve to characterize the environments where early people settled and eventually help to predict the location of additional sites.

Finally, we will develop interpretative models that help to integrate the collected information. By discovering new sites, describing their (paleo)environments, and exploring how these were integrated, we will use a human ecology framework to generate new knowledge regarding the sustainable and flexible use of the desert landscape as an environment of human adaptation that witnessed the development of a long-term cultural tradition.

Final products

1. We will carry out fieldwork trips with the participation of the researchers from both Chilean and North American teams.
2. We will collaborate in the application of novel research methodologies for the collection and interpretation of data during fieldwork.
3. We will carry out laboratory sessions to discuss the results and exchange data regarding the research problem as well as to establish a network to exchange scientific ideas.
4. We will train undergraduate and graduate students, specializing in the recognition of late Pleistocene landscapes, study of paleo-environments, and the inference of human behavior from early foraging archaeological sites.
5. We will organize a scientific workshop at the end of the third year to summarize our main findings as well as to present our results to a broader research community.
6. We will write up the results of our research and publish them in international peer-reviewed journals.
7. We will also organize presentations for selected local communities in northern Chile, including lectures in rural as well as urban settings hoping to advance in integrating cultural heritage management with socioeconomic development.



Articulation of the different disciplines within the project

Building on previous projects funded in part by the US National Science Foundation, the National Geographic Society, and the Chilean CONICYT (including FONDECYT, PIA, and other agencies), this Project will feature international cooperation from Dr. Jason Rech, an international specialist on Quaternary desert geology, geomorphology and geoarchaeology, and Dr. Nicholas Tripcevich, an archaeometrist and archaeologist specializing in obsidian and prehistoric regional interaction dynamics.

The Project will also involve the active participation of undergraduate and graduate students from Universidad de Tarapacá, Pontificia Universidad Católica de Chile, Miami University and the University of California, Berkeley as well as postdoctoral scholars from Chile and the US. Students and senior and junior researchers will be actively involved in the collection, analysis, and interpretation of empirical data, which will be oriented not only to answer our research questions but also for training in novel theoretical, methodological, and analytical approaches.

We will also encourage our students to follow-up their training through our international network of colleagues and institutions. For instance, just this year, Ms. Daniela Osorio (Archaeologist, 2013, Universidad de Chile) was granted a CONICYT Becas Chile scholarship to pursue her doctoral studies at the Institute of Archaeology of the University College London and Ms. Katherine Herrera (Archaeologist, 2012, Universidad de Tarapacá) will be starting graduate studies in the Département d'Anthropologie, Université Paris Ouest, Nanterre, France.

3. PROJECT ORGANIZATION

Scientific Program and Tasks

(Maximum 3 pages)

In this section the scientific program to be carried out should be presented, indicating all tasks and activities required to achieve the scientific-technical objectives of the project. It should include the tasks and distribution of the responsibilities of the Chilean and the foreign teams, based on the abilities and resources of each team. Link the research tasks and activities with those of international cooperation, such as exchange and travels of students and researchers from both countries.

To answer our research problem and accomplish the research goals, we will place emphasis on archaeological surveys and paleoenvironmental reconstruction including improved understanding of the cross-cutting relationships across fluvial, aeolian, and wetland depositional environments that formed in the Pampa del Tamarugal basin and adjacent Pacific Coast and high Andes during the late Quaternary. We will establish how variable these ecosystems were over time and discuss our results in terms of the overall impact these changes would have had on the chronology of early human occupation in this region.

The present proposal relies heavily on the complementary methodological and scientific expertise of the partners in the USA and in Chile. Project partners from the USA will provide geological, geoarchaeological, and archaeometric expertise and state-of-the-art equipment for the paleoenvironmental and archaeological reconstruction and dating of landforms and sites. The Project partners will collaborate in exchanging expertise on ecological and archaeological proxies for environmental/climate reconstruction and an intimate knowledge of environmental and cultural archives in the region. Scientific training is an important aspect of the present proposal and we will involve several graduate and undergraduate students from the USA and Chile in our research, which will require research internships abroad as well for at least one student per year of the proposal. We will also involve supporting with incentives to at least two postdoctoral scholars from Chile who will perform specific analyses on cultural artifacts and ecofacts.

Archaeological Methods

During the course of the Project we will carry out a combined and complementary strategy of opportunistic surveys along an altitudinal gradient. As state above, the general goal of survey is to locate the earliest hunter-gatherer human occupations in the Atacama Desert and its neighboring regions to capture early landscape and evidence of paleo-environmental utilization as guided by our research hypotheses. Opportunistic survey will continue exploring the late Pleistocene paleo-landscape guided by a combination of remote sensing to identify landforms of the appropriate age and the exploration of potentially suitable landscape settings (e.g., paleo-wetland and riparian settings). This strategy has been successful in the past, allowing us to identify several early settlements in the Pampa del Tamarugal and the hyperarid core of the Atacama Desert (Santoro & Latorre, 2009). The implementation of this strategy in previous projects helped to develop an increasingly thorough understanding of the antiquity of paleo-wetland deposits as well as the dynamic cultural landscape associated with these environments used by early hunter-gatherers. We will continue focusing our survey to regions that have the late Pleistocene deposits associated with the Central Andean Pluvial Event I (CAPE I; 17.6-13.8 ka) and (CAPE II; 12.7-9.7 ka) dated paleo-environmental records.



In this Project we plan to extend the implementation of opportunistic survey to three areas: (1) the Pacific Coastal zone towards the west, (2) the precordillera piedmont toward the east, and (3) the Andean Altiplano and puna towards the east and into southwestern Bolivia. We are interested in locating even earlier human occupations, possibly dated to the Central Andean Pluvial Event I (17.6-13.8 ka), as well as sites along key passes through which the earliest explorers of the Atacama passed both downwards towards the coast and upwards towards the Andes. It is our intention to identify key logistical locations and verify if occupations reside there. We are also interested in continuing to identify key hunter-gatherer sites within the Atacama Desert hyper-core pursuing our already successful survey strategy. By carrying out opportunistic survey at an altitudinal gradient, we hope to identify very small camps, ephemeral lithic flaking, and other logistical activities and settlements for enhancing our understanding of site function and landscape use. The survey will feature systematic mapping and collection of diagnostic artifacts using combining Total Station and GPS data.

To gain a better understanding of the sites, we plan to implement non-destructive site-level geophysical survey. Specifically, we will survey key sites with a ground penetrating radar (GPR) and magnetometry surveys, using equipment from the Archaeological Research Facility at the University of California, Berkeley. At a regional scale mobility among early Atacama populations can be detected in the geochemistry of obsidian artifacts produced material from altiplano sources located high in the western cordillera. The Bruker Tracer portable X-ray fluorescence instrument can assign obsidian artifacts to sources when source chemistry is known. Another major research category is site prospection using geophysical instruments including the GSSI SIR 3000 Ground Penetrating Radar (GPR) and the Bartington GRAD601 gradiometer. The GPR is especially useful for detecting density changes and two antennas are available: one for near surface (900 mhz) and another for 1-3 m depth (400 mhz). The gradiometer detects magnetic anomalies resulting from the presence of large hearths or dense artifact concentrations. These will be useful for locating site features in the Atacama. Surface scatters, geophysical survey blocks, and active research areas will be documented using a Trimble differential GPS unit. Further spatial data will be provided by an Unmanned Aerial Vehicle (UAV or drone) with high resolution photography. Photogrammetric software allows the aerial photos to be combined and spatially referenced into a 3D point cloud. These spatial research approaches will be integrated with other project data using geospatial software (ArcGIS) for spatial analysis, statistical summaries, and map production. We will apply these surveys over sites such as QM12, QM32 and Chipana 1, which are situated in sandy substrates, which will facilitate the identification of anthropogenic features such as structures, hearths, and burials.

Excavations

We plan to carry out a combined strategy of test units and large horizontal trenches and blocks. With a few exceptions (for instance, we excavated a 15 m² continuous block at QM12), most of our previous work has featured 1 m² test units, which are helpful for dating sites and reconstructing a basic idea of their chronology. Nevertheless, given the size and internal complexity of some of the already identified sites, we believe more can be gained by carrying out larger horizontal excavations. In this sense, we plan to continue carrying out 1 m² test excavations in new potentially earlier sites for verifying their archaeological context as well as collecting material to the date their earliest human occupations. In addition and given the unique preservation of activities and the density of materials recovered at QM32, we plan to carry out an ambitious excavation strategy in this site. More specifically, we will carry out a 50 x 1 m linear trench that will cut the site and we will open large (>8 m) associated excavations blocks in locations where features were identified as well as in selected additional locations as suggested guided by surficial evidence (burn stains, high density of artifacts, rock accumulations, burials, etc.). Our goal will be to identify and expose formal features such as those formed by domestic structures but also formal burials and other activity areas.

Given that our dated sites often contain charcoal from old wood, during our new excavations we will complement AMS radiocarbon dating of different materials (charcoal, uncarbonized seeds, worked wood, bone, shell, cordage, fibers, etc.) with Optical Luminescence Dating (OSL) of anthropogenic sediments. By complementing dating methods and dating materials, we hope to contrast and verify the antiquity of the studied sites.

Laboratory Analysis

We will sort the recovered sediment in the lab using 2 mm meshes. This fine-grained recovery procedure will deliver microlithic, microfaunal, and macrobotanical remains, all of which will be analyzed in collaboration with scientists from other universities. All the recovered lithic material will be analyzed for determining the morphology, function and context of lithic material use. Bone remains will be identified to the highest taxonomic and anatomical level possible and used for reconstructing economic and taphonomic patterns. Based on the preponderance of certain taxa we will be able to identify key aspects related to the subsistence as well as help to reconstruct formation processes involved in the configuration of the sites. The plant remains including textiles and cordage will be identified to the highest taxonomic level and associated with possible use and transformation techniques. The plants and their context will help to complement the economic organization as well as the local environment.

Late quaternary geological methods



We will use a variety of geological methods and techniques to identify landforms associated with more pluvial periods, infer site formation processes (e.g. Latorre et al., 2013), and reconstruct changing climatic and environmental conditions. In new survey areas that are adjacent to areas that have been mapped recently for Quaternary geology, we will use aerial photographs and remotely sensed imagery to extend the mapped units into our new survey areas. In other areas, we will describe the geomorphology and landscape evolution by describing Quaternary sedimentary deposits, identifying key unconformities between deposits, and radiocarbon dating these deposits when they contain organic materials. We will also use a variety of standard techniques (mineralogy, particle size analysis, thin sections of soils and sediments) to describe the soils and sediments to understand the evolution of particular landscapes. At specific localities, where the sequence of depositional environments can be defined precisely, we will use a variety of potential techniques (e.g. Stable isotopic analyses, pollen analysis, analysis of plant macrofossils, microfaunal assemblages (ostracodes, diatoms, etc.) To better constrain depositional environments, and sequences of climate change.

Dissemination and knowledge transfer Activities

(Maximum 2 pages)

State here the program of dissemination activities (seminar organization, congress presentations, public sector- oriented conferences and others, etc.), excluding specialized publications, planned during the project development. Clearly explained which of these activities will be performed in Chile and which will be performed abroad.

Our proposal considers several outreach and dissemination activities:

1. Publication of relevant news in local and national media, printed and online.
2. Three outreach seminars (one per year) aimed at students and/or the general public.
3. Congress and/or seminar presentations in Chile and abroad.
4. Scientific workshops to inform and discuss the project and its results, with local colleagues.
5. A final scientific workshop, with international and national researchers.

These dissemination activities are connected with other research projects that are currently being developed. All of these projects aim to find new data and discuss the human occupations of the Atacama Desert in a long-term and multidisciplinary perspective. Consequently, our outreach activities are focused on unraveling and uncovering the deep cultural, climatic, and geological history of the Atacama Desert, and to ultimately collaborate with current societies to understand and develop different aspects of sustainable economies in the Atacama Desert. We will also carry out three annual and consecutive workshops for local communities of northern Chile (see below).

Project Management

(Maximum 3 pages)

Describe how the collaboration among partners will be organized, defining roles and responsibilities of each team, their participants and the tasks distribution for Chilean and foreign researchers within the project.

- 3.3.1 *Include a chronogram (such as Gantt Chart) with the activities plan (activities mentioned in sections 3.1, 3.2 y 3.3) considered for the three-year period.*

Chronogram for the activity plan mentioned in sections 3.1, 3.2 y 3.3

ACTIVITY PLAN- FIRST YEAR												
Activities/Months	1	2	3	4	5	6	7	8	9	10	11	12
Archaeological surveys				X	X			X				
Paleo reconstructions				X	X			X				
Laboratory analyses						X	X		X	X	X	
Training						X						X



Narratives	X	X	X							X		
Organize Seminar								X				
Congress presentations										X		

ACTIVITY PLAN – SECOND YEAR												
Activities/Months	1	2	3	4	5	6	7	8	9	10	11	12
Archaeological surveys			X	X								
Paleo reconstruction			X	X								
Excavations						X	X	X				
Laboratory analysis					X				X	X	X	X
Training		X										
Narratives					X							
Organize Seminar								X				
Congress presentations				X					X			

ACTIVITY PLAN – THIRD YEAR												
Activities/Months	1	2	3	4	5	6	7	8	9	10	11	12
Archaeological survey		X										
Paleo reconstruction		X										
Excavations			X	X								
Laboratory analysis					X	X	X	X	X	X		
Training	X											
Narratives	X											
Organize Seminar					X							
Congress presentations			X									
Final scientific workshop						X						

3.3.2 If this project includes the participation of associated institutions or third parties, please describe in this section the roles each one of these will play within the project. Link this information with the corresponding letters of commitment required enclosed to this form.

The project will incorporate four universities from Chile and the USA: Universidad de Tarapacá, Pontificia Universidad Católica de Chile, Miami University, and the University of California, Berkeley. The merging of the theoretical and methodological expertise of the US colleagues from Miami Universities (geology) and University of California, Berkeley (archaeometry), along with the Chilean research team from Universidad de Tarapacá (archaeology) and Pontificia Universidad Católica de Chile (paleoecology), will greatly improve the potential for success of this multidisciplinary group. Besides, the participants of the project direct important laboratory facilities and maintain scientific instruments that represent important intellectual and economic input to the realization of the project, as expressed in their letter of commitment. The integration of



Jason Rech's experience (Miami University) on the transformation of desert landscapes during the Pleistocene and Holocene, coupled with the experience of Nicholas Tripcevich (University of California, Berkeley) to track the movement of human groups from the Andes to the coast by applying sophisticated archaeometrical procedures for the identification of obsidian sources and the utilization of remote sensors to identify archaeological sites buried by sand, offers the opportunity to strengthen and expand the multidisciplinary research lines of the Chilean team.

Intellectual Property Management

Describe the management of the intellectual property rights of the outcomes of the project. If relevant, a global consortium agreement should be prepared to manage the intellectual property rights, publication and exploitation plans, as well as management rules between the partners.

The results of the proposed Project will be published in peer-reviewed journals and authorship will be defined on the basis of concrete contributions to the manuscripts as established by ethical conventions of scientific practice. The Project participants, both Chilean and North American, declare no conflict of interest.

The participant students and postdoctoral fellow will be part of the intellectual property generated by the Project. This means that students are not considered data producers but members with equal intellectual rights.

4. EXPECTED IMPACT, DISSEMINATION AND APPLICATION OF RESULTS

(maximum 3 pages)

Expected impact

Describe the expected scientific and technological impact of the project in relation to the project objectives, with emphasis on issues such as generation of new knowledge, development of the research lines of the project and formation of human capital.

In this international collaborative Project, we propose to add disciplinary strengths to study the landscapes first explored by humans in the Atacama Desert by combining archaeological, paleoecological, and geological perspectives. We will use modern survey techniques to survey selected areas between the Pacific Coast and the high Andes of northern Chile, specifically seeking to identify early human occupations, determine their age, and describe their surrounding environment. This information will provide a solid foundation to understand how humans subsisted and even thrived in the Atacama. These groups may have combined resources and habitats from different ecological zones, a sustainable cultural practice that has endured until historic times, and is currently relevant as the world is undergoing significant changes due to human-induced global climate change.

Particularly, the present project is aimed to advance our understanding of the earliest human colonization of the Atacama Desert. The theoretical and methodological approaches integrated in this project is directed at reconstructing the environment and landscape of the Atacama Desert during the first peopling of this region over 13,000 years ago. Knowledge about human adaptation to extreme environments, such as the Atacama Desert, is limited and rarely investigated and discussed interdisciplinary, as designed here. Moreover, scientific knowledge regarding the foundation of sustainable ways of life in the Atacama Desert ecosystems will be a central outcome of the project. The participation of junior and senior researchers along with undergraduate and graduate students, and postdoctoral fellows, strengthens possibilities to explore new lines of research knowledge as a contribution to the regional development of the country.

In sum, by enhancing the knowledge and explanation on how prehistoric societies managed to live sustainably in desert ecosystems, and how they responded to climatic and environmental changes, may provide a historical perspectives to enter into the worldwide discussion of social sustainability in the third millennium.

Dissemination and application of the results

Indicate here the strategies for the uptake of the project results:

- Scientific, technical, industrial and economic implications
- Indicate the position of the project within the industrial strategy of those enterprises associated with it (if applicable)
- Indicate the timing and the nature of the technical and economic expected implications
- Point out the possible implications in job opportunity, new activities creation, etc.
- Introduce the overall plan on results protection and exploitation (if applicable)

An indirect but important economic impact of the project is linked to one of the key aspect of the Chilean Strategic National Plan for Economic Improvement: tourism. Within this sphere, tourism of special interests or cultural tourism requires a good



understanding of the cultural and natural history of the Atacama Desert, a worldwide recognized tourist landscape attraction. Thus, basic knowledge is fundamental to the development of such an industry.

Last but not least, the outreach devoted to the local communities may allow them to better manage their own position in the development of their tourist industry.

The results of this project will result in at least five peer-review publications in ISI journals. Most of these publications will be submitted to Q1 and Q2 journals in the fields of the social and earth sciences.

The nature of this project does not produce commodities that can be sold in a regular market. On the contrary, as most of the international consortiums of journals kept the commercial rights for spreading the scientific work in different platforms (Monbiot, 2011; Watson et al., 2010), there is no commercial return for publishing the research results.

We will also organize three outreach community seminars (one in Arica, one in Iquique, and one in Pica), one final scientific workshop, and several press releases in local and national media.

The project will involve incentives for research postdocs and opportunities for undergraduate and graduate students including monthly stipends, significant opportunities to travel to the USA, participate in classes and work in modern laboratories with latest-generation equipment and techniques, and eventually enroll in some of the best universities in the country.

This in turn will help to increase the scientific investigation of many aspects relating to the geography, ecology, archaeology, and landscape of northern Chile. One of these aspects is the creation and extension of collaborative international networks, which will be strengthened by the formation and/or specialization of graduate students. As a collateral result of this project, we expect to collaborate in field studies with two 2 national students who are currently accepted in graduate programs abroad, and thus help to achieve a master thesis and a doctoral dissertation regarding the early peopling of the Atacama.

This project, together with other national funding such as FONDECYT and Anillo, will contribute to the development of science, culture and education in a region outside of the Capital city, and this intellectual capital will generate job opportunities not only for the young generation of scholars that will be part of this project, as it may scale to other members of the civil society.

In this way we follow the idea that sustainable social improvement does not exclusively depend on industrial and commercial development. First world countries, for instance, rely also in the intellectual spheres to advance their social systems.

5. PARTICIPANTS (RESEARCH TEAMS AND OTHER PARTNERS)

Dr. José Capriles, Ph.D. Bolivian archaeologist, Assistant Professor at the Departamento de Antropología of Universidad de Tarapacá, project's coordinator (investigador responsable).

Dr. Calogero M. Santoro, Ph.D. Chilean archaeologist, Professor at the Instituto de Alta Investigación of Universidad de Tarapacá, alternate leader of the project (investigador asociado alterno)

Dr. Claudio Latorre, Ph.D, Chilean paleoecologist, Associate professor at the Departamento de Ecología of Pontificia Universidad Católica de Chile, principal investigator of the project (investigador asociado (co-investigador)).

Dr. Jason Rech, Ph.D. US geologist, Professor at the Department of Geology & Environmental Earth Science, Miami University, Oxford, Ohio, U.S.A. International collaborator (Investigador extranjero responsable).

Dr. Nicholas Tripcevich, Ph.D. US archaeologist, Laboratory Manager at the Archaeological Research Facility of the University of California, Berkeley, U.S.A. International collaborator (Investigador extranjero asociado).

Description and relevance of key participants, complementary aspects.

(Maximum half page per person)

The funds available through this call are intended to support focused, coordinated and collaborative research between the Chile and the foreign counterpart to address the scope of the call as outlined in the Call Document ("bases del concurso"). These grants are intended to promote inter-institutional collaborations between Chile and the counterpart. Partnerships should be genuine and reciprocal, and working together must add value to that which could be achieved by individual partners working on their own. Briefly describe each main researcher from the Chilean and foreign team, as well as those other participants that play key roles in the project development from any other institution or enterprise (Exclude students and technicians). Please deliver information of their qualifications and their know-how for the project and the expectations of their contribution to the project.



addition to this description please enclose a summary of the CV on the online platform (maximum five pages per CV). Indicate the added value of the collaboration among the different key participants of this project (exclude students and technicians). Inter-discipline approach and opening to diverse collaborations should be justified according to the project orientations.

(1 page).

Dr. José M. Capriles will head the research Project. Although Dr. Capriles is a young scholar, he has extensive experience participating in international and interdisciplinary research teams in all capacities (fieldwork assistant, lab analyst, and co-director) and has worked with North American, Swiss, Belgian, and Chilean research projects in the U.S., Bolivia, and Chile. Dr. Capriles has specialized in environmental archaeology, zooarchaeology, quantitative applications in archaeology, and geographic information systems. Dr. Capriles will coordinate and participate in fieldwork-related activities as well as laboratory analyses. He will also supervise undergraduate and graduate Chilean students and promote their engagement in internships and other research-related opportunities within the Project.

Dr. Calogero M. Santoro has conducted several interdisciplinary archaeological studies in the Atacama Desert focusing on late prehistoric farming societies and Inca state-related groups, as well as the long-term cultural process of hunting and gathering societies and rock art. His research has been supported by research grants awarded from numerous national institutions such as FONDECYT, CONICYT (the Chilean National Science and Technology Foundation), Andes Foundation, FONDART (The National Foundation for the development of Art and Culture), and Mecesup (Education Ministry of Chile). Furthermore, he has worked with international institutions such as the Wenner-Gren Foundation, National Geographic Society, and PAGES (Past Global Changes). He has received research fellowships from Fulbright, The Heinz Foundation, The National Museum of Natural History in Washington D.C., The American Museum of Natural History in New York, Dumbarton Oaks, USA, Endeavour from Australia, and Rennes University (France). He regularly shares archaeological knowledge with wider audiences in TV and web-based documentaries. He teaches courses on the prehistory of the Andes for the general public, archaeological tour guides, elementary school and high school students and teachers, and local community and ethnic leaders to popularize the knowledge on the history of the Atacama Desert. He occasionally contributes to local and national newspapers and radios. Conversely as a senior researcher Santoro will contribute along the different part of this research proposal, including fieldwork, student training, data analysis, preparation of papers for international journals, and other forms of diffusion, as well as contributing to the general public and local communities.

Dr. Claudio Latorre is a leading expert on desert paleoecology who studies the complex relationship between climate, vegetation and humans in arid and semiarid regions of Chile. His research spans from historical times to the last glacial period. Most of his recent work has been on the paleoclimatic and environmental reconstruction of habitats in the Atacama Desert using a wide range of proxies (e.g. Betancourt et al., 2000; Díaz et al., 2012; Gayo et al., 2012; Maldonado et al., 2005; Nester et al., 2007; Quade et al., 2008). The evidence for wetter climate events during the late Quaternary in the Atacama Desert largely stems from this research. Recent research has also gone into understanding coastal ecosystems and how they have responded to past variations in advective fog (see Latorre et al., 2011). Dr. Latorre will perform fieldwork along with paleoecological, biogeochemical and stable isotope analyses on past desert ecosystems.

Dr. Jason Rech is an expert in arid lands geomorphology and geoarchaeology. He has worked extensively on records of climatic and environmental change and archaeological sites in the Gobi Desert of Mongolia, the Middle East (Israel and Jordan), and in the Atacama Desert. His education and training is in Archaeology (Roman/Byzantine sites in the Middle East and Upper Paleolithic archaeology in Mongolia), Geography (MA, University of Arizona), and Geology (PhD University of Arizona). He is interested broadly in past climate and how climatic change has impacted humans in the past and how it may impact society in the future. His research lab is equipped for the preparation of AMS ^{14}C targets and the analysis of stable isotopes (^{13}C and ^{18}O) in fossil shells and soils. Dr. Rech has worked in the Atacama continuously since 1998 on various projects ranging from paleowetlands and late Quaternary paleohydrology, soil formation in the hyper-arid Atacama, to Andean uplift and desiccation of the west coast of South America. Dr. Rech will perform fieldwork along with geochronological and stable isotope analyses on Quaternary deposits.

Dr. Nicholas Tripcevich is an expert on archaeometry, Andean archaeology, and geographic information systems (GIS) and with specializations in field archaeology, archaeological geophysics, geochemistry, and spatial analyses. He has worked on early human settlements in southern Peru and southwestern Bolivia. He has worked on the most important obsidian sources in the Andes including Chivay and Quispisisa. He has also directed ethnoarchaeological research regarding mobility and particularly llama caravans in the sierras of Ayacucho. Dr. Tripcevich routinely collaborates with scientists working on different regions of the world, including the application of novel hardware and software in the benefit of archaeological research. At the Archaeological Research Facility of the University of California, Berkeley, Dr. Tripcevich has been responsible for coordinating equipment use and training our scholars in the use of these instruments as well as teaching courses in geospatial applications in archaeology. His active collaborations with worldwide specialists who have collaborated with Chilean projects in the past (e.g. Dr. Ronald Amundson, Dr. Anthony Barnosky,



Christine Hastorf, among others) will be key for facilitating internships and other opportunities, especially for undergraduate and graduate students. Dr. Nicholas Tripcevich was trained at the University of California in Santa Barbara (PhD, 2007) with a dissertation project that involved obsidian source research at highland sources in adjacent southern Peru and since then has been examining raw material procurement and mapping distributions. He has also conducted geophysical surveys in highland Peruvian sites as well as at coastal and desert sites in California and has developed customized mobile mapping technology for field GIS applications.

The added value of the collaboration is that primary investigators are experts in archaeology, zooarchaeology, paleoecology, and Quaternary geology with long-standing research programs for studying the Atacama Desert, the Central Andes, and other comparable environments and paleo-environments. However, only recently have the primary investigators begun to collaborate and jointly ask new questions about how human societies lived in the Atacama and adapted to environmental change; key questions for understanding how to live sustainably in the next millennium. This new inter-disciplinary and multi-national collaboration has been extremely successful. We have been able to answer specific research questions, develop novel hypotheses, and exchange a variety of methods and techniques for addressing these questions. This international and multi-national collaboration will foster globally-engaged students and faculty, allow for the dissemination of advanced methods and techniques across scientific disciplines and nations, and enhance the research capacity and global perspectives of all participants. A broad portion of the budget is geared towards incentivizing the participation of undergraduate and graduates students as well as young postdoctoral scholars in the Project, which will amplify not only their research skills but also their academic network. In this sense, we will encourage training students for participating in international meetings and workshops as well as other professional development and improvement opportunities. This collaboration not only brings together international expertise but cross-disciplinary approaches for addressing key questions regarding human adaption, sustainability, and the long-term effects of climate change on the environment and human populations.

Declare, for each key participant of the Chilean team, his/her involvement in other projects (public and private contracts current or established in the last three years must be declared in the format provided in appendix 7.2). National and international funds granted have to be included. Explain in this section the link between the proposed tasks of this project and those already done or currently undertaken.

Relevant Experience of the project coordinator

(Maximum half page)

Please provide information to evaluate the Chilean and the foreign coordinator's capacity to lead this project.

Dr. José M. Capriles is Assistant Professor in the Department of Anthropology at the Universidad de Tarapacá and will coordinate the Project. Dr. Capriles has extensive research experience involving research in the U.S., Bolivia and Chile. Dr. Capriles has been a successful grantee of the U.S. National Science Foundation, the National Geographic Society, the DigitalGlobe Foundation, and others as well as from the Swiss National Science Foundation and the Chilean National Science and Technology Foundation (FONDECYT). His research experience is related to addressing three sets of questions: (1) how did humans adapt to the changing environmental conditions of the Atacama, the Andes, and the Amazon during the late Pleistocene-early Holocene transition? (2) Which specific economic and ecological processes were involved in the development of early food production? And (3) how were the economic and technological organization of subsistence-scale communities impacted by the emergence and expansion of complex polities? In this effort he has analyzed research collections from late Pleistocene sites in Bolivia and Chile. In close collaboration with the Co-Investigators, Dr. Capriles will organize fieldwork seasons, participate in the archaeological, paleoecological, and geological surveys, and study the materials recovered from these investigations. As a Bolivian scholar who has been directing the work in Cueva Bautista, Dr. Capriles will also foster the exploration of southwestern Bolivia as part of complementary work to the one projected in this proposal.

Dr. Jason Rech is a Professor of Geology and Environmental Earth Science at Miami University, Ohio, USA. He has worked extensively on records of climate change over tectonic, orbital, and millennial time scales, soil formation processes, and records of landscape evolution in the Atacama Desert. He has advised undergraduate, masters, and doctoral students from Miami University on field and lab-based research projects in the Atacama Desert, and collaborated with several Chilean research teams. His broad inter-disciplinary background in archaeology, geography, and geology combined with his expertise in geomorphology and geoarchaeology of arid lands makes him well-suited to lead this component of the research project. Rech's experience in the Atacama Desert will allow him to isolate parts of the landscape most likely to contain late Pleistocene archaeological sites, infer climatic and environmental histories at select localities, and along with other team members assess how past human societies lived in the Atacama and responded to past environmental



changes. Finally, he will bring forward these methodological skills for training undergraduate and graduate students from the Universidad de Tarapacá and Pontificia Universidad Católica de Chile over the course of the project.

OTHER RESEARCHERS (OPTIONAL):

ROLE IN THE PROJECT	NAME	BACKGROUND	INSTITUTION
Graduate Student (Ph.D.)	María Magdalena García Barriga	Archaeologist specializing on cultural landscapes	Universidad de Tarapacá
Graduate Student (Ph.D.)	Daniela Osorio Ferrara	Archaeology (spatial analysis)	Universidad de Tarapacá, University College of London
Graduate Student (Master 2)	Katherine Herrera Godoy	Archaeology (technological analysis)	Universidad de Tarapacá, Université Paris-Ouest
Graduate Student (Ph.D.)	Paula Ugalde	Archaeologist with the intention of specializing in geoarchaeology	Universidad de Tarapacá
Graduate Student (Ph.D.)	Terry Workman	Geology; geoarchaeology	Miami University
Research Postdoc	Alejandra I. Domic Rivadeneira	Paleoecology	Universidad de Tarapacá
Research Postdoc	Virginia McRostie	Archaeobotany	Pontificia Universidad Católica de Chile
Undergraduate	Claudio Pozo	Paleoecology	Pontificia Universidad Católica de Chile

6. JUSTIFICATION OF THE BUDGET REQUESTED FROM CONICYT

In this section, the scientific and technical reasons that justify the following must be explained: The justification must be coherent with the budget annex presented in the project. Provide a narrative clarification of each budget item demonstrating the necessity of the costs and how they relate to the actions. Provide a justification of the calculation of the estimated costs. Note that the estimation should be based on real costs. Clearly state if and how the requested budget is complemented by other project funds.

The budget requested is oriented to maximizing the support of participants in training, collaboration, and dissemination. We will incorporate in the Project at least three research postdocs, one per year. The majority of these researchers already possess independent funding from FONDECYT but we will provide incentives for travel abroad and for training and participation on specialized workshops as well as for presenting papers in specialized conferences. Significant funds are also designated to support one undergraduate and one graduate student per year, who will be able to spend some time in the collaborating institutions to improve their training. Some incentive funds are also budgeted for hiring at least one professional and technical staff, who will substantially contribute to the success of the project.

We are requesting funds for three visits of international collaborators to Chile, one per year, including their airfare and 14 days of stay, which from previous experiences, involve enough time for participating of fieldwork, analytical, and technical activities. We also expect that additional support from the international collaborations might extend these stays or add additional trips during the course of the Project.



We have budgeted three airfares and their respective allowances, one per year, so that the project investigators can travel and work with the international research collaborators. We expect only one trip for a period of one month for each of the Chilean collaborators.

We are not requested funding for equipment as we generally fund it by means of other funds including CONICYT's FONDECYT program. Moreover, one of the salient aspects of this Project proposal is the collaboration in training and analysis using archaeometric instruments including pXRF, georadars, differential GPS, and their processing software.

The budget requested for operational costs including vehicle rentals and trip insurances for carrying out fieldwork as well as a battery of AMS radiocarbon and OSL dates (43 in total) and other types of laboratory analyses and office supplies.

We are not requesting any funding for consultancy or advice. Moreover, the international collaborators will aid precisely as research specialists.

The dissemination of our results is very important for our research team. In this sense we are requesting funds to pay a fee for a journal for specific tasks such as disseminating research presentations and writing short pieces about the preliminary results for broader audiences. We will also carry out three outreach seminars, one for each year, and preferably in different locations including Arica, Iquique, and possibly Pica.

We are requesting funds for two trips per year within Chile so that the Chilean researchers can move to and from Santiago to the study area in Arica y Parinacota and Tarapacá. We are also requesting living allowances for the national researchers for a period of 20 work days per year, which will mostly be spent during fieldwork.

7. ANNEXES

Appendix 7.1

References

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Appendix 7.2

Involvement of each key Participant in other projects/contracts (Chilean applicants only)

(One record for each participant)

The involvement in other projects (public and private contracts current or established in the last three years) of each of the key persons of this project should be included fusing the format of the following record. Include national and international funds granted. Explain the link between the proposed tasks of this project and those already done or currently undertaken.

Mention here those projects in evaluation process, either from CONICYT or other public agencies, foundations, etc. in which the applicants may be participating in any category.



Participant's Name	Name of the Program/ Funding institution, agency or other	Title of the project	Coordinator's Name	Starting and finishing dates
José M. Capriles	Fondo Nacional de Desarrollo Científico y Tecnológico (1150031)	Ancient DNA, Population Dynamics and Social Change during the Late Archaic/Early Formative Transition in Northern Chile	Francisco Rothhammer	2015-2019
José M. Capriles	CONICYT PIA Anillo SOC 1405	Long Term Social Change and Climatic Variability in the Atacama Desert	Calogero M. Santoro	2015-2018
José M. Capriles	Fondo Nacional de Desarrollo Científico y Tecnológico Postdoctoral Grant (3140008)	Human Peopling of the North Chilean Andes: Foraging, Mobility, and Subsistence Strategies during the Late Pleistocene in the Highlands of Arica and Iquique	José M. Capriles	2013-2016
José M. Capriles	University of Missouri Research Reactor Center - Archaeometry Laboratory Grant	Sourcing Obsidian Samples from the Late Pleistocene Site of Cueva Bautista, Southwestern Bolivia	José M. Capriles	2013-2015
José M. Capriles	Swiss National Science Foundation Grant No. 200020-141277/1	Human Presence, Anthropogenic Landscape Modifications and Environmental Change during the Holocene in the Llanos de Moxos (LM) - Bolivian Amazon	Heinz Veit	2012-2015
José M. Capriles	GeoEye Foundation (currently DigitalGlobe Foundation) Satellite Imagery Grant	Lípez Archaeological Project: Survey of the Sora River Valley	José M. Capriles	2012
José M. Capriles	U.S. National Science Foundation Grant EAR# 1148181	South American Megafauna Extinction: A Test of Synergistic Effects of Climate Change and Human Population Growth in Magnifying Extinction Intensity	Anthony Barnosky	2012-2015
José M. Capriles	National Geographic Society Committee for Research and Exploration Grant # 8742-10	Early Human Settlement, Shamanism, and Caravan Trade in the Southern Andes: Archeological Excavations at Caves with Excellent Preservation in Lípez, Bolivia	Juan Albarracín-Jordan	2010-2012
José M. Capriles	U.S. National Science Foundation Doctoral Dissertation Improvement Grant BCS# 0737793	A Zooarchaeological Perspective on the Development of Camelid Pastoralism in the South Central Andes of Bolivia	José M. Capriles	2007-2009
José M. Capriles	Lambda Alpha, National Collegiate Honor Society for Anthropology, Graduate Overseas Research Charles R. Jenkins Award	Exploring the Economic Organization of Early Camelid Pastoralism in the South Central Andes of Bolivia	José M. Capriles	2008

Participant's Name	Name of the Program/ Funding institution, agency or other	Title of the project	Coordinator's Name	Starting and finishing dates
Calogero M. Santoro	CONICYT-PIA-Anillo código SOC 1405	Cambios Sociales y Variabilidad Climática a Largo Plazo en el Desierto de Atacama	Calogero M. Santoro	2015-2018
Calogero M. Santoro	ECOS/CONICYT C13H02	Perspectivas interdisciplinarias para el análisis de procesos de formación y transformación de estructuras arqueológicas en el contexto de la historia natural	Calogero M. Santoro	2014-2016



		cultural del Desierto de Atacama		
Calogero M. Santoro	Fondo Nacional de Desarrollo Científico y Tecnológico (1120454)	Landscape evolution in the hyperarid Atacama during the Pleistocene-Holocene transition: choices and social processes in a extreme environment (~20-21° S)	Calogero M. Santoro	2012-2016
Calogero M. Santoro	Fondo Nacional de Desarrollo Científico y Tecnológico (1151046)	Consumo integral de animales en la prehistoria del extremo norte de Chile: una perspectiva interdisciplinaria a través de diferentes líneas de evidencias (ca. 1000 a 1400 d.C.)	Daniela Valenzuela	2015-2019
Calogero M. Santoro	Fondo Nacional de Desarrollo Científico y Tecnológico (1150763)	Marine radiocarbon reservoir effects from Holocene archaeological shell middens as a proxy for past coastal upwelling in northern Chile: Local or regional?	Claudio Latorre	2015-2019
Calogero M. Santoro	Programme Régional France-Amérique Latine-Caribe (PREFALC)	Master International Archéologie Sud-Américaine: Théorie, Méthodologie et Pratique (Sociétés sud-américaines, modélisation, expérimentation et techniques analytiques)	Ramiro March	2012-2016

Participant's Name	Name of the Program/ Funding institution, agency or other	Title of the project	Coordinator's Name	Starting and finishing dates
Claudio Latorre	Fondo Nacional de Desarrollo Científico y Tecnológico (1150763)	Marine radiocarbon reservoir effects from holocene archaeological shell middens as a proxy for past coastal upwelling in northern Chile: Local or regional?	Claudio Latorre	2015-2019
Claudio Latorre	Fondo Nacional de Desarrollo Científico y Tecnológico	Evolutionary history of <i>Orestias agassizii</i> in the altiplano: an holistic approach using multiple taxonomic evidence, hydrological history and limnological information	Irma Vila	2014-2018
Claudio Latorre	DGICT - Ministry of Economy and Competitiveness, Spain	HOLOCHILL: Cambio global durante el Holoceno en Chile a partir de un transecto de registros lacustres desde el trópico a la región mediterránea (18 – 36°S)	Vlas Valero	2013-2015



Project Budget

Use the tables for the budget details for the Chilean funds

Details for the Chilean funds (please maintain the vertical position of the form)

SECTION 1: BREAKDOWN OF RESOURCES REQUESTED PER FINANCEABLE ITEM

Below is a list of the specific items that may be financed within the framework of this *Call for Proposals of International Research Projects*. Please complete the tables below detailing your funding requests for each item (as applicable), making sure to consult and adhere to the **Terms and Conditions for this Call**.

THIS SECTION CONTAINS 9 TABLES (a to i) WHICH MUST BE COMPLETED IN FULL

a) ITEM: INCENTIVES

Copy and paste additional cells if necessary

DETAIL	N°	FUNDING REQUESTED (Chilean pesos \$CLP)			TOTAL REQUESTED (\$CLP) Over 3 year period
		Year 1	Year 2	Year 3	
Postdoctoral researchers	1	3,600,000	3,600,000	3,600,000	10,800,000
Undergraduate and postgraduate students	2	5,150,000	5,150,000	5,150,000	15,450,000
Professional and technical staff	1	9,600,000	9,600,000	9,600,000	28,800,000
Total		18,350,000	18,350,000	18,350,000	55,050,000

b) ITEM: INTERNSHIPS ABROAD

The maximum amount of living allowance per month is CLP 1,600,000

Copy and paste additional cells if necessary

DETAIL	N°	FUNDING REQUESTED (Chilean pesos \$CLP)			TOTAL REQUESTED (\$CLP) Over 3 year period
		Year 1	Year 2	Year 3	
Airfare(s)	3	1,000,000	1,000,000	1,000,000	3,000,000
Allowance	3	1,600,000	1,600,000	1,600,000	4,800,000
Total		2,600,000	2,600,000	2,600,000	7,800,000

c) ITEM: WORKING VISITS IN CHILE

The maximum amount of living allowance per day is CLP 75,000



Living allowance will only cover stays up to 1 month

Copy and paste additional cells if necessary

DETAIL	N°	FUNDING REQUESTED (Chilean pesos \$CLP)			TOTAL REQUESTED (\$CLP) Over 3 year period
		Year 1	Year 2	Año 3	
Airfare(s)	6	2,000,000	2,000,000	2,000,000	6,000,000
Living Allowance	6	2,100,000	2,100,000	2,100,000	6,300,000
Total		4,100,000	4,100,000	4,100,000	12,300,000

d) ITEM: WORKING VISITS ABROAD

The maximum amount of living allowance per day is CLP 75,000

Living allowance will only cover stays up to 1 month

Copy and paste additional cells if necessary

DETAIL	N°	FUNDING REQUESTED (Chilean pesos \$CLP)			TOTAL REQUESTED (\$CLP) Over 3 year period
		Year 1	Year 2	Año 3	
Airfare(s)	6	2,000,000	2,000,000	2,000,000	6,000,000
Living Allowance	6	1,050,000	1,050,000	1,050,000	3,150,000
Total		3,050,000	3,050,000	3,050,000	9,150,000

e) ITEM: EQUIPMENT

Copy and paste additional cells if necessary

DETAIL	N°	FUNDING REQUESTED (Chilean pesos \$CLP)			TOTAL REQUESTED (\$CLP) Over 3 year period
		Year 1	Year 2	Year 3	
Total		0	0	0	0.00

f) ITEM: OPERATIONAL COSTS

Copy and paste additional cells if necessary

DETAIL	N°	FUNDING REQUESTED (Chilean pesos \$CLP)			TOTAL REQUESTED (\$CLP) Over 3 year period
		Year 1	Year 2	Year 3	
Laboratory analyses (i.e. radiocarbon dates)	43	2,280,000	2,280,000	600,000	5,160,000
Laboratory and office materials		520,000	520,000	200,000	1,240,000



Fieldwork (4x4 rentals, fuel)	3	1,500,000	1,500,000	0	3,000,000
Trip/Fieldwork insurance		200,000	200,000	200,000	600,000
Total		4,500,000	4,500,000	1,000,000	10,000,000

g) ITEM: CONSULTANCY AND ADVICE

Copy and paste additional cells if necessary

DETAIL	N°	FUNDING REQUESTED (Chilean pesos \$CLP)			TOTAL REQUESTED (\$CLP) Over 3 year period
		Year 1	Year 2	Year 3	
Total	0	0	0	0	0

h) ITEM: DISSEMINATION & SEMINARS

Copy and paste additional cells if necessary

DETAIL	N°	FUNDING REQUESTED (Chilean pesos \$CLP)			TOTAL REQUESTED (\$CLP) Over 3 year period
		Year 1	Year 2	Year 3	
Journalist fees	1	1,000,000	1,000,000	1,000,000	3,000,000
Workshops	1	0	0	3,500,000	3,500,000
Outreach seminars	3	400,000	400,000	400,000	1,200,000
Total		1,400,000	1,400,000	4,900,000	7,700,000

i) ITEM: NATIONAL & INTERNATIONAL TRAVEL

The maximum amount of living allowance per day is CLP 75,000

Copy and paste additional cells if necessary

DETAIL	N°	FUNDING REQUESTED (Chilean pesos \$CLP)			TOTAL REQUESTED (\$CLP) Over 3 year period
		Year 1	Year 2	Año 3	
Airfare(s)	6	400,000	400,000	400,000	1,200,000
Living Allowance	60	600,000	600,000	600,000	1,800,000
Total		1,000,000	1,000,000	1,000,000	3,000,000

SECTION 2: SUMMARY OF FUNDING REQUESTED



THIS SECTION CONTAINS 1 TABLE WHICH MUST BE FULLY COMPLETED

ITEM		FUNDING REQUESTED (Chilean pesos \$CLP)			TOTAL REQUESTED (\$CLP)
		Year 1	Year 2	Year 3	
INCENTIVES		18,350,000	18,350,000	18,350,000	55,050,000
INTERNSHIPS ABROAD	Airfares	1,000,000	1,000,000	1,000,000	3,000,000
	Living Allowance	1,600,000	1,600,000	1,600,000	4,800,000
WORKING VISITS IN CHILE	Airfares	2,000,000	2,000,000	2,000,000	6,000,000
	Living Allowance	2,100,000	2,100,000	2,100,000	6,300,000
WORKING VISITS ABROAD	Airfares	2,000,000	2,000,000	2,000,000	6,000,000
	Living Allowance	1,050,000	1,050,000	1,050,000	3,150,000
OTHER ACTIVITIES RELATED TO THE RESEARCH PROJECT	Equipment	0	0	0	0
	Operational Cost	4,500,000	4,500,000	1,000,000	10,000,000
	Consultancy and advice	0	0	0	0
	Dissemination & Seminars	1,400,000	1,400,000	4,900,000	7,700,000
NATIONAL AND INTERNATIONAL TRAVEL	Airfares/Transport	400,000	400,000	400,000	1,200,000
	Living Allowance	600,000	600,000	600,000	1,800,000

SECTION 3: DECLARATION OF ADDITIONAL FUNDING SUPPORT SECURED FROM OTHER CHILEAN SOURCES (PUBLIC OR PRIVATE INSTITUTIONS OR ENTITIES) (IF APPLICABLE)

THIS SECTION CONTAINS 1 TABLE

SOURCE	ITEM	SUPPORT SECURED (Chilean pesos \$CLP)	
		PECUNIARY (FINANCIAL)	NON-PECUNIARY (NON FINANCIAL SUPPORT - E.G. EQUIPMENT USE)
Universidad de Tarapacá	Incentives	0	30,967,000
Universidad de Tarapacá	Operational Expenses	4,500,000	18,500,000
University of Miami	Operational Expenses	3,862,000	28,712,000
University of California, Berkeley	Operational Expenses	1,950,000	15,483,000

